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Developing higher order thinking skills of Arab public high school students in Israel: a mixed method study

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ABSTRACT

The present research project represents a case study that examines the outcomes of the intervention programme based on the "Pedagogical horizons" (2007) policies in order to develop the higher order thinking skills (HOTS) of high school students (the HOTS programme). This is the first study that presents the results of the implementation of the HOTS programme in an Arab public high school. In addition, the study reflects on how the implementation of the HOTS programme could impact on the Arab school culture in Israel.

The study employs a concurrent mixed method design in which qualitative investigation is a core component and qualitative findings are used for the interpretation of quantitative results. Qualitative data collection tools include semi-structured teacher interviews, teacher focus group interview, teachers' instruction plans and written reports, and students' responses to the questionnaire open-ended questions. Data were analysed through thematic analysis in which inductive coding was used. The quantitative strand involved teacher control and intervention groups and the student control and intervention groups. Based on the Critical Thinking Diagnostic Questionnaire (CTDQ) (Weiss, 2010), teacher and student questionnaires were developed, using a six-point Likert scale.

Both qualitative and quantitative findings suggest an improvement in teachers' perceptions of the HOTS-based instruction and students' perceptions of their cognitive and dispositional skills, as a result of the intervention. The study shows the factors that have impeded the implementation of the intervention, including time constraints and the preference of many teachers for a traditional, instruction. As a result, the programme's guidelines regarding a desired balance between traditional and constructivist instruction were not fully implemented. Due to the governmental policies and lack of research background, the conditions were not created for developing the HOTS of Arab students through studying civics and the history of Israel. The study's recommendations point to the necessity of intensive measures for creating the HOTS-promoting environment in Israeli Arab schools, including the improvement of education of Arab teachers.

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1. INTRODUCTION

The ever-growing complexity of knowledge and technological, economic and social changes determine the occupational outlook of today's school students. It is generally agreed upon that, to meet the demands of the contemporary world, students need to be educated to become effective thinkers who can make decisions about complex issues and have good interpersonal skills (Gallagher, Hipkins & Zohar, 2012; Cheng, 2011; Zohar, 2010). In view of the increasing learning challenges, many nations determined developing higher order thinking skills (HOTS) of students as an explicit learning goal within the school curriculum (Abed & Dori, 2013; Brookhart, 2011; Cheng, 2011).

Like other countries, the Ministry of Education of Israel has designed a new national educational policy with implications for pedagogy, assessment methods and teachers' professional development (Gallagher et al., 2012; Barak, & Dori, 2009; Zohar, 2008). It is stated in the document explaining this policy (Pedagogical horizons, 2007) that in the 21st century students will need higher-order thinking abilities, including the skills for creative and critical thinking. The policy includes two main aspects: considering HOTS a major educational goal and planning practical measures for the policy implementation throughout the Israeli school system (Gallagher et al., 2012; Zohar, 2008). Another reason behind the Ministry's decision was deterioration in the results the Israeli students had been getting both in national and international (TIMMS, PISA and PIRLS) student achievement tests (Wolf, 2014). Poor achievements in education have been even more evident in the Arab education sector (Arar, 2012). For instance, according to the results of the 2011 TIMSS mathematics test, Arab students score much lower than their Jewish counterparts (465 against 536) (Wolf, 2014). As a result of the new policies, a compulsory intervention programme (the HOTS programme) was initiated by the Ministry of Education of Israel in order to develop the HOTS of Israeli school students across the national curriculum disciplines.

In the past decades, Israeli research literature has illuminated the results of the HOTS-based instruction in Jewish schools (Barzilai & Zohar, 2012; Barak & Dori, 2009; Zohar, 2008; Lunetta, Hofstein & Clough, 2007; Dori, 2003). Yet, the situation in the Arab school sector has received less attention of Israeli scholars. Moreover, the research into the development of HOTS, both with regard to the Arab and Jewish school sectors, has been concerned with the students' thinking skills

applied in mathematics, natural sciences and ICT (Barzilai & Zohar, 2012; Dkeidek, Mamlok-Naaman & Hofstein, 2010; Kaberman & Dori, 2009; Lunetta et al., 2007; Tal & Kedmi, 2006). Very few studies were conducted to explore the development of HOTS in other disciplines (Amer, 2011; Abu-Hussein, 2007). The present research project represents a mixed method study that examines the results of implementing the HOTS intervention programme in an Arab high public school. The main research question investigates how the HOTS programme is reflected in the instructional and learning processes in an Arab public high school. To address this question, the following sub-questions were formulated:

1. How was the programme implementation reflected in teachers' pedagogical practices?
2. Were there changes in students' cognitive skills and thinking dispositions, as a consequence of the HOTS intervention?
3. What are the HOTS programme implications for the Israeli Arab school culture?

The first two sub-questions relate to the process of the HOTS intervention programme and, presumably, changes in instruction and learning practices. The third sub-question concerns participants' attitudes to the HOTS-based learning and problems associated with the intervention, and how these may impact on the Arab school culture.

The theoretical framework for the research questions is rooted in the educational practices which have been carried out in many countries over the last decades. By the end of the 1980s, the importance of developing HOTS within the framework of regular instruction was recognized worldwide (Csapo, 1999; Zoller, 1997; Lazarowitz, & Tamir, 1994; Perkins & Salomon, 1992; Resnik, 1987). According to the new educational policies being implemented in Israel (Pedagogical horizons for learning, 2007), teachers should use the content-based, or 'infusion' approach in teaching students with different learning abilities to use thinking strategies across curriculum subjects. The educational professionals and scholars, who, on the behalf of the Israeli education Ministry, developed the HOTS intervention programme based on a complex concept of HOTS. It is based on a broad conceptualisation of critical thinking (Facione, 1990; 2010; Paul & Elder, 2006; Lewis & Smith, 1993) and understanding of HOTS as a term that encompasses cognitive, metacognitive and affective knowledge and skills which are essential for students to

effectively function in society (Thompson, 2011; Facione, 2011; Paul & Elder, 2006; Bailin, 2002; Jonassen, 2000; Lewis & Smith, 1993). A broad view of HOTS implies the use of a wide range of educational goals and measures. The concept of 'thinking curriculum' that concerns different curriculum areas (Zohar, 2008; 2010; Perkins, 1992; Resnik & Klopfer, 1989) represents the core idea of the conceptual framework of this study. Based on this framework, the research questions are addressed by considering the view of research participants on how the HOTS programme has been implemented in the school under study.

The educational methods described in the HOTS intervention programme were developed on the basis of different learning theories, with an emphasis being made on the constructivist type of learning (see Literature Review, section 2.3.2 and Methodology, section 3.4.2.1). The constructivist nature of the HOT-based instruction and learning environment has been emphasised by a large number of researchers (Thompson, 2011; Zohar & David, 2009; Jordan, Orison & Stack, 2008; Barak, Ben-Chaim & Zoller, 2007). The principles, which underlie the HOT-based pedagogical strategies, assert that students need to be active constructors of knowledge rather than passive recipients of information in the teacher-centered classroom (Thompson, 2011; Zohar, 2008; Perkins, 1992; Resnik, 1987). The idea is promoted that rote learners have little ability of transferring their knowledge to tasks requiring problem-solving and applying acquired knowledge to new situations (Thompson, 2011; Zohar, 2008; 2010; Perkins, 1992). There must be also a change in the role of a teacher who should act as a facilitator of learning, rather than a source of solutions (Brookhart, 2011; Zohar, 2004; 2008; Brophy & Alleman, 2005).

In order to understand the significance of the integration of HOT in the Arab school environment, some background information will be provided about the Israeli educational system in general and the Arab educational sector in particular. The educational system in Israel is centralized and there is one curriculum prescribed by the Education Ministry that includes a large percentage of what is taught in most schools (Pinar, 2013; Zohar, 2010). At the end of high school students sit matriculation exams in seven mandatory core subjects: language (Hebrew/Arabic), English (as a second language), mathematics, history, bible (in Jewish schools), literature and civics. In addition, many other subjects are electives in high school (e.g., biology, physics, chemistry, communication, arts, and computer science). The Israeli matriculation exams assess mainly knowledge of facts and

the ability to solve routine problems while the tasks requiring HOTS are less significant (Pinar, 2013; Gallagher et al., 2012; Zohar, 2010). With the implementation of the 'Pedagogical horizons' policy (2007), considerable efforts have been made to position HOT within core curriculum and assessment systems, including an increase in the student-centered inquiry learning and in the percentage of HOT items in exams (Gallagher et al., 2012; Zohar, 2010).

The changes that have taken place as a result of the new policies are less visible in the Arab educational sector. Several reasons can be given to account for this problem. They are shortly outlined below.

Over the last decades, economic and social developments that have taken place in Israel caused many transformations in the Israeli Arab society. It has been argued, however, that despite intensive processes of urbanization and modernization of the Israeli Arab society, it suffers from deprivation in almost all domains of life, including education (Dattel, 2014; Abu-Asbah, 2012; Arar & Ab-Rabia-Queder, 2011). The Arab education system in Israel operates under inequitable conditions: investments in Arab education are meager and the policy that determines its content does not take in account the voices of Arab citizens (Abu-Asbah, 2012; Arar, 2012; Golan-Agnon, 2006; Gavison, 2006; Mazawi, 2003). Vast majority of students within the Arab education system come from low socio-economic backgrounds**,** but they receive 42% less of the Education Ministry funding than Jews from a similar background (Dattel, 2014).

In addition, the Arab education system in Israel is claimed to be caught in the culture conflict of traditionalism versus modernism (Arar, 2012; Abu-Asbah, 2012). For decades, traditional education, both in Jewish and Arab schools, has emphasised mastering and memorizing content knowledge, with learning being too focused on routine memorization and with teachers transferring knowledge to students through direct instruction (Abed & Dori, 2013; Abed, 2008; Mazawi, 2003). It has been argued that Arab schools find it difficult to deal with the conflicts between modernism and traditionalism and are challenged by the demand to satisfy the conditions of competitive markets in Israel (Abu-Asbah & Avishai, 2008). Other factors, which impede the Arab system's ability to provide suitable educational solutions, concern the quality of teacher education and teaching methods, as well as insufficient attention to the content of curriculum

(Arar, 2012; Abu-Asbah & Avishai, 2008). Arab teachers trained in Israeli teacher-training institutions are expected to increase the collective consciousness of Arab society and, at the same time, catalyze modernization in rural and traditional regions. It has been argued (Abu-Asbah, 2012; Abu-Asbah & Avishai, 2008) that the policies maintained by the Israeli educational authorities affects the freedom of thought and actions of Arab teachers. Whereas in the large majority of Jewish educational institutions ideological pluralism exists as well as differentiation in educational and pedagogical aspects, the options available in the Arab education system are still more limited (Abu-Asbah, 2012; Arar, 2012).

Another problem related to the education of Arab students in Israel is concerned with the instruction of social disciplines. The curricula and textbooks in subjects such as history, geography, literature, and civics demonstrate that official educational policy in Israel still does not relate to the Arab public as a minority with its own distinctive cultural heritage and a historical narrative different from that of the Jewish majority (Pinar, 2013; Barak, 2013; Arar, 2012; Lemish, 2003; Aden, Ashkenazi & Alperson, 2001). This might create a significant obstacle in teaching Arab students about the democratic mechanisms on which the state of Israel is founded (Barak, 2013).

It is true that the Arab education system in Israel has made major progress since the establishment of the state. Due to the social and economic changes that have occurred in the Arab community over recent decades, the overall educational level of the Arab population in Israel has risen significantly and the quality of instruction has improved (Dattel, 2014; Abu-Asbah, 2012). The proportions of children studying in Arab schools have increased and there is an increase in the proportion of the Arab population studying in institutions of higher education (Arar & Ab-Rabia-Queder, 2011). It should be noted that Arab educators seek to change the traditional approaches in the education system in which rote learning dominates, hiring school staff is based on family ties and little attention is paid to teacher training (Abu-Asbah, 2012; Arar, 2012). The new educational strategies adopted by the Israeli Education Ministry (Pedagogical horizons, 2007) are concerned with developing of students' HOTS as the main, explicit and universal educational goal across the entire school system in Israel. By drawing on these policies, the implementation of the HOTS programme is intended to make a shift from the school based on rote pedagogy to a more

constructivist environment that enables Arab students to be active learners and respond to real-world demands.

The present research is expected to make contribution to research and practice aimed at creating the culture of HOT in Israeli Arab schools. This is the first study that presents the outcomes of implementing the HOTS programme in an Arab high school and calls for the engagement of Israeli scholars in investigating the results of the new educational policies in Israeli Arab schools. The researcher believes that the development of HOTS of Arab children is expected to create a reliable basis for equal opportunities between Jewish and Arab students. The change invoked by the implementation of the HOTS programme concerns the aim of making Arab students better learners who will be creative and critical thinkers possessing the ability to analyse, evaluate and reflect on their own thinking approaches. The investigation of the HOTS programme implementation is expected to shed light on the factors that affect its success in the Arab educational system, thus helping this sector to undergo the process of modernization and to better cope with the requirements of the 21st century.

The structure of the thesis is as follows.

The Literature Review highlights a variety of approaches to the conceptualisation of the concept of HOTS and main characteristics thereof. The claim was made that behaviourist, cognitivist and constructivist learning theories made contribution to the HOTS-based pedagogy and limitations of each theory are briefly outlined. Discussion is presented on the use of content-dependent (infusion) and content-independent learning approaches. The review presents the examples of the "thinking curriculum" models. The importance of summative and formative assessment of thinking skills is shown. This chapter reveals the lack of Israeli research into developing the HOTS of high school students by means of social disciplines. It outlines the problems related to the Arab education system, particularly instruction of social disciplines in Israeli Arab schools.

The Methodology chapter provides the rationale behind the use of the mixed method methodology and a qualitatively driven approach in developing the study design. The chapter describes in detail the ways of forming the research population as well as data collection and analysis methods used

in the qualitative and quantitative strands of the study. Attention was paid to the measures that ensured the internal and external validity of the qualitative and quantitative investigations study. Ethical issues are carefully addressed, including the problems of insider research. The limitations of the study's methodology and the ways to overcome them are displayed.

The Findings chapter presents the results of the mixed method study in which qualitative and quantitative investigations were carried out concurrently, with the two types of data being collected and analysed separately. The themes presented in the qualitative part of the chapter are related to the intervention methods used by teachers on the basis of the HOTS programme recommendations and the results of the implementation of intervention. The latter include the characteristics of students' performance and reflect the attitudes of teachers and students to the HOTS intervention. The quantitative part of this study presents the results of analysing the data collected through questionnaires for teachers and students, prior and after the intervention.

The Discussion chapter displays the meta-inferences based on the corroboration of quantitative and qualitative findings, following the concept of the between method triangulation. In addition, the results are presented of "within-method triangulation" (Denzin, 1978: 301) which was used to check findings for internal consistency or reliability. The qualitative data were used for the interpretation of quantitative findings, according to the principles of the qualitatively-driven mixed method research. A discussion is provided of the validity of study's results and findings are presented that help reduce the limitations of this study. The summary to the chapter outlines such aspects as the importance of this research project in comparison with other studies and the relevance of findings to the research questions.

In the last chapter, conclusions are drawn from the results of literature review and requirements set forth the HOTS programme are outlined. The chapter points to the shortcomings in the government policies regarding the implementation of the HOTS-based instruction. The Conclusion chapter presents the perspectives on the effectiveness of the HOTS intervention programme with regard to the performance of teachers and students. Recommendations are provided regarding the implementation of the HOT-based educational strategies.

2. LITERATURE REVIEW

2.1 Introduction

This chapter discusses the theoretical background for the intervention programme used for developing the HOTS of students in an Arab high public school. The type and scope of the literature reviewed in this chapter were determined by the sources referred to in the HOTS programme and by concepts appearing in the programme. The latter were used as key words in the search for literature. The search was limited by the following criteria: selection of publications in English and Hebrew and studies on developing critical thinking/higher order thinking of school students. Chronologically, the review covers the HOT-related academic works that range from the Bloom's (1956) taxonomy of educational objectives to the papers published in the first eight years of this century (the HOTS programme was issued in 2009). In addition, some of the recent studies (Abed & Dori, 2013; Gallagher et al., 2012; Cheng, 2011; Hu, Adey, Jia, Liu, Zhang & Dong, 2011) have been reviewed, as they are relevant to the theoretical framework of this study (the concepts of 'thinking curriculum' and an infusion approach to developing HOT). In literature search, several resources was used, including ERIC, the University of Derby Online Library, ScienceDirect**,** Sage Journals, and Google Scholar databases.

The chapter consists of several sections. It starts by describing the situation in the Arab education system and outlining the problems to be tackled. The next section deals with the conceptualization of critical thinking and creation of the theoretical background for the terminology used in this study. The cognitive and affective domains of HOT as well as the issues of metacognition and creativity in thinking are discussed in more detail. In order to gain a deeper insight into the complexity of the educational measures used in the HOTS intervention programme, it was decided to provide a brief review of the main approaches to learning (behaviourist, cognitivist, and constructivist) and their contributions for the HOTS-based instruction and learning activities. Various approaches to teaching thinking are examined, in terms of their relation to the subject matter studied. The problem of transfer of thinking skills between subjects and into life is also discussed. Further, several studies were reviewed, showing the implementation of the concept of 'thinking curriculum', including the research that relates specifically to the Israeli Arab education sector. The last section deals with the principles of HOTS assessment. At the end of the chapter,

conclusions are drawn concerning the significance of the literature reviewed to the purposes of the current study.

2. 2 Critical thinking: theoretical background

2.2.1 Crystallisation of the concept

The conceptualization of critical thinking has been developed and refined over centuries, having its roots in philosophy, psychology, and in pedagogical research. The representatives of different schools of thought developed different approaches in their efforts to clarify the concept of critical thinking. It has been acknowledged that the study of critical thinking is characterised by the lack of a generally agreed-upon conception of the term (Thompson, 2011; Willlis, 2004), with many definitions being developed in the areas of philosophy and psychology and being used in educational research. An outline is given of the main tendencies in the conceptualization of critical thinking.

Up to the early 1990-ies, several American philosophers developed their concepts of critical thinking. These include the influence of creative thinking and predispositions (Ennis, 1993); using strategies that are both cognitive (logical and creative thinking) and emotional/moral (Paul, 1995; 2000); engaging in a reflexive skepticism to identify the true reasons on which beliefs are based (McPeck, 1994). An emphasis is placed on the set of criteria or standards of intellectual thought that guide the performance of complex analytical and reasoning tasks. These standards include clarity, accuracy, precision, relevance, consistency, depth, and breadth (Paul, 1995). In addition, great significance is attached to the ability to self-monitor thinking processes (Bailin, 2006; Paul, 1995). As Paul (1995) argues, the ability to reflect over the thinking processes with the purpose of improving thereof is at the core of critical thinking.

A broad definition of critical thinking, which included the characteristics of critical thinking provided above, was developed when a group of researchers with expertise in the field was required to define critical thinking through the Delphi study (Facione, 1990). The study identified a set of cognitive skills and sub-skills that can be applied to teaching, utilizing, and assessing HOTS. In addition, the researchers recognized a number of intellectual virtues or habits of mind that reflect the individual's disposition to think critically. Paul (1995) and Paul & Elder (2006)

further refined the concept of critical thinking by identifying three groups of components: intellectual standards, elements of reasoning, and intellectual traits.

The prominent cognitive psychologist Sternberg (1986) believes that the focus on standards of intellectual thought does not always correspond to reality: by emphasizing the capacities of an ideal critical thinker, it may contribute less to the knowledge of how the thinking process actually occurs. In his essay containing the characteristics of the three 'waves' of critical thinking research, Paul (1997) held that the first wave theorists were focused on the theory of logic, argumentation and reasoning. They viewed reasoning and logic in a relatively narrow and technical fashion, paying little attention to the contexts in which 'thinking is at work in human feelings and behaviour' (Paul, 1997:1). He also claims that most informal logicians have never seriously considered the problem of developing the critical thinking theory which is adequate for the teaching of all subjects across all grade levels.

While some philosophers relied on logical reasoning and perfection of thinking, cognitive and developmental psychologists developed their concepts based on empirical research, being concerned with the process of thinking and how it can help people acquire knowledge and skills (Lai, 2011; Lewis & Smith, 1993). In psychology, critical thinking is often referred to as mastering various discrete skills and thinking dispositions, with an emphasis being placed on problem solving Brierton, 2011; Lewis & Smith, 1993). Such an interpretation of critical thinking was criticized by stating that simply carrying out a set of procedures is insufficient to ensure critical thinking, since any procedure can be carried out superficially or unreflectively (Bailin & Ziegel, 2003; Bailin, 2002). To assure that the procedure will be carried out 'in a critical manner', the normative criteria must be built into the description of the procedure (Bailin, 2002: 363). Critical thinking is a normative concept that necessitates mastery of the content-specific knowledge to evaluate specific claims and actions and making sound judgments. Moon (2007: 126) concurs in her definition of critical thinking:

> Critical thinking is a capacity to work with complex ideas whereby a person can make effective provision of evidence to justify a reasonable judgement. The evidence, and therefore the judgement, will pay appropriate attention to context.

It can be suggested, however, that while most of psychologists generally consider critical thinking a matter of proficiency in mental tasks, they inevitably concern themselves with the quality of the thinking process, including such features as being purposeful and self-correcting and requiring the evaluation of its outcomes. This can be seen from the comparison of the critical thinking definitions provided by some representatives of different schools of thought (see Table 2.1).

Lai (2011) concurs, suggesting that despite contentions among different schools of thought and their approaches to defining critical thinking, points of agreement can be found. They include analysing claims or evidence, making inferences through logical reasoning, evaluating, interpreting and explaining, making decisions, open-mindedness, and the role of metacognition.

Table 2.1. A comparison of the critical thinking definitions provided by representatives of philosophical and psychological approaches

Philosophers	Psychologists
'... skillful, responsible thinking that facilitates good judgment because it 1) relies upon criteria, 2) is self-correcting, and 3) is sensitive to context' (Lipman, 1988, p. 39).	'... thinking that is purposeful, reasoned and goal directed. …. When we think critically, we are evaluating the outcomes of our thought processes - how good a decision is or how well a problem is solved' (Halpern, 1989, p. 70).
'... purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or conceptual considerations upon which that judgment is based' (Facione, 1990, p. 3).	'... seeing both sides of an issue, being open to new evidence that disconfirms your ideas, reasoning dispassionately, demanding that claims be backed by evidence ….' (Willingham, 2007, p. 8).

2.2.2 Critical thinking and higher order thinking

Critical thinking was first referred as 'higher order thinking skills' in the taxonomy developed by Bloom, Englehart, Furst, Hill & Krathwohl (1956) in order to provide a classification of forms and levels of learning. In the first book of this taxonomy (Handbook I: Cognitive domain), definitions were given for the six major categories of cognitive domain. Each domain presents a set of observable intellectual behaviours which are hierarchical according to complexity The first three categories – 'Knowledge', 'Comprehension', and 'Application' - refer to lower levels of cognition

and learning, or lower order thinking skills (LOTS) while 'Analysis', 'Synthesis', and 'Evaluation' refer to higher order thinking skills (HOTS) (see also sections 2.3.1 of this chapter).

With regard to the use of the terms 'higher order thinking' (HOT), and 'critical thinking', many scholars and educators employ them interchangeably (Caesar & Lazarowitz, 2010; Astleitner, 2002; Lewis & Smith, 1993). Others (Rudd, Baker, Hoover & Gregg, 2000; Facione, 1990) hold that, although thinking critically requires HOT, critical thinking and HOT are not equivalent terms. The former is one of the family of the closely related forms of HOT. Other forms include skills needed for problem solving, creative thinking, and decision-making (Facione, 1990). Over the past decades, there has been a tendency to use HOT as an umbrella term which encompasses various forms of thinking, such as critical, systemic, and creative thinking (Facione, 2010; Paul & Elder, 2006; Bailin, 2002; Anderson et al., 2001; Thayer-Bacon, 2000), including logical reasoning skills and those needed for decision making and solving both well-defined and ill-defined problems (Dori & Kaberman, 2012; Laxman, 2010; Israel's Ministry of education. Higher-order thinking strategies, 2009; Dori & Sasson, 2008; Zohar & Dori 2003; Jonassen, 2000; Lewis & Smith, 1993; Resnik, 1987).

With the developments in cognitive psychology and critical constructivist pedagogy, the concept of HOT was enhanced (Shah, 2010; Anderson, 1994; Resnick & Resnick, 1992). It was defined as a non-algorithmic, complex mode of thinking, in which 'the path of action is not fully specified in advance' (Resnick, 1987: 3). It often results in multiple solutions and involves 'uncertainty, application of multiple criteria, reflection, and self-regulation' (Resnick, 1987: 3). This mode of thinking has been believed to address the new societal needs that required professionals possessing skills for discovery, scientific enquiry and complex problem solving (Shah, 2010; Dunn, 2010; Anderson, 1994; Resnick & Resnick, 1992). The Israeli scholars, who have contributed to the educational reforms toward developing the HOTS of students (Dori & Kaberman, 2012; Zohar, 2004; 2008; Tamir, 2006; Zohar & Dori, 2003; Zoller, 1999) consider this mode of thinking an essential component of HOT.

It has also been asserted (Facione, 1990; 2011; Zohar & David, 2009; Paul & Elder, 2006; Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths & Wittrock, 2001; Halpern, 2001) that teaching metacognitive skills help students become aware of their strengths and weaknesses as learners. The theories of a wide range of scholars (Facione, 2000; 2011; Paul & Elder, 2006; Halpern, 2001; Resnick, 1987; Krathwohl, Bloom & Masia, 1965) suggest that there is a back-and-forth relationship between the cognitive and affective domains of learning, where the emphasis in the affective domain is the 'development of a positive disposition toward learning regardless of the subject matter' (Hunt, Wiseman & Touzel, 2009: 58). In addition, researchers suggest that if students develop the ability to analyse arguments, assess claims, examine evidence and draw conclusions, they also develop the tools to critically examine the society and world, in which they live, and to obtain the competence citizens need for participating in democratic society (Paul & Elder, 2006; Dam & Volman, 2004; Facione, 1990).

The characteristics of HOT described above provide the grounds for using it as the term that refers to cognitive, metacognitive and dispositional skills which learners need in order to effectively function in modern society. There is a claim (Lewis & Smith, 1993) that a broad conceptualization of HOT would assist in achieving a range of purposes, including making the decisions on what to believe and what to do, creating new ideas, and developing problem solving skills. It also concurs with the conceptualization of critical thinking developed by the Delphi Committee (Facione, 1990) and by Paul & Elder (2006). By drawing on a broad view of HOT, the developers of the HOTS intervention programme developed a wide range of educational goals and measures which are intended to improve the thinking skills of students and which are examined in the present study (further, the term HOTS will be used). In the following sections, the cognitive and affective domains of HOTS will be discussed in more detail.

2.2.3 Cognitive skills

Cognitive skills have been analysed from different perspectives in a variety of areas like psychology, philosophy and linguistics, neuroscience, biology and other fields. In philosophy or psychology, the concept of cognition is related to abstract concepts such as mind and intelligence, encompassing mental processes and skills, and states of intelligent entities (humans, human organizations, artificial intelligences) (Blomberg, 2011; Fisher, 2006; Lohman, 2005). Despite the

wide variety of concepts of HOTS, there has been a broad agreement that cognitive skills are necessary for becoming an effective thinker. The Delphi study (Facione, 1990) identified six core cognitive skills, providing a unified framework for the development of critical thinking: interpretation, analysis, evaluation, inference, explanation and self-regulation. Each main skill is broken down into a group of sub-skills designating a set of specific activities which can be taught and assessed. The thinking skills should be employed interactively and interchangeably in the critical and reflective reasoning process of making judgments and in accordance with the intellectual standards that determine the quality of reasoning (Paul & Elder, 2006; Facione, 1990). It can be suggested that, in developing cognitive skills, philosophers primarily concern themselves with normative criteria on how people should think and about how they should act.

Researchers working in the area of cognitive psychology have mostly used empirical research to explore the ways in which people process and treat information (Lai, 2011; Jordan et al., 2008; Perkins & Grotzer, 1997; Salomon, 1993). The issues in the focus of cognitive psychologists' attention include the internal mechanism of human thought and the processes of knowing. One of the major theories developed by cognitive psychologists refers to a network of cognitive constructs called 'schema' (Anderson, 2004; Rumelhart & Norman, 1981; Piajet, 1973). Cognitivists hold that learning involves developing effective ways of building schemata for processing information. Schemata are organized meaningfully, can be extended, and as an individual gains experience, develop to include more variables. Memory can be reconstructed through the integration of current experience with prior knowledge (Anderson, 2004; Winn & Snyder, 1996). The use of schemata implies developing and applying techniques for students to impose structure on what they learn and thus make it more memorable, such as the use of information mapping or advance organizer (Hassard, 2005; Ausubel, 1978).

2.2.4 Metacognition and self-regulation in learning

It was previously mentioned that the representatives of both philosophical and psychological approaches to HOT have believed that the ability to reflect over the thinking processes is inherent to effective thinking. HOT is claimed to have a self-correcting nature which is referred to as meta-cognition (Zohar & David, 2009; Crowl, Kaminsky & Podell, 1997). This implies the mental process of being aware of monitoring, supervising, organizing, and making executive decisions

about one's thinking process. Research (Hofer & Pintrich, 2004; Kuhn, 1991; 2000; Schraw, 2000) claims that, by having an impact on perceptions and evaluations of information, epistemic beliefs inform metacognition and self-regulation of learning. Control of cognition and self-regulation refer to planning, strategy selection, allocation of resources, and volitional control (Pintrich, Wolters & Baxter, 2000). Researchers (Facione, 2011; Stenberg, 2003) argue that metacognitive procedures include problem finding and link it with creativity through activities of planning, self-monitoring of progress, and self-adjustments to problem-solving strategies.

It has been argued that metacognition is a foundational cognitive process that is necessary for effective learning in all disciplines (Facione, 2011; Paul & Elder, 2006; Kuhn & Dean, 2004; Halpern, 1998). Metacognitive strategies are believed to be at the heart of self-directed learning activity (Cotterall & Murray, 2009). Teaching students to monitor their own thinking, or developing metacognition is likely to be an essential element of any HOTS programme (Dean & Kuhn, 2003; Perkins and Salomon, 1989). One of the problems recognized by cognitive development researchers and educational practitioners is the difficulty of achieving transfer of learning from one context to another (Dean & Kuhn, 2003; Csapo, 1999). A key to the transfer is believed to be in metacognition. Students need to obtain their knowledge of the world by building relationships among different concepts and different domains (Dean & Kuhn, 2003; Crowl et al., 1997).

Schraw, Crippen & Hartley (2006: 111) connect meta-cognition, critical thinking, and motivation under the umbrella of self-regulated learning which is defined as 'our ability to understand and control our learning environments'. The cognitive component includes critical thinking, which, as authors explain, consists of identifying and analysing sources and drawing conclusions. In the thinking ability structure model (TASM) (Hu et al., 2011: 533), self-regulation of thinking is characterised as 'the supreme commander of the whole thinking structure'. Some authors believe that the ability of an individual to recognize when a particular skill is relevant and to use this skill is not a part of critical thinking, but actually represents general intelligence (McPeck, 1994; Lipman, 1988). It seems, however, that the notion prevails of meta-cognition as an essential component that supports HOT and as the tool used for self-regulated learning and skill transfer.

2.2.5 Affective domain of HOT: thinking dispositions and emotional intelligence

Regardless of differences in the conceptualization of HOT in the fields of philosophy and psychology, there has been a consensus that HOT includes both cognitive skills and dispositions toward thinking critically. Thinking dispositions are broadly defined by many authors as attitudes and habits of mind, or tendencies toward particular patterns of intellectual performance (Facione, 1990; 2013; Moon, 2007; Paul & Elder, 2006; Facione, Facione & Giancarlo, 2000; Halpern, 1998; Krathwohl et al., 1965). On the grounds of the findings and conclusions from the Delphi study (Facione, 1990), 19 dispositions were established, including such attitudes to thinking as being inquisitive, trustful of reason, open-minded, flexible, honest in facing personal biases, prudent in making judgments, orderly in complex matters, and other dispositions.

By drawing upon the empirical research findings, which suggested about the relationship of critical thinking skills and dispositions to use these skills, Facione and associates (2000) described a scientific process of developing conventional testing tools to measure cognitive skills and thinking dispositions. Tishman, Perkins & Jay (1995) suggest that the idea that thinking dispositions are learned through a process of enculturation. By drawing upon the large body of research activities conducted within Harvard Project Zero, Tishman and her colleagues argue that an effective programme for teaching thinking dispositions should create a culture of thinking - the cultural milieu that encourages the development of dispositions (Tishman et al., 1995; Tishman, Jay & Perkins, 1993).

The dispositions to think critically included 'consistent internal motivation to engage problems and make decisions by using critical thinking' (Facione et al., 2000: 65). Pintrich (2003) claims that the motivation for learning is the predisposition of the learner to adapt to his environment. Researchers distinguished between extrinsic and intrinsic motivation (Woolfolk, 2010; Deci, Koestner & Ryan, 2001). Extrinsic motivation does not imply a person engaging in a work itself, but because of rewards that follow. Intrinsic motivation directs the person to engage into a work because they find it interesting, challenging and fulfilling. These two dimensions should not be seen as mutually exclusive and can often work in tandem (Woolfolk, 2010; Lepper, Henderlong, & Iyengar, 2005; Deci, Koestner & Ryan, 2001).

A considerable number of researchers (Rowell & Hong, 2013; Stedman, 2007; Bailin, 2006; Elder, 1996; Goleman, 1995) emphasise the relationship between emotion and reason, arguing that emotions are intimately connected with cognitive matters. Bailin (2006) claims that inquiry is not disassociated from emotion: people can be very emotionally committed to the search for truth, striving to obtain the best justification of the inquiry outcome. Paul (1993) urges critical thinkers to manage their emotions and use them to reason themselves into feelings appropriate to the situation. Students need to work on developing rational feelings and emotions during group interaction, following the arguments and deciding things in terms of where they lead. The ability to recognize a feeling as it happens is defined by Goleman (1995: 42) as 'self-awareness'. Goleman (1995) noted that the ability to monitor feelings is crucial to psychological insight and self-understanding. People who have a greater certainty about their feelings 'are better pilots of their lives, having a surer sense of how they feel about personal decisions …' (Goleman, 1995: 43).

2.5.6 HOTS and creativity

Many researchers argue that there is a connection between critical thinking and creativity (Eckhoff & Urbach, 2008; Paul & Elder, 2006; Bailin, 2002; Thayer-Bacon, 2000). The act of creating is placed at the top of cognitive skill hierarchy in the revised Bloom's taxonomy and among the most important educational objectives (Anderson et al., 2001). Paul & Elder (2006) hold that both creativity and critical thinking are the aspects of good, purposeful thinking, since it requires the ability to generate intellectual products. They maintain that good thinking requires the individual to be strategic and critical about the quality of intellectual products. Moon (2007: 136) concurs, adding that to engage in critical thinking about the self, 'a learner should have a constructive and creative attitude to critical thinking about the self'. Researchers (Eckhoff & Urbach, 2008; Fisher & Williams, 2004; Vygotsky, 1978) believe that imagination as both a cognitive and affective attribute is considered to be crucial in enhancing creative thinking.

Creative thinking may occur spontaneously, but usually involves the individual or collective acts of preparation, incubation, insight, evaluation, and communication (Paul & Elder, 2006; Fisher & Williams, 2004). There is a range of attitudes and behaviours associated with creativity. These include the ability to visualise ideas, convergent and divergent ways of thinking as well as personal characteristics like intellectual curiosity, deep commitment, courage to be different, strong desire

for self-realization, strong self-confidence, attraction to complexity and obscurity, and high capacity for emotions (Spendlove, 2008). HOTS requires generating possibilities and finding solutions by looking for many possible answers rather than just one (Sternberg, 2006).

Many researchers (Baer & Kauffman, 2012; Paul & Elder, 2006; Veenema, Hetland & Chalfen, 1997) have claimed that creative thinking is impossible without a strong foundation in content knowledge. Teachers have to ensure that students have sufficient content knowledge and then give them opportunities to flexibly apply content knowledge (Baer & Kauffman, 2012; Conclin & Williams, 2011). Students need to develop the ability to see existing situations in new ways and combine components to form something original. Teachers can encourage students to search new connections between disparate ideas or offer multiple solutions to complex problems (Conclin & Williams, 2011; Cachia, Ferrari, Ala-Mutka & Punie, 2010). A number of methods were introduced for teaching creative thinking within a subject context (Ong, 2006; Swartz, Fischer & Parks, 1998). Researchers (Conclin & Williams, 2011; Cheng, 2011; Cropley, 2001; Plucker & Runco, 1999) acknowledged that the most popular method to increase creativity in the recent decades has been teaching of divergent thinking and the idea-generation strategies including brainstorming sessions, and posing open-ended questions. In the United Kingdom, for instance, the government proposed several kinds of student activities for creative thinking which included exploring ideas, questioning, keeping option open and search for multiple solutions, as well as reflecting critically on actions and outcomes (QCA, 2005). Gordon (1973) and associates suggested that creative process can be described and taught. On the basis of research conducted at the Arthur D. Little organisation into creative individuals and the creative process, they developed a set of principles and methodologies called 'Synetics'. It was used to facilitate problem solving and the process of creative thinking. By conducting problem solving tests, which were carried out by creative individuals and further by average thinkers, the authors discovered that the latter were able could consciously achieve creative thinking patterns by following a set of guidelines. It was also found that social interaction made the process of creative thinking more efficient.

2.3 Main learning theories and their contributions to the HOTS pedagogy

In the following two sections, a brief outline is given of the main learning theories and concepts which influenced educational practices in the 20th and 21st centuries. The HOTS programme

developers refer to these in the description of the educational methods for fostering HOTS. They point out the strengths and limitations of different learning theories and promote the notion that the HOTS-based instruction can effectively combine teaching methods created within different educational paradigms.

2.3.1 Behaviourism and cognitivism

Behaviourism was recognized as the theory of learning that dominated the field of education in the first half of the 20th century (Jordan, Orison & Stack, 2008; Fisher, 2008; Orton, 2004). Cognitive processes should be explained through behavioural terms and all behaviours are acquired through conditioning which occurs in interaction with the environment (Bush, 2006; Harris, 2000). The behaviourist concept of learning states that learning results in a change in behaviour which can be reinforced in a positive or a negative manner (Fisher, 2008; Skinner, 1938). In a school setting, instruction is mainly focused on rote learning, repetition, recall, and other forms of short term memory retrieval strategies (Jordan et al, 2008).

Whereas classical behaviourism focused only on the external manipulation of the individual's behaviour, the development of cognitive science led to a stronger awareness of the importance of both internal (personality, motivation and habit) and external behaviours (Jordan et al., 2008). As a result, a taxonomy of learning objectives was created, including the cognitive domain (Bloom et al., 1956) and affective domain (Krathwohl et al., 1965). Bloom identified a number of cognitive levels at which students function, moving from the basic ability to understand and recall information (LOTS) to more complex cognitive tasks of the synthesis and valuation of information (HOTS). Bloom's taxonomy provided educators with a common vocabulary for discussing learning objectives and outcomes and a way to align learning objectives, instruction and assessment of outcomes (Jordan et al., 2008). Another important contribution of Bloom's classification for the contemporary pedagogy is the adoption of a holistic approach which takes account of different aspects of child development, particularly the role of affective knowledge for developing intellectual behaviours.

The critics of behaviourism (Jordan et al., 2008; Wakefield, 2007) claim that its principles fail to take account of creative processes and underestimate the role of inherited intelligence and

personality in learning. On the other hand, it has been argued (Ertner & Newby, 2013; Jordan et al., 2008) that behaviourism is not totally antagonistic to other theories of learning and can be embedded in the more modern instructional practices. Behaviourist theories offer precise specification of instructional methods and assessment of learning outcomes, asserting that these methods are efficient when rapid learning is required (Oats, Wood & Grayson, 2005; Davey, 2004). Behaviourist principles underlie system-wide, standardised types of curricula which are based on prescribed objectives and performance/assessment criteria (Jordan, 2008; Harman, 2008). Mastering early steps, including memorization and learning of fundamental skills, is necessary before students can progress to more complex levels of performance (Lemov, 2010; Orton, 2004). Researchers (Lemov, 2010; Kirschner, Sweller & Clark, 2006) point out that direct instruction, which implies that teacher's primary function is transmitting information to students in an organized way, can be effectively used along with the student-centered learning practices. The teacher also determines which reinforcers are most effective for a particular student, including tangible rewards and informative feedback.

As the area of psychology continued to develop, researchers move their focus from an interest in external behaviours to internal brain processes and development of artificial intelligence (Harman, 2008; Fisher, 2008). This led to the development of cognitive science which deals with such cognitive processes as thinking, problem solving, language, concept formation and information processing. Because of the focus on mental structures, cognitive theories are considered to be appropriate for complex forms of learning and developing HOTS, including information-processing, reasoning and problem-solving (Thomson, 2011).

According to the cognitivist learning theories, teachers have to determine the most effective way of organizing and structuring new information in order to tap into the knowledge acquired by students, their abilities and experiences (Jordan et al., 2008). Teachers should guide students in processing information by combining visual and verbal learning (dual coding theory of Paivio, 1986); involve learners in the task that require developing schemata, using sound rules of logic, analogical reasoning and problem solving; encourage reflection and meta-cognition, and explore the students' dispositional aspect of thinking (Ertmer & Newby, 2013; Jordan et al., 2008; Ormrod, 2006; Gagne, Yekovich & Yekovich, 1993; Paivio, 1986; Ausubel, 1978). Ausubel (1960; 1978)

proposed the idea of an ‘advanced organizer’, or concept maps intended to assist students in linking prior and new knowledge, representing, therefore, a kind of “mental scaffolding to learn new information” (Hassard, 2005: p. 1). Another concept of thinking organizer called ‘Text Concept Mapping (TCM)’ (Tishman & Perkins, 1997) is based on graphical differentiations that represent the text's content and structure components and focused on explicit semantic relations between components.

Within the development of cognitivism as a learning theory, Anderson and associates updated the cognitive domain of original taxonomy (Anderson et al., 2001). Unlike the original cognitive taxonomy, the revised Bloom’s taxonomy includes the aspects of meta-cognitive knowledge and skills which were not widely recognized when the original taxonomy was designed (Krathwohl, 2002). The six major categories (‘Remember’, ‘Understand’, ‘Apply’, ‘Analyse’, ‘Evaluate’, and ‘Create’) differ in their complexity. The act of creating is placed at the top of cognitive hierarchy and among the most important educational objectives. It should be noticed that a great deal of importance is attached to developing students’ cognitive skills while the role of the thinking disposition factors was out of authors’ consideration.

Cognitivists’ learning theories have been criticized for being focused on isolating the universal forms of knowledge and limiting the consideration of socio-cultural and contextual impacts on the knowledge construction (Andrade & May, 2004). Another criticism concerns the domination of the teacher-centered instruction. Similarly to the behaviourist viewpoint, the actual goal of instruction is to communicate or transfer knowledge to students in the most efficient manner possible (Ertmer & Newby, 2013; Arends, 2001). The efficiency of transfer is mainly achieved by the simplification and standardization of knowledge: the new information is transferred in such a way that students can assimilate it as quickly and easily as possible.

2.3.2 Constructivism

2.3.2.1 General characteristics

Some researchers (Jordan et al., 2008) consider constructivism a natural progression from cognitivism, since both approaches are interested in cognitive processes. Broadly, two main approaches can be distinguished in constructivist learning - cognitive and social or socio-cultural

(Powell & Kalina, 2009; Scheurman, 1998). For cognitive constructivism (Piaget, 1970; 1985; Bruner, 1966), knowledge is constructed in the mind of the learner while she/he reorganizes personal experiences and cognitive structures. From the perspectives of socio-cultural constructivism (Vygotsky, 1978; 1986; Rogoff, 1990; 2003; Mantero, 2002), the individual learns through participation in socially and culturally organized practices. Many researchers (Fosnot, 2005; Cobb, 2005; Shaw, 1995) share the view that constructivist type of learning synthesizes both of these perspectives: developmental cycles of the individual are enhanced by shared constructive activity in the socio-cultural setting while the latter is enhanced by the developmental activities of the individual.

2.3.2.2 The significance of teachers' and students' beliefs about learning

The connections between teachers' beliefs about knowledge and knowing and their pedagogical methods have been investigated by several researchers (Amer, 2011; Wong, Chan & Lai, 2009; Maggioni & Parkinson, 2008; Tsai, 2007). Brownlee, Schraw, & Berthelsen (2011) claim that, by understanding the way students perceive knowledge, teachers can help students become active agents in their own learning. Researchers (Amer, 2011; Davis & Andrzejewski, 2009; Torff, 2006; Davis, 2006) suggest that many beliefs, which teachers hold about teaching, originate from their personal experiences, social encounters, popular culture, professional contacts, professional development, and from reading scholarly literature. Generally, when teachers perceive knowing as an accumulation of facts, they tend to adopt the traditional, teacher-centered pedagogy (Amer, 2011; Wong et al., 2009; Maggioni & Parkinson, 2008). On the contrary, when teachers see knowing as construction of understanding and meaning, they are more inclined towards the constructivist approach.

There is a claim (Hofer, 2000; Hofer & Pintrich, 1997; 2004; Baxter Magolda, 1992; Belenky, Clinchy, Goldberger & Tarule, 1986; Perry, 1970) that students' beliefs about how knowledge is acquired are important factors that determine school achievement and learning processes in classrooms. They have relation to students' cognitive styles and motivation. These ideas were supported by other authors (Yoad & Levin, 2007; Hammer & Elby, 2002; Buehl & Alexander, 2001) who added that students with more sophisticated beliefs showed better ability of learning in an inquiry-based learning environment. In addition, a number of researchers advocated the

importance of socio-cultural milieu in shaping students' beliefs about knowledge and approaches to learning (Phan, 2008; Hofer, 2004; Biggs, Kember & Leung, 2001; Hofer & Pintrich, 1997).

A number of researchers (Feucht & Bendixen, 2010; Fives & Buehl, 2010; Hofer, 2008; Perso, 2007) argue that beliefs about knowledge and knowing are sensitive to the cultural context. These ideas are supported by other researchers (Weinstock, 2010; Zhu, Valcke & Schellens, 2008) who, on the basis of empirical studies, conclude that a deeper understanding of the relation between personal epistemology and the ways students learn can be gained from a cross-cultural perspective. To date, there has been scarce Israeli research into beliefs of Israeli Arab teachers and students about how knowledge is acquired. There are few studies of teachers' and students' beliefs from a cross-cultural perspective (Markic, Mamlok-Naaman, Muhamad, Hofstein, Dkeidek, Kortam & Eilks, 2015; Tabak & Weinstock, 2008). It has been mentioned by a number of authors (Markic et al., 2015; Tabak & Weinstock, 2008; Birenbaum, Tatsuoka & Yamada 2004) that Israel applies the same educational system to the sectors that have diverse cultural orientation. The beliefs of many Arab teachers differ from those of Jewish ones, although both groups live in the same country and operate the same educational system (Markic et al., 2015).

2.3.2.3 Student-centered, collaborative and inquiry-based learning

Constructivists' theories imply that teacher's purpose is not to simply transfer knowledge to students. According to the constructivist approach, students are at the center of instruction and their performance creates opportunities for a fruitful teacher-student interaction (Baumfield, 2006; Zohar, 2004). Teachers should act as facilitators who encourage the intellectual development of learner by the use of active learning techniques (experiments, real-world problem solving) in order to create knowledge and then to reflect on it (Dunn, 2010; Duffy & Raymer, 2010; Ozman & Craver, 2008). Yet some authors (Klinger, 2007; Rowe, 2006; Kirschner, Sweller & Clark, 2006) believe that carefully planned direct instruction can be more effective than student-centered learning which is very time consuming. There is a claim (Mayer, 2008; Hung & Chen, 2002 Hogan & Pressley, 1997) that teachers need to employ scaffolding techniques in order to guide students toward independence and self-regulation. Also, more knowledgeable peers can function as teachers (Zohar & David, 2008; Rogoff, 1990; Vygotsky, 1978; 1986).

Constructivism supports the idea that an effective learning occurs when students work collaboratively (Cook, 2008; Driscoll, 2005; Thayer-Bacon, 2000; Johnson & Johnson, 1999). Many authors (McLaughlin & Talbert, 2006; Warren, 2005; Walker, 2002; Marzano, 2000) believe that constructivist principles of collaborative learning create the foundation for developing school as an open professional learning community. Discussion and brainstorming activities are believed to be effective methods for developing cognitive skills and creativity in thinking (Leicester, 2010; Ritchhart & Perkins, 2008; El Karfa, 2007; Ritchhart et al., 2006). Some authors (Isaksen & Gaulin, 2005; Brown & Paulus, 2002; Sutton & Hargadon, 1996) suggest, however, that group brainstorming often produce fewer good/relevant ideas than those produced by individuals. As to collaborative learning projects, there are arguments that some group members can perform effectively while others contribute very little, if anything at all (Makewa, Gitonga, Ngussa, Njoroge & Kuboja, 2014; Ormrod, 2006). Yet, the idea seems to prevail among researchers that through active and cooperative learning, students can discover and negotiate meaning and knowledge as well as develop open-mindedness and tolerance of different opinions (Thomson, 2011; Jordan et al., 2008; Ferretti, MacArthur & Okolo, 2001; Perkins, 1992).

As to inquiry-based learning, three types of inquiry are differentiated: structured, guided and open (Mayer, 2008; Savery, 2006). They differ on the level of the student independence in the inquiry activities. The proponents of open inquiry (Jordan et al., 2011; Krystyniak & Heikkinen, 2007; Berg, Bergendahl, Lundberg & Tibell, 2003) claim that it achieves a higher level of inquiry, enabling students to become more familiar with the nature of scientific knowledge and engage in HOT. A review of the research on the use of inquiry-based learning leads to the suggestion that many researchers (Zion & Mendelovici, 2012; Banchi & Bell, 2008; Lunsford, Melear, Roth, Perkins & Hickok, 2007; Llewellyn, 2007) advocate the transition of students' learning from structured inquiry to guided and open inquiry. In this way, students learn gradually about the nature of scientific knowledge, developing both critical and scientific thinking and appropriate thinking dispositions.

2.3.2.4 Problem-based learning as type of situated learning

Constructivist learning places an emphasis on problem-solving activities which also involve learning tasks related to real-world problems (Black, 2007; Bohgossian, 2006). The use of

interactive problem based learning (PBL) is an example of situated learning which allows students to develop their problem solving skills and apply their knowledge to real world scenarios (Black, 2007; Bohgossian, 2006; Jonassen, 2000). Researchers (Royer, 2005; Ge, Chen & Davis, 2005; Jonassen, 2000) argue that the problems, which are most commonly encountered in schools, are well-structured problems that have well-defined beginning and goal states and optimal solution paths, but have limited transferability to everyday contexts. Ill-structured problems are typically emergent from a specific context, usually having unclear goals and incomplete information. Educational researchers (Black, 2007; Ge et al., 2005; Jonassen, 1997) emphasise the need to engage students in complex, ill-structured problem solving tasks that will help them see the relevance of school knowledge to real world situations.

2.3.2.5 Developing HOTS in social disciplines

It has been stated that people who are truly effective in their moral and civic engagement need substantive expertise in the complex issues with which they have to cope (Krogh, 2008; Paul & Elder, 2006; Hofreiter, 2005; Dam & Volman, 2004). Paul (1995) argues that there are many complex moral, political, and social issues that citizens must face and, therefore, teaching critical thinking in a strong sense is a powerful and necessary means to moral integrity and responsible citizenship. Many researchers agree that HOT should be included in teaching social sciences within the undergraduate curriculum (Willingham, 2007; Hofstede & Hofstede, 2005; Mumm & Kersting, 1997). It should be noted, however, that the large majority of scholars, particularly Israeli educational researchers are focused on fostering students' HOTS within the mathematics, science and ICT curricula. Few researchers explored the development of teachers' and students' HOTS within social disciplines. Krogh (2008) describes the methods used to help move students towards an understanding of democracy. In her study, students are involved in learning concepts of democracy and democratic leadership. Concurrent to learning the conceptual material, students are engaged in a political activity by thinking critically about the leadership qualities within their classroom (Krogh, 2008). Dam & Volman (2004) argue that critical thinking is an essential competence needed to participate in a modern, democratic society, enabling citizens to make their own contribution to society in a critical and aware manner. The concept of 'participation' is a key one: learning to think critically is regarded as the acquisition of the competence to participate critically in the communities and social practices of which students are members.

2.3.2.6 Challenges faced in developing HOTS in the constructivist learning environment

An integration of constructivist principles into learning environment raises a number of problems and there exist debates over how this integration should be implemented. According to some authors (Gordon, 2009; Mayer, 2008), the divisions between student-initiated and teacher-guided activities are often imprecise. As a result, students nay draw untrue conclusions if educators are not available or capable to provide feedback and direction (Gordon, 2009; Mayer, 2008). Evidence from some studies reveals teachers' belief that indirect, student-centered instruction is likely to lead to negative results, including misconceptions or incomplete knowledge (Barak, Ben-Chaim & Zoller, 2007; Zohar, 2004; Pedercen, 2003). It seems that many problems emerge because teachers are often ill equipped to manage student centered activities and do not understand their role as a learning facilitator (Gordon, 2009; Abrami et al., 2008; Barak et al., 2007; Brush & Saye, 2000). In addition, many students, instead of being required to discover ideas, prefer to rely on the teacher as someone who helps them get everything possible from the lesson (Cheng, 2011; Brush & Saye, 2000).

Problems exist when it comes to the use of open inquiry in the inquiry-based activities. When engaged in open inquiry, the research question and the procedure originates from students who are involved in continuous decision-making throughout each stage of the investigation process. Few educational researchers, however, propose that teachers should frequently use open inquiry, as it is very time-consuming, creates cognitive overload for students, and some learners will never discover a solution or concept without teacher's guidance (Mayer, 2008; Kirschner et al., 2006). This is supported by the argument (Klinger, 2007; Rowe, 2006) that it is not reasonable to expect or require students at any level to actually discover foundational mathematical and scientific concepts and corresponding procedures which should be learned in the same way as vocabulary and rules of grammar.

There is a claim that for constructivist methods to be effective, teachers need to be experts in child development and have to be excellent in observing their students and interpreting data to keep track of students' development (Gordon, 2009). The evidence collected reveals, however, that teachers' classroom practices can be resistant to change, even the use of problem-based and inquiry

learning has been emphasised in pre-service and in-service training (Zohar, 2004; Torff, 2003; Patrick & Pintrich, 2001). As it was mentioned previously, constructivist learning is often not compatible with the standardised school curricula, which makes it difficult for teachers to respond to students' construction of knowledge. Teachers who have 45-50 minute classes and work in the classrooms populated by students with diverse abilities cannot allow students enough time to investigate. They also have insufficient time to assess the correctness of the students' knowledge construction. Many authors (Cheng, 2011; Gordon, 2009; Fisher, 2008; Driscoll, 2005) argue that current curricula need to be amended, as they require too much factual knowledge to learn and leave little room for discovery and construction of knowledge. Constructivist instruction methods also require a different grading system, as learner's efforts should be taken into consideration regardless of whether or not correct conclusions have been reached (Brookhart, 2011; Fisher, 2008).

2.3.2.7 Summary

Although the research in cognitive and instructional psychology and education varies in its depth and specificity, there seem to be an agreement that the development of students' HOTS requires a sound theoretical basis for the establishment of an effective learning environment (Gallagher et al., 2012; Hu et al., 2011; Abrami et al., 2008; Anderson et al., 2001; Perkins, 1992). This is a cornerstone of the HOTS programme examined in the current study. Main learning theories and concepts create the basis for the establishment of the school curricula, learning materials and assessment system that promote HOTS and provide concrete guidance for a teacher in implementing the HOTS-based activities in the classroom. Most of education research emphasizes the significance of collaborative and problem- and inquiry-based learning, arguing that it is most effective in preparing students for the demands of the contemporary world (Abed & Dori, 2013; Cheng, 2011; Cook, 2008; Jonassen, 2000) Teaching critical thinking is claimed to be a powerful and necessary means to educate socially responsible citizens (Paul & Elder, 2006; Dam & Volman, 2004). In addition, many researchers (Amer, 2011; Feucht & Bendixen, 2010; Hofer, 2008) point to the importance of teachers' and students' personal beliefs and cultural environment that may impact on teaching and learning patterns as well as teachers' commitment to active, student-centered learning. Adoption of the HOTS-based strategies creates a challenging working environment for teachers and students. It has been argued (Gallagher et al., 2012; Hayes & Devitt,

2008; Zohar, 2008) that school systems need to implement changes to curriculum and assessment standards in order to ensure that students develop a strong foundation of HOTS and are able to utilize broad factual information for critical exploration and analysis.

2.4. Approaches to teaching HOTS and the problem of transferability of thinking skills

2.4.1 Content-independent approach versus content-based teaching HOT

For decades, developing HOTS in students has been the aim of educational studies and programmes (Boddy, Watson & Aubusson, 2003; Kuhn, 1999; Ennis, 1993; 2002). There has been a debate that students should acquire HOTS as general, universal skills (Dewey & Bento, 2009; Stenberg, 1987), or teaching HOTS needs to be content (domain) dependent and infused in subject matter instruction (Kirkwood, 2010; Moore, 2004; McPeck, 1990; Resnik, 1987).

Those researchers, who maintain that development HOTS should not be domain-specific (Dewey & Bento, 2009; Pogrow, 2005; Halpern, 2001; Ikuenobe, 2001), recognize that critical thinking as a discipline is useful for educators to understand the structure of thinking and steps and processes that characterise the process. Some researchers (Dewey & Bento, 2009; Pogrow, 2005; Icuenobe, 2001) point out that the precise analysis is needed of the structure of the skills being trained (operational skills, patterns of thinking and rules), starting from the rudiments of thought or the most basic structure out of which thinking is comprised. Such a method was supported by other researchers (Hu et al., 2011). Marin & Halpern (2011) and Halpern (2001) draw upon the empirical evidence on the success of the content-independent instruction in HOTS. On the grounds of the randomized control trials, these authors conclude that such instruction has great potential. Marin & Halpern (2011) acknowledge that both content-independent and content-dependent instruction can develop HOTS, claiming that each approach has its strength and place in education, but they do not suggest in which conditions each method works best.

It has been argued, on the other hand, that, in the content-based approach the goals of developing HOT are harder to define and operationalize due to the inherent logic of the subject matter (Csapo, 1999; Ennis, 1993). Csapo (1999) claims that understanding the content of subject matter requires an intensive processing of material, organizing concepts and facts, drawing conclusions, and establishing relationships between the newly learned material and knowledge obtained in the past.

In addition, practicing thinking in the process of teaching a specific subject is necessary not only for improving the quality of thinking, but also for improving the quality and applicability of knowledge (Csapo, 1999).

By the end of the 1980s, teaching thinking skills in the framework of subject matter instruction (an infusion approach) has received a growing attention (Chan, 2010; Schwartz & Parks, 1994; Perkins & Salomon, 1989; Resnik, 1987; Freseman, 1990). Researchers, such as Yoad & Levin (2007), Willingham (2007), Ennis (1989), and Resnick (1987) believe that HOTS can only be taught in the context of a specific domain, arguing that content dependent approach provides a natural knowledge basis and environment for developing HOTS. In two separate studies, (Solon, 2001; 2003) demonstrated a substantial rise in HOTS after examining pre-and post-test results of measuring HOTS of three groups of students by using the Cornell Critical Thinking Test (level Z) developed by Ennis & Millman (1985) (level Z of this test is used for determining the critical thinking abilities of the students of grades 10-12). The results of both studies suggested the importance of an infusion approach, implying that generalist skills should be taught in the context of disciplines.

Some researchers consider developing students' dispositions a separate approach in teaching HOT (Sedaghat & Rahmani, 2011) Harpaz, 2007; McGuinness, 2005). Sedaghat & Rahmani (2011), for instance, view it as a preferable method over the content-based and domain-independent methods in the conditions of the Iranian education system. They emphasise the attention to motivational and emotional aspects of learning. However, the characteristics of the approach discussed in their study, including development of strategies to manage thinking, improving transfer of the knowledge, and connecting course content with the real life, suggest that the authors rather deal with an infusion approach.

2.4.2 Transferability of thinking skills

McPeck (1990: 111) uses the term 'transfer' to describe the process of applying skills learned in school to problems encountered in everyday life, suggesting that the whole point of obtaining subject knowledge at school is to 'enlighten people about our everyday world'. One of the crucial questions in improving thinking skills is to what extent learned content-based thinking skills can

be applied to different contexts. Different types of content-based way of teaching on thinking are distinguished in terms of the role of transfer. Some proponents of content-based teaching on thinking (Willingham, 2007; Pithers & Soden, 2000; Csapo, 1999) believe that transfer to new contexts is rare, or they believe that it is not important, since most thinking skills are domain-linked and thinking skills should be taught in each particular subject/domain. Many researchers (Zohar & David, 2009; Kuhn & Dean, 2004; Pintrich, 2002; Salomon & Perkins, 1992; Schoenfeld, 1991) believe that there is a positive correlation between instruction in metacognitive strategies and transfer of learning.

Other proponents of the content-based approach (Nair & Ngang, 2011; Ramsay, Harding, Cools & McLaren, 2009; Halpern, 2001; McPeck, 1990) recognize that thinking skills obtained in one domain can be transferred to other area of knowledge, possibly many other areas, and can be used to cope with problems encountered in everyday life. It has been claimed (Muijs & Reynolds, 2011; Javris, 2009) that applying thinking skills in different contexts can be the basis of cross-curricular learning and the way to overcome the fragmentation of curriculum and isolated learning of skills. It should be noticed that many researchers (Zohar & David, 2009; Kuhn & Dean, 2004; Pintrich, 2002; Salomon & Perkins, 1992; Schoenfeld, 1991) believe that there is a positive correlation between instruction in metacognitive strategies and transfer of learning. For students to become more metacognitive, they must be taught the concept and its language explicitly. There is also a suggestion that transfer of learning is age-dependent (Hu et al., 2011). In their study, Hu and associates (2011) point out that older students (grades 3-4) show better abilities of learning transfer than their younger counterparts.

Csapo (1999) claims that in some conditions the transfer of skills works well while in others the degree of transfer is almost zero. Csapo (1999) suggests that the purpose is to create learning conditions that ensure the best transfer. Since thinking skills, especially in the early phase of their development, are bound to the area in which they are practiced, further specific training is required to make skills transferable (Csapo, 1999). In fact, it is not the skill itself that it is transferred, but transfer rather means an increased ability ‘to learn a skill (with the same or similar structure) in new content areas’ (Csapo, 1999: 43). Other researchers (Thompson, 2011; Chan, 2010) agree

that, in order to generalize a skill and make it transferrable, training in the contents of several sub-domains is required.

Within an infusion approach, an appropriate balance between content objectives and broader educational goals can be beneficial (Kirkwood, 2010).The study conducted by Kirkwood (2010) in a large secondary school situated in Scotland was focused on the implementation and evaluation of a combined learning and research environment for students learning computer programming as part of secondary curriculum. The results of the study demonstrated that students successfully applied metacognitive skills of planning, monitoring, checking and self-testing in various contexts. On these grounds, Kirkwood (2010) suggests that the pedagogy used in the study could be efficiently extended to other curricular areas, particularly those for which problem solving is an important activity. Thompson (2011), Jones (2004) and Pithers & Soden, (2000) concur, emphasizing the significance of using a cross-curricular approach. Some researchers (Savage, 2010; Rocard, 2007) believe that cross-curricular teaching may be ineffective, mostly due to teachers' little experience or competence with cross-curricular themes or approaches.

2.5 Development of the HOTS curriculum and pedagogy

The view that cultivating HOTS should be the primary role of school instruction has become more and more dominant since the end of the 1980s. The idea of thinking curriculum has crystallized in the studies by a number of researchers (Hu et al., 2011; Zohar, 2008; Schwarz et al., 2003; Perkins, 1992; Resnik & Klopfer, 1989; Marzano et al., 1988). According to this notion, the task of teaching HOTS cannot be completed in one or even in a number of separate courses. Developing HOTS should be a continuous goal for the entire period of schooling and training students to think should begin from the earlier grades (Thompson, 2011; Jones, 2004; Resnik & Klopfer, 1989). The following is a review of a number of studies, the main purpose of which is to implement 'thinking curriculum'. This review includes the research referred to by the HOTS programme developers in order to identify the theoretical basis for 'thinking curriculum' (Perkins, 1992; Marzano, Brandt, Hughes, Jones, Presseisen, Rankine & Suhor, 1988). In addition, some of the recent studies (Hu et al., 2011; Cheng, 2011) are reviewed, as they are supportive of the 'thinking curriculum' concept and might be of importance to the HOTS programme facilitators.

2.5.1 The models of 'thinking curriculum' developed by Marzano (1988) and Perkins (1992)

On the basis of empirical research in cognitive psychology, Marzano and associates developed the model of thinking curriculum (Marzano et al., 1988). The model has five dimensions of thinking that became the focus of an intellectual processes curriculum: (a) thinking processes, (b) core thinking skills, (c) critical and creative thinking, (d) metacognition, and (e) the relationship of content to thinking. The comprehensiveness of the model lies in that the dimensions of thinking are not separate or forming a taxonomy or hierarchy, but are interlinked in a complex system of interaction within the content of curriculum (Marzano et al., 1988).

Marzano (1988) provides a detailed explanation of thinking processes and skills. Thinking processes are defined as complex mental operations like concept formation, principle formation, comprehension or problem solving result from a combination of specific thinking skills (Marzano et al., 1988). The final process is oral discourse in which students are involved during acquisition and application of knowledge. Core thinking skills are the specific mental operations that are used to achieve a particular learning goal (Marzano et al., 1988). In his further research, Marzano (2000) offers evidence to support his claim that there are generalized thinking skills that can be taught across the curriculum subjects. This list of skills, which is based on the analysis of national standard documents of different subjects, includes skills that refer to processing general information (comparing, analysing relationships, classifying); logical reasoning (argumentation, making inductions, making decisions), and the group that comprises knowledge utilisation skills (experimental enquiry, investigation, problem solving and decision making).

Marzano (2000) advocates infusion approach by offering to teach these skills as part of normal classroom procedure and then by implementing them across all curriculum areas with the aim that, eventually, these skills can be used independently. Marzano (1992) argues that students do not always see productive habits of mind they use. Having analysed almost 400 research studies, Marzano asserts that the primary vehicle for student learning is metacognitive thinking. He makes an important claim that there is a need to bring metacognition to the awareness of students by overtly teaching metacognitive skills to them.

The use of thinking skills, making thinking visual and developing metacognitive strategies have much in common with the notion of metacurriculum of Perkins (1992) in which he introduces the idea of metacurriculum. The latter is part of his concept of 'Smart Schools' based on the theory of multiple intelligences of Gardner (1983). According to his theory, much of everyday intelligence is located in the human and non-human resources with which people work and on which people depend in their productive work. The rational beyond Perkin's (1992) book is that school education should be changed, since traditional teaching approaches are insufficient for students to actively use knowledge and routine skills often serve poorly because students do not understand when and how to use them.

According to Perkins (1992), metacurriculum should be understood as an interrelation of the levels of learning. He identifies six components of metacurriculum. These include levels of understanding (skills referring to explanation, comparison, contrast and generalisation); language of thinking (exposing students to thinking vocabulary: 'believe', 'hyposesise', 'compare', 'predict' in interaction with students); intellectual passions (the dispositional part of HOTS; integrative mental images (linking to other subject matter by mental images, both visual and verbal); learning to learn (exercising control on learning with the purpose of developing metacognitive strategies); learning for transfer (creating learning situations that allow transfer of knowledge and skills).

By drawing upon research-based evidence (Brown, 1989; Perkins & Salomon, 1987; Belmont, Butterfield & Ferretti, 1982), Perkins (1992) holds that education can be improved by more explicit teaching for transfer, focusing on HOTS, and the use of project-based learning. Perkins (1992) makes an important suggestion, saying that there are no limits of human potential; it is seen as open-ended. Students, either gifted or slow learners, should be given the opportunity and motivation to learn. There are three basic tools that promote thoughtful learning: Socratic teaching (discussion, debates, asking probing questions); didactic instruction, and coaching for understanding performances through practice, self-assessment and informative feedback (Perkins, 1992). Like Marzano (1988; 2000), Perkins (1992) believes that peer tutoring and cooperative learning are effective teaching methods.

2.5.2 Implementing a 'thinking curriculum' in Eastern Asia schools (Hu et al., 2011; Cheng, 2011)

Two studies reviewed below have been chosen because the learning environment, in which they have been conducted, is similar to that existing in Israeli Arab schools. Classrooms in Asia are characterised by a higher level of discipline and conformity than classrooms in the West countries, with teacher's opinions being unquestioned and classroom discussions being rarely held (Cheng, 2011; Hofsdtede & Hofstede, 2005; Cheng, 2004). These results are consistent with the data obtained from Israeli researchers (Dkeidek, Mamlok-Naaman, & Hofstein, 2010; Weinstock, 2010; Tabak & Weinstock, 2008) who claim that Israeli Arab students are more respectful to teacher authority than their Jewish counterparts.

The 'Learn to think curriculum' (LTT) (Hu et al., 2011) involves three aspects of the thinking training: basic thinking strategy training, problem-solving skills training, and creative thinking skill training. The theoretical basis for the design of the difficulty of activities of the LTT curriculum embraces ideas from Piaget's account of cognitive development that allows for the specification of the cognitive complexity of tasks. It also draws on Vygotsky's (1978) zone of proximal development which is based on the principle that good learning must be in advance of development. LTT integrated some principles of the content-independent and content-based approaches.

The effectiveness of the LTT curriculum was examined in one Chinese primary school in which more than one hundred sixty students participated in a randomized quantitative study. The learning process includes establishing the learning situation, thinking method recognition, method deduction, method application, evaluation and consolidation through transfer practice (activity broadening). Problem-solving skill training is accomplished through introducing a problem, problem analysis, brainstorming, selection of the best method, evaluation and reflection, and consolidation transfer. The training of creative thinking skill is completed through task introduction, preparation activity, deductive reasoning, brainstorming, evaluation and reflection on results, and consolidation through transfer practice.

The researchers argue that LTT creates a kind of open, democratic and positive, creative atmosphere, encourages students to discuss problems with peers and teachers, thinking independently, speaking out their own ideas, and judging others' views. At the same time, the authors acknowledge that the LTT curriculum, in its first implementation, has failed to have a significant impact on the initially low-achieving students. The authors draw a conclusion about the necessity of further attention to lower ability students and to developing programmes to make the materials and methods more generally accessible.

Embedding creativity elements into learning practices was the main goal of a large-scale, 3-yearlong study conducted in thirty Hong Kong schools by Cheng (2011). It was driven by the need of making changes to the regular school curriculum which was considered 'highly conventional and knowledge-centered' (Cheng, 2011: 68). The intervention programme described in the study adopted an infusion approach. The study deployed five different kinds of creative science learning activities: discovery, understanding, presentation, application and transformation of science knowledge. Learning objective included developing divergent thinking abilities of students and students' appreciation of creativity and interest in creative thinking as well. An emphasis was placed on cultivating students' curiosity, imaginative mind, preparedness to complex and challenging situations, and 'willingness to take sensible risks' (Cheng, 2011: 70).

An evaluation of this project was done from students' perspectives obtained from self-administered questionnaires and individual interviews. Students reported about experiencing a more active learning style, the playful feeling, more confidence in asking questions and more freedom to express themselves. At the same time, findings showed that no students reported that they were encouraged to think or solve problems in novel or original ways, to take risks to make mistakes, explain the unknown, to self-monitor or self-assess their own thinking. The problems caused by time constraints were also highlighted. The author attempted to explain this failure by the fact that students were not impressed enough by the creative thinking aspect of the learning experience, or by deficiency in teacher instruction, or both.

The findings of both studies suggest that an educational intervention, which is rooted in well-established theories of cognitive development, can have sustainable and replicable effects on

children's academic achievement. A question has been not addressed as to how the LTT curriculum overcomes the constraints posed by the national school curricula existing in China and which are characterised as loaded with didactic knowledge and oriented at rote learning (Hu et al., 2011). It seems that in the classroom environment characterised by a high level of conformism and conventionality changes cannot occur quickly (Cheng, 2011). The results may reflect the first signs of liberating students' mind from the constraints of traditional way of learning.

2.6 Implementing the concept of "thinking curriculum" in Israel

2.6.1 The orientation at infusing HOTS in the instruction of sciences and ICT

Since the early 1970's, inquiry into biology problems in laboratory classes has taken place in all Israeli high-schools. Tamir (2006) who initiated this learning used the inquiry-based American BSCS curriculum. Enquiry learning was also employed in teaching chemistry (Barak & Dori, 2009; Dori et al., 2002; Barnea & Dori, 1999). It has been mentioned earlier in this chapter that the Israeli HOTS-related research mostly concerns developing students' thinking skills in mathematics, natural sciences and ICT (Barzilai & Zohar, 2012; Caesar & Lazarowitz, 2010; Kaberman & Dori, 2009; Lunetta et al., 2007; Tal & Kedmi, 2006; Zohar & Schwartzer, 2005; Dori, 2003) and there is little research that examines the issue of HOTS in other areas.

With the purpose of infusing HOTS in school curricula, the Ministry of Education of Israel initiated a new national educational policy called 'Pedagogical horizons' (2007) aimed at directing education towards developing HOTS of students. The policy stated in the 'Pedagogical horizons' (2007) was to be implemented by simultaneously addressing several dimensions: curriculum, learning materials and standards, assessment, and teacher professional development. (Gallagher et al., 2012; Zohar, 2008). The policy holds that if changes are made to the tests without providing adequate learning materials and without helping teachers to develop appropriate ways of instruction, students will not have the necessary skills for succeeding in the tests requiring HOTS (Gallagher et al., 2012; Zohar, 2008). On the other hand, an investment in teacher professional development as well as in curriculum and learning materials will not be efficient without a parallel change in assessment, as teachers consider the preparation of students for high-stake testing as an important part of their job. In terms of professional development, the implementation of the new

educational policies requires the organization of courses for teachers' instructors and workshops for teachers (Gallagher et al., 2012; Zohar, 2008).

An example of the research that examines the results of infusing HOTS in science curriculum is the longitude case study conducted by Barak, Ben-Chaim & Zoller (2007). The study took place in one of the Israeli high schools and was aimed at investigating teaching strategies for developing cognitive skills and thinking dispositions of students, particularly their HOTS capabilities in science disciplines. Data collection was done by using quantitative and qualitative tools: the California Critical Thinking Disposition Inventory (CCTDI) (Facione & Facione, 1992), The California Critical Thinking Skills Test (CCTST) (Facione, 1990; Facione & Facione, 1994), semi-structured interviews, and classroom observations. Pre-post and post-post experimental design enabled the analysis of the influence of different instructional approaches and indication of changes throughout the three years. Three teaching strategies were identified as fostering HOTS: using inquiry-oriented experiments, dealing with real-world cases, and encouraging class discussions.

The results of the study strongly suggested that persistence in teaching for enhancing HOTS developed students' HOTS components, such as truth-seeking, open-mindedness, self-confidence, and maturity in their decision making. Teaching for enhancing HOTS promoted students' ability to assess information (evaluation) and the ability to identify and secure information required to draw conclusions (inference). At the same time, no significant differences, both in cognitive and dispositional domains of HOTS, were found in the comparison with the classes where teachers did not promote HOTS. This research confirms the results of the previously conducted study (Zohar, 2004), showing that the idea of letting students struggle with the tasks requiring HOTS is hardly acceptable to many teachers who are not prepared to a constructivist nature of the HOTS-based instruction. The authors suggest that if teachers purposely and persistently practice the HOTS-related strategies, such as dealing with real-world problems, encouraging open-ended class discussions, and implementing inquiry-oriented experiments, there is a good chance for the development of students' HOTS.

2.6.2 An impact of cultural/traditional norms on students' thinking styles and learning attitudes

Over the twenty years, several HOTS-related studies have been conducted, involving the researchers and research population from the Israeli Arab sector. Most of the recently conducted research has been dedicated to the examination of the thinking skills demonstrated by high school Arab students in chemistry and biology laboratories (Abed & Dori, 2013; Dkeidek et al., 2010; Caesar & Lazarowitz, 2010; Abed, 2008).

The study of Dkeidek et al., (2010) aimed at examining the practice of science education within the two cultures - Arab and Jewish - as two models for studying the effect of culture and ethnicity on the question-asking ability (QAA) among high-school students. Drawing upon the existing research (Lunetta et al., 2007; Hofstein et al., 2005), Dkeidek et al., 2010) argue that inquiry skills are highly dependent on the student-student and student-teacher interactions that directly affect the learning environment. It has been pointed out that, according to Jewish cultural behaviour and deep-rooted traditions of Jewish education, asking and answering questions is a central form of learning and interaction (Dkeidek et al., 2010; Siegel, D. S., Veugelers, R. & Wright, 2007; Horowitz, 2005). The culture and social structure of the Arab sector are very different from the Jewish one due to great differences in traditions, ways of living, and other cultural elements (Reichel & Arnon, 2009; Tal & Alkaher, 2009; Birenbaum, et al., 2004; Tal & Kedmi, 2006). Dkeidek, Mamlok-Naaman, & Hofstein (2010) point out to a common pre-conception among Arab students that the teacher is the person who asks questions while the task of students is answering questions.

Dkeidek et al.'s (2010) study was conducted in six 12th grade (ages 17–18) chemistry classes. The student population consisted of two groups: the Arab inquiry group and the Jewish inquiry group. During two years, six different teachers were involved in instruction according to the programme designed for the inquiry-oriented chemistry laboratory (Hofstein, Navon, Kipnis & Mamlok-Naaman, 2004). Specially developed and validated tools included a novel practical test and an adapted article followed by a questionnaire for evaluating QAA. For Arab students, they were translated into Arabic in order to eliminate the language effect as a source of error in the research results. The results showed differences between Jewish students and their counterparts from the

Arab sector regarding QAA. Students from the Jewish sector tended to work in an independent manner when deciding on the research questions. Their teachers acted as guides for students during that phase. The students from Arab sector were dependent on their teachers. They requested their help almost all the time while formulating the inquiry questions. The authors notice that the results of this study concur with the findings of previous studies (Birenbaum et al., 2004; Tamir & Caridin, 1993), suggesting that these differences in the QAA between the Arab and Jewish sectors can be attributed (at least partially) to the cultural/traditional differences, which influence students' educational attitudes and habits, as well as to the differences in the science teachers' qualifications and their teaching methods (Dkeidek et al., 2010). The authors also conclude that any intended attempt targeting the QAA paradigm shift must take into consideration the multicultural context in which it is to be implemented.

It can be suggested that the research by Abed & Dori (2013) addresses the issues raised in Dkeidek et al.'s (2010) study. The research followed the teaching and learning processes of the case-based chemistry computerized laboratory (CCL) module in bilingual setting (BCCL) (Abed & Dori, 2013). Integrating IT in laboratories and developing an appropriate curriculum enabled conduction of experimental studies in which computers serve as tools for collecting, processing and displaying real-time data. The goal of this study was to examine the effect of the CCL module in bilingual setting (Hebrew and Arabic) on developing HOTS among 270 12th grade honor chemistry students from thirteen Arab public schools.

Abed & Dori (2013) argue that an integration of CCL into the Arab sector in Israel faces three main obstacles. First, it requires Arab students to read and comprehend Hebrew, which is a second language (SL) for them (Abed, 2008). Similarly to what has been stated in the previously described study, developing HOTS, particularly constructing the inquiry skills, are not typical neither of the Arab school nor for the Arab society culture. According to their norms, one must respect the wisdom of elders and the number of questions asked by students during class time is limited (Abed & Dori, 2013). Furthermore, Arab high schools are characterised by large class sizes and average high school students limited proficiency in Hebrew (Abed & Dori, 2013). Arabs are taught by Arab teachers in the medium of Arabic language in Arabic schools (Abed & Dori, 2013; Abed, 2008). Since some of the chemistry learning materials for the advanced and honor chemistry

students are only available in Hebrew, Arab teachers have to translate these learning materials into Arabic. Abed & Dori (2013) propose an alternative model - adapting SL model via gradual translation from Arabic into Hebrew. The module, which was proposed for instruction, included bilingual learning in the CCL environment (BCCL) (Abed, 2008; Abed & Dori, 2007) may be perceived as faded scaffolding (Abed & Dori, 2013). Authors assumed that being a bilingual learner may assist Arab students to integrate smoothly into Israeli universities where Hebrew is the language of instruction.

Pre - and post-module questionnaires were used to assess students' question posing and inquiry skills. The results show that the number of questions students posed in the post-module questionnaire and their complexity were higher than in the pre-module questionnaire. The BCCL students also improved their inquiry skills. Abed & Dori (2013) conclude that exposure to a second language (SL) via gradual translation of scientific learning materials is effective in promoting students' inquiry skills. They hold that results concur with the findings of the studies conducted in other countries (Lee, 2002; Bransford, Brown & Cocking, 2000). It has been claimed that when instruction in the first language is implemented to language minority students in addition to balanced SL support, these students' academic achievements are higher than if they have been taught in a second language only (Lee, 2002).

2.6.3 Instilling HOTS in low-achieving students

The view that teaching for HOT is important for the learning of students of all ages and backgrounds has been emphasised by many researchers (Brookhart, 2011; Pogrow, 2005; Zohar & Dori, 2003; Perkins, 1992; Resnick & Resnick, 1992). Teachers, however, often believe that this goal is not intended for all students, as the same teacher tends to emphasise HOTS when teaching students of higher academic achievements more than when teaching weak students (Zohar & Dori, 2003; Zohar, Degani & Vaaknin, 2001). The most common explanation teachers provided for the difference between low-and high-achieving students is that thinking-based learning created difficulties and confusion for weak learners. These ideas may have far-reaching consequences as they may lead teachers to deprive low-achieving students from the tasks requiring HOTS (Zohar & Dori, 2003). It has been thus claimed (Davis & Andrzejewski, 2009; Torff, 2006) that research

and practice in teacher education are needed to encourage teachers to support HOTS-based instruction for weak learners.

Among the studies related to the HOTS-based pedagogy for low-achieving students, there are the studies conducted by Zohar & Dori (2003) in the context of the Thinking in Science Classrooms (TSC) project. Within this project, an infusion approach was used by integrating skill learning into studies of particular topics in science. Four case studies pursued the same educational objective - fostering students' HOTS within the STS (Science, technology and society) approach. Based on the notion of integrating societal, cultural, environmental, political, and ethical aspects into the science curriculum, the STS curricula aim to teach all students scientific literacy (Aikenhead, 2005; Zohar & Dori, 2003; Dori & Hofstein, 2000). It implies that the entire student population should be challenged to develop their HOTS, not only high-achieving students (Zohar & Dori, 2003). After exercising multiple thinking skills on a procedural level (completing the tasks and solving the problems), students engaged in a metacognitive activities regarding these skills. The methodology used in the TSC project is to exercise the same skill repeatedly in different scientific contexts and to apply it to various types of problems (Zohar & Dori, 2003).

Each of the four studies addressed a different programme for developing HOTS in science classrooms and was unique with regard to its science content, specific reasoning goals, student population, and the means of instruction and assessment. Quantitative and qualitative methodologies were employed. Zohar & Dori (2003) reported a similar pattern of findings recurred in all four studies. Both high - and low-achieving students made considerable progress with respect to their initial scores. It was suggested, therefore, that students of both groups gained significantly from educational interventions. Zohar & Dori (2003) argue that by emphasizing the development of students' thinking skills, the scientific and technological literacy of students at all academic levels may significantly improve relative to each student's initial starting point. In their considerations, the authors, however, are not concerned with the problem of poor prerequisite knowledge in low-achieving students who advance through grades without having learned the curriculum properly.

In practice, teachers often encounter difficulties when using differentiated instruction in heterogeneous classes which include a broad spectrum of students (Zohar & Dori, 2003; Zohar et al., 2001). It has been recommended that professional development programmes should equip teachers with such pedagogical means as modeling of thinking procedures; using metacognitive processes; learning in small groups; scaffolding and involving teachers in the development of STS modules, and assessment tools for their own classes (Zohar, 2004;2008; Zohar & Dori, 2003).

2.7 Assessing HOTS

Many researchers (Lai, 2011; Abrami, Bernard, Borokhovski, Wade & Surkes, 2008; Silva, 2008) hold that the essential problem of assessment is how to assess to make it more credible and valid. In addition, it is difficult to assess HOTS transfer because the assessment has to deal with subject-specific knowledge that is necessary for exercising HOTS (Lai, 2011). Therefore, students who fail to transfer their skills to another subject either require additional instruction in HOTS or additional instruction in the subject matter. As Ku (2009) argues, available empirical evidence suggests that open-ended measures better reflect the construct of HOTS because they are more sensitive to the dispositional aspects of HOTS than are multiple-choice measures. Ku recommends using tests of mixed item format, both multiple-choice and open-ended, as they allow for a more complete representation of both the cognitive and dispositional aspects of HOTS. Brookhart (2011) recommends selecting or writing rubrics that are appropriate to the content and thinking skills the teacher intends to assess and that are appropriate for the educational development of students.

An assessment of students' HOTS concerns the summative and formative assessment practices (Leshem & Markovits, 2012; Zohar, 2008; Tamir, 2006). Leshem & Markovits (2012) state that scores from a standardised test is only a snapshot of the knowledge and skill acquired by students. They suggest that test performance, particularly on standardised tests, is only part of student's life experiences and not his/her entire identity. In order to effectively assess student performance, teachers should also use formative assessment techniques (Heritage, 2010; Goertz, Olah & Riggan, 2009). It is pointed out that detailed teacher feedbacks can serve as effective tools to assess students' dispositions to reasoning performance, their open-mindedness, and attitudes toward learning in general. It is also argued that students should be involved in developing the assessment

criteria for the tasks in order to better understand the outcomes they intend to achieve (Ku, 2009; O'Donovan et al., 2008).

Another issue concerns matriculation exams. Recently, the Ministry of Education of Israel has begun a process of introducing gradual changes in the matriculation exams by using the following means: increasing the proportion of written items that require HOTS, including open-ended written items; increasing the number of subjects in which the products of inquiry learning or individual projects are considered a component of the final scores; and combining ongoing assessment with the scores of external exams (Leshem & Markovits, 2012; Zohar, 2008). In Israel, attempts to upgrade assessment and examination system have faced several challenges over the recent years. They concern the development of content-specific assessment which will assess both thinking and content goals in a reliable way (Gallagher et al., 2012). Further, one of the leading educational policies promoted by the new Minister of Education elected in 2009 refers to raising test scores on national and international tests. It is believed that by emphasizing high stakes testing and intense test preparation, this policy contributes less to teaching for deep thinking and understanding (Gallagher et al., 2012). If assessment policies are not coherent with intended curriculum change, schools may end up being driven by the needs of accountability and measurement, as opposed to the intention to develop more engaging pedagogies (Gallagher et al., 2012).

2.8 Summary

The review of research literature provided in this chapter creates a broad picture of the HOTS-related issues. Scholars from the areas of philosophy, psychology and education have contributed to a conceptualization of HOTS and to development of the methods for fostering the HOTS of students. The HOTS intervention programme examined in this study refers to HOTS as complex cognitive, metacognitive and affective knowledge and skills and creativity in thinking. Over the recent decades, various strategies have been discussed of implementing the HOTS-based instruction and learning. The main of them are summarized below.

The issue of combination of different learning theories and strategies in the classroom instruction is highlighted by a number of scholars (Lai, 2011; Thompson, 2011; Leicester, 2010). Many

researchers (Abed &Dori, 2013; Thompson, 2011; Zohar, 2010) emphasise a constructivist nature of the HOTS-based instruction and learning environment. At the same time, some researchers (Lemov, 2010; Davies, 2006) believe that memorization and learning of fundamental skills are crucial to HOTS, arguing that the more proficient students are at fundamental skills, the more proficient they can become at HOTS. It is suggested (Gallagher et al., 2012; Thompson, 2011; Zohar, 2010), however, that due to the wide use of behaviorist approaches to teaching, many schools are still graduating students who are ill-equipped to problem-solving. It has been stated (Abu-Asbah, 2012; Cheng, 2011; Hu et al., 2011) that in many Asian countries, the education systems are rigid and highly-centralized, with curricula being heavily loaded with didactic knowledge, and with teachers and students being rarely involved in classroom discussions. The HOTS intervention programme promotes the notion that different learning approaches can be effectively integrated into instruction practices. This is supported by recent studies (Gallagher et al., 2012; Thompson, 2011; Brookhart, 2011). The literature reviewed shows that scholars' debates are not about whether certain approaches or methods should or should not be used, but about the ways in which they should be integrated into the acquisition of HOTS. There seems to be a challenge to teachers as to how to achieve a well-balanced use of the methods related to different learning theories (Thompson, 2011).

Although an infusion approach has been dominated in the research dedicated to developing HOTS (Gallagher et al., 2012; Leicester, 2010), recent decades have seen a debate concerning whether educators view teaching HOTS as a separate discipline or a construct to be infused in other areas (Thompson, 2011; Davies, 2006). It has been argued (Sedaghat & Rahmani, 2011; Marin & Halpern, 2011) that in the content-dependent approach the goals of developing HOTS are harder to define and operationalize due to the inherent logic of the subject matter. Many other researchers (Abed & Dori, 2013; Kirkwood, 2010; Zohar, 2010) believe that HOTS can only be taught in the context of a specific domain, as content-dependent (infusion) approach provides a natural knowledge basis and environment for developing HOTS. The arguments articulated by Freseman (1990) and adopted by other scholars (Marin & Halpern, 2011; Brookhart, 2011; Thompson, 2011; Zohar, 2010) may represent a reconciliation of different approaches by stating that the explicit teaching of thinking skills needs to be followed by immediate application to subject areas.

Many researchers (Barak, 2013; Zohar, 2010; Willingham, 2007) agree that HOTS should be included in teaching social sciences within the undergraduate curriculum. In Israel, however, the HOTS-related research mostly concerns developing students' thinking skills in mathematics, natural sciences and ICT (Barzilai & Zohar, 2012; Caesar & Lazarowitz, 2010). The current study is the first Israeli research that examines the results of a comprehensive intervention programme the developers of which point to the importance of developing student's HOTS by using social disciplines like history, civics and social work. Recently, the importance has been emphasised of updating the current civic curriculum in order to make Israeli students think critically about the complexity of the political and cultural realities existing in the country (Pinar, 2013; Barak, 2013; Zohar, 2010). This problem has become more obvious in the Arab sector of the Israeli educational system. The curricula and textbooks in subjects such as history, geography, literature, and civics demonstrate that official educational policy in Israel still does not relate to the Arab public as a minority with its own distinctive cultural heritage and historical narrative (Pinar, 2013; Barak, 2013; Arar, 2012). To educate citizens who have the ability to make sound, moral judgments on how the political systems function (Barak, 2013; Zohar, 2010), the need emerged to conduct more research into developing HOTS in the areas of social disciplines.

There is a growing body of research beliefs about instruction and learning in the socio-cultural context (Markic et al., 2015; Feucht & Bendixen, 2010; Fives & Buehl, 2010). A profound understanding of the culture of education includes many factors, including ways of instruction and student learning practices (Perso, 2012; Weinstok, 2010). In Israel, conducting culturally-sensitive studies would provide a better understanding of the beliefs structure of a given group of students and their educators. Up to date, there are few authors (Markic et al., 2015; Amer, 2011; Weinstok, 2010) who have brought up the issue of Israeli Arab teachers' and students' beliefs about the nature of knowledge and knowing and the impact of their beliefs on instruction and learning practices. It seems that Israeli educational researchers need to pay more attention to the development of the curriculum content and instruction methods that are responsive to the socio-cultural processes taking place in Israeli Arab society.

3. METHODOLOGY

The purpose of this chapter is to present the factors that shape the methodology of this study - the research paradigm and type of research employed. The chapter describes the research design, sampling procedures and discusses the use of data collection tools and data analysis techniques. It also addresses the issue of research ethics.

3.1 Research paradigm and methodology

There are different ways of viewing social reality. Positivist ontology is based on the belief that the world of social interactions is a rational, external entity, which exists independently of what researchers perceive it. From the perspective of epistemology, this world should be studied through direct observations or measurements of phenomena and without concern for how people create meaning (Biggam, 2011; Cohen et al., 2007; Lincoln & Guba, 2000). The goal is to discover patterns of cause-and-effect that can be used as the basis for the prediction and control of natural phenomena. Advocates of positivism believe that educational theories must conform to the logical requirements of scientific explanations and generally use quantitative methods of data collection and modes of analysis. The positivist researcher must take a distanced and objective stance towards the research subjects (Biggam, 2011).

By contrast, interpretivist/constructivist ontology claims that social reality can be viewed as being co-constructed by individuals, who individually and collectively create meaning from their experience, and emphasises the importance of context in understanding the phenomenon (Creswell, 2013; Charmaz, 2006). Epistemologically, knowledge is derived from the understanding of phenomenon from the perspectives of research participants. It is dependent upon the context of the study and is shaped by the researcher's perceptions, interests and professional orientation. Over the last twenty years, the interpretivist/constructivist approach has been growing in strength in the field of educational research. Interpretivist/constructivist researchers believe that understanding the multiple perspectives of stakeholders is a prerequisite to the development and improvement of educational strategies (Creswell, 2013; Hinchey, 2008).

The research into HOTS has been carried out through employing different methodologies and from different theoretical standpoints. The HOTS-based pedagogy practices and associated research

demonstrate that HOTS can be measured and analysed through a variety of assessments, including established standardised tests. Speaking in terms of research methodology, researchers can investigate HOTS by using quantitative methods (Nair & Ngang, 2012; Hu et al., 2010; Sullivan-Mann et al., 2009; Fischer et al., 2009). At the same time, critical thinking and argumentation skills have been claimed (Larochelle, 2010; Runco, 2007; Fosnot, 2006; Cobb, 1994) to be taught by implementing a constructivist-oriented pedagogy that is based on the theory of social constructivism. Vygotsky (1978) argues that social interaction is central to children's development and that by verbalizing their reasoning they reach higher levels of reasoning and self-expression. From these perspectives, studying HOT can be done within the constructivist conceptual framework and by using interpretive qualitative methodology (Barak & Dori, 2009; Miri, David & Uri, 2007; Cooper, 2004).

A careful examination of research literature reveals that, over the last decades, mixed method approach has become more acceptable in education research (Behar-Horenstein & Niu, 2011; Creswell & Garrett, 2008; Johnson, Onwuegbuzie & Turner, 2007; Mackenzie & Knipe, 2006; Brannen, 2005). This reflects a tendency towards a greater degree of epistemological and methodological pluralism. It has been suggested that taking a pragmatic or pluralist position will help improve communication among researchers from different paradigms in their attempt to advance knowledge (Feilzer, 2010; Johnson et al., 2007). A 'pragmatic' approach has been claimed (Feilzer, 2010; Morgan, 2007) as the basis for the combination of qualitative and quantitative methods. It draws, therefore, from multiple paradigms rather than advocates for dichotomy between different theoretical frameworks.

Reasons for mixing methods have been widely discussed by a number of researchers (Creswell & Plano Clark, 2011; Tashakkori & Teddlie, 2010; Betzner, 2008; Bryman, 2006). It has been pointed out to such factors as triangulation (corroboration of results obtained through different methods), completeness (creating a more comprehensive account of the area of investigation), offset (offsetting the weakness of different methods and combination of the strengths of each), credibility (using different methods may enhance the integrity of findings), and other factors may contribute to a better understanding of the phenomenon being studied (Creswell & Plano Clark, 2011; Tashakkori & Teddlie, 2010; Bryman, 2006). The advantages of mixed method enquiries

might be a reason that a considerable number of education researchers in the field of HOTS (Cheng, 2011; Kirkwood, 2010; Barak et al., 2007; Baumfield & Butterworth, 2005; Jenkins, 2001; Coolican, 1996) engaged in mixed-method research.

The above reasons for conducting a mixed method research underpinned the decision to use both quantitative and qualitative approaches in the current study. They enabled the researcher to evaluate the results of the intervention programme by using different approaches and a variety of data collection tools (Cheng, 2011; Kirkwood, 2010; Teddlie & Tashakkori, 2009). It was planned to use questionnaires for measuring the variables associated with the cognitive and affective (dispositional) domains of students' HOTS as well as the methods used for developing the HOTS of students. Quantitative investigation provided measurable evidence while qualitative techniques were employed to explore the process of the implementation of the intervention and provide detailed information about the research context (Creswell & Plano Clark, 2011; Cheng, 2011; Barak et al., 2007).

Despite its advantages, conducting mixed method research is faced by many challenges. It is a complex process which requires much time, resources and researcher's proficiency in both methods. Problems might arise in making inferences on the basis of findings obtained through different methodologies, since they are not always complementary, but capture different perspectives of the phenomenon (De Lisle, 2011). It has been argued, however, that the advantages of mixed method research provide a more comprehensive understanding of opportunities and challenges in the implementation of intervention programmes (Aarons, Fettes, Sommerfeld & Palinkas, 2012).

3.2 Research design and population characteristics

3.2.1 Identifying the role of qualitative and quantitative investigations

Researchers identify three approaches in the integration/combination of different forms of data - merging data, connecting data, and embedding data (Creswell et al., 2011; Johnson et al., 2007). Connecting data involves an analysis of one dataset and using the results to inform the data collection of the subsequent phase of research. Embedding data means that one dataset is embedded, or nested within the other so that one type of data has a supportive role for the other

dataset (Creswell, Klassen, Plano Clark, & Smith, 2011). Merging data implies conducting quantitative and qualitative investigations concurrently, with the two types of data being collected and analysed separately and results being merged at the point of interpretation. Upon the analysis of mixed method designs used in various fields of investigation (Creswell et al., 2003), a concurrent mixed method design was found to be widely used by educational researchers, including the implementation of intervention programmes (Cheng, 2011; Kirkwood, 2010; Creswell & Plano Clark, 2007; Jenkins, 2001). Creswell & Plano Clark (2007) emphasise that this research design offers a strong basis for triangulation, since there are multiple sources of data to be drawn upon, and it is useful in offsetting the weakness within one method with the strength of another method. In the present study, it has been decided to use a concurrent mixed method design for the purpose of comparing and integrating qualitative analysis with quantitative analysis (Creswell et al., 2003). The comparison or corroboration of quantitative results with rich qualitative findings allows for drawing inferences on what was found from the combination of qualitative and quantitative results and contributes to obtaining well-substantiated conclusions about a single phenomenon (Bryman, 2006; Creswell et al., 2003).

In this study, a combination of different methods was done in the way similar to that suggested by Morse & Niehaus (2009: 14) who hold that a mixed method design includes 'a qualitative or quantitative core component which directs the theoretical drive, with qualitative or quantitative supplementary component(s)'. Mason (2006:10) has suggested that a qualitatively driven approach to mixing methods 'offers enormous potential for generating new ways of understanding the complexities and contexts of social experience …' In her review of educational, mixed-method research, Niglas (2009) found that ninety (90) of the one hundred forty two (142) studies (65%) included a dominant qualitative strategy in data utilization.

The qualitative component is of great importance for this study: the research that explores implementing HOT-based interventions in the Arab educational system is scarce and, therefore, the primary interest of the study is the examination of the instructional and learning processes, participants' perceptions of the HOT-related activities, as well the problems arising in the process of intervention. The qualitative component of the present study is reflected in the main research question and in the first research sub-question: both of them emphacise the process of

implementing the programme. Given that the qualitative investigation is the primary method used to address research questions, the constructivist-interpretive approach dominates during the investigation and the interpretation phase of the study (Creswell & Plano Clark, 2011; Morse & Niehaus, 2009; Teddlie & Tashakkori, 2009). Following the principle of concurrent mixed method design, the results from the two strands were mixed at the stage of interpretation. In the discussion chapter, qualitative findings were compared with the results discovered in research literature and with quantitative findings. Qualitative findings were used for the interpretation of quantitative results (Teddlie & Tashakkori, 2009; Bryman, 2006).

The design and stages of this study are displayed on Figure 3.1 and Table 3.1.

Figure 3.1. Study design

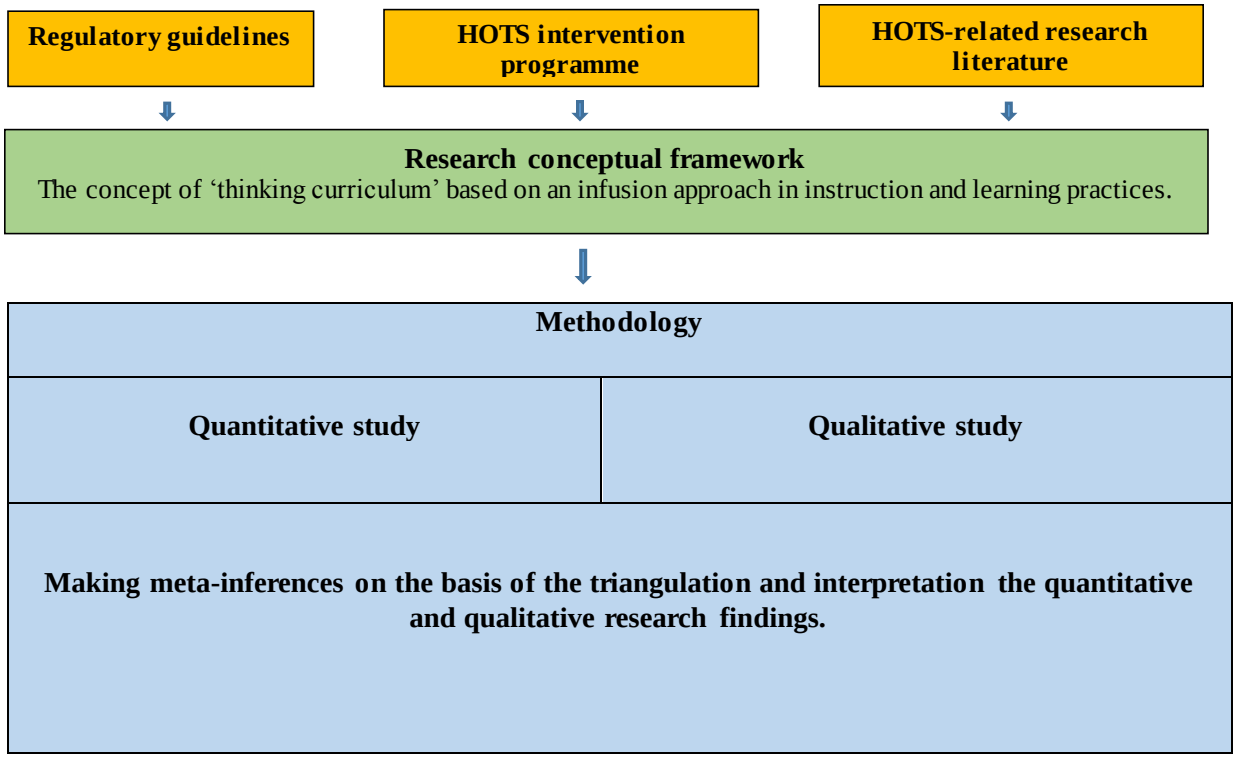

Table 3.1. Stages of research

Date	Research process
September 2009 – November 2009	Engaging the teachers, who were to complete a continuing education programme based on the guidelines issued by regulatory bodies, and students studying in the grades 10-11. Addressing ethical issues. Piloting the questionnaires for students and teachers. Analysing the content of the HOTS continuing education programme (teachers' professional development course). Studying HOT-related literature.
December 2009	Administering questionnaires to the teachers and students from the experimental and control groups (pre-test). Analysis of quantitative data.
January 2010 – June 2010	The teachers from experimental group attend the professional development course (HOTS programme). Analysis of quantitative data.
September 2010 – June 2012	The teachers from experimental group implement the HOTS programme in the classrooms. Studying HOT-related literature.
The first quarter of 2012	Conducting individual interviews with teachers. Teachers are required to write short reports about their experiences regarding the programme implementation.
April -May 2012	Administering questionnaires to teachers and students (post-test). Analysis of quantitative data.
June 2012	Conducting focus group with teachers. Analysis of quantitative data.
June-July 2012	Conducting individual interviews with the parents of the students
July – December 2012	Analysing the data obtained from the individual interviews, focus group, teachers' written narratives, and individual instruction plans maintained by teachers. Analysing and triangulating of qualitative data. Writing Introduction chapter of the thesis.
The last quarter of 2012 – 2016	Triangulating and interpreting quantitative and qualitative data. Writing up the thesis.

Figure 3.1 shows the relationships between this research theoretical background, research questions, and methodology. It can also be seen from Table 3.1 that quantitative and qualitative investigations are conducted concurrently and the final inferences are made after both types of data have been triangulated.

3.2.2 The research field and participants

The current study took place in an Arab public high school situated in a large Arab village (15000 residents) in the north of Israel. According to the nationwide standards for public secular high schools, the average figures are as follows: grades 10-12; school population about 700 students; 23-25 classes in school; and 32-38 students per class. The school, which has served as a research

setting, can be regarded as representative of Arab high public schools in the north of the country, as it is populated by 630 students and has 18 classes, with approximately 35 students per class. The school staff included 45 teachers and a principal at the time of conducting this study. This study involved 43 teachers and 177 students from six classes of the grades 10-11 (ages 16-17).

3.3. The qualitative research strand

3.3.1 Sampling strategies

All the 20 teachers who had studied under the HOTS in-service programme volunteered to participate in the qualitative part of this study. From this group, 10 teachers agreed to be interviewed. This group included teachers of different disciplines and with working experience ranging from 4 to 26 years. Six teachers participated in the focus group discussion. In addition, all the 20 teachers agreed to write reports about their intervention experiences.

3.3.2 Qualitative data collection tools

Several data collection methods were used in the qualitative part of the study: semi-structured interview, focus group interview, and documentation related to the HOTS programme implementation. Using observation as the data collection tool was also considered by the researcher. Teachers, however, were not in favour of conducting observations in their classrooms, arguing that students would feel uncomfortable when being observed and would not perform up to their abilities. The researcher, on his part, decided not to insist on having teachers participate in observations, believing that this would affect their motivation to take part in this study.

3.3.2.1 Individual interviews

The method of semi-structured interviews was chosen in the present study. A semi-structured interview with open-ended questions is claimed to have a number of advantages: flexibility, the ability to go into more depth, and the possibility of clearing up any misunderstanding (Cohen, Manion & Morrison, 2007). An interviewer can create a friendly atmosphere of informal conversation and, at the same time, a set of pre-determined questions prevents straying from the subject of interview. Also, questions that are not included in the guide may emerge to elaborate on or clarify the information delivered by the interviewee (Fontana and Frey, 2000; Kvale, 1996).

This type of interview, on the other hand, has its limitations. It is time consuming, both in terms of data collection and analysis of data. As an interview lasts for a long time, only a relatively small number of such interviews can be conducted and, therefore, results may not be representative of a particular population. In addition, the effectiveness of this method depends significantly on the skill of the interviewer (Cohen et al., 2007).

As Bryman (2012) states, there is little agreement about the minimum sample size in qualitative investigations. But taking an account such factors as interviewing teachers of different disciplines and with different working experience and that half of the teacher intervention group (ten out of twenty teachers who had studied under the HOTS in-service programme) was interviewed might contribute to the representativeness of the results for this participant group. Relevant literature (Cohen et al., 2007; Fontana and Frey, 2000) was studied as to gain knowledge on conducting interviews and advices about this procedure were given by 'critical friends'.

The aim of interviews with teachers was to learn about the teachers' intervention practices, perceptions of their personal and professional development, and the problems they experienced in the course of implementation of the HOTS programme. One can see in Appendix 2 (part A) the types of questions asked. The first question of the interview concerned the general characteristic of the contribution of the HOTS programme to the respondent's personal and professional development. The questions two through fourteen were intended to identify the pedagogical strategies used by the teachers in the classroom. The last two questions dealt with the presumed impact of the HOTS programme on the school culture and teachers' perception of school as culture of thinking. Appendix 14 includes the examples of follow-up questions (2a and 3a) that elaborate on respondent's answers. One of these questions (2a) was asked to clarify about the necessity of teaching thinking dispositions, since the teacher was focused on fostering cognitive domain of students' HOTS. Another one was asked to clarify about the use of thinking strategies in teaching history and because the respondent strayed away from the issue of thinking strategies by talking about the intervention problems (this issue was to be addressed in the interview question 9). The average length of an interview was one hour and fifteen minutes.

All the interviews were conducted at the times and places convenient for respondents. The interviews were audio recorded and transcribed verbatim to preserve all the details of participants' discourse.

3.3.2.2 Documentary analysis

Hammersley & Atkinson (2007) embraced the use of documents in qualitative research, arguing that the presence and significance of documentary products provides researchers with a wide range of analytic topics, as well as a valuable source of data. Materials of the HOTS intervention programme were reviewed in order to learn about the Educational Ministry guidelines on teaching HOTS in Israeli schools and about theoretical foundations of developing HOTS and a detailed description of the methods used for this purpose. Twenty teachers' annual instruction plans for the 2011-2012 academic year (general plans for the whole academic year) were analysed to find out how teachers implemented the recommended methods in their instruction. In the plans, teachers noted which skills students would be expected to learn and how these skills would be taught and assessed during the year. The plans included the notes on the topics in which inductive instruction could be implemented, when to use thinking guides, where to make cross-curricular connections, problem-based learning issues, and other methods for developing the HOTS of students. In the written reports, intervention group teachers described the learning activities provided within the programme implementation. Teachers were required to focus on the following aspects: organization and implementation of the activity and student behaviours and attitudes thereto.

In addition, thematic analysis was provided of students' written responses to the four questionnaire statements (see Appendix 3, part A). These questions refer to the level of metacognition in thinking (statement 2), problem-solving abilities (6), transfer of thinking skills (11), and teamwork abilities (15). This was done in order to examine students' perceptions of their thinking abilities and their attitudes to learning prior to and after the intervention. The purpose was also to find out whether differences existed between the perceptions of the two groups of students. It has been mentioned in the Introduction chapter that this study represents the first step in the longitude investigation of implementing the HOTS-based pedagogy in an Arab school. It was decided that at this stage, the use of written responses would allow for exploring the beliefs of a large number of students and having a general understanding of their learning habits in the new learning environment.

It has been stated (Hammersley & Atkinson, 2007; Russ-Eft & Preskill, 2001) that documents intended for an analysis should be relevant to the issues examined in the study. The problem is that the information included in documents could be unavailable or out of date. In the current study, the regulatory documents dedicated to developing HOTS in Israeli schools were reviewed (Higher-Order thinking strategies, 2009; Goals and aims for years 2009-2012, 2009; Pedagogical horizons, 2007). The materials of the HOTS programme developed by expert teachers (see section 3.4.2.1) were examined. In addition, the information documents contain may be incomplete or inaccurate. To overcome this limitation, documentary sources were checked against other data collected: teachers' reports were compared with the data obtained from teacher interviews. Students' written responses were also checked against the information presented in teacher reports, instruction plans and interviews.

3.3.2.3 Focus group

Focus group is considered a method that can provide insights about the phenomena being studied by allowing all participants to speak up in front of an entire group. Conduct of a focus group is led by the purpose to reveal things that cannot be seen or heard, using other data collection tools (Bryman, 2012; Cresswell, 2002; Spradley, 1979). The dynamics of the focus group enables identification of balanced views and extreme opinions while differences of opinions may provide new topics for discussion. Krueger & Casey (2000) have noted that emotions and tensions, which emerge during the discussion, may help to confirm or reject the facts discussed.

The focus group conducted in the current study included six teachers from the intervention group and lasted almost two hours. The researcher sought to examine teachers' collective perspectives on the implementation of the HOTS programme, including the successes they experienced and the problems they encountered. Appendix 2 (part B) includes the discussion guide which was prepared by the researcher. The guide indicates the issues to be explored, drawing upon the research questions. The researcher acted as a moderator, keeping the discussion focused and ensuring that all participants voiced their opinions. The participants were informed that one person could talk at a time and were ensured that each opinion would be respected, whatever it may be, and each participant could express his/her opinion freely. Of the five interview questions, four are open,

enabling the participants to provide more detailed responses. At the end of the session, the researcher provided a short summary of the discussion and thanked the participants.

While focus group interview is a useful tool for qualitative research, it has limitations. Interviewees may be unwilling or uncomfortable to share views in front of others (Krueger & Casey, 2000). In case of this focus group interview, however, this was not the issue because all the participants were eager to speak out over their successes and were not hesitant to express their thoughts about the problems related to the programme implementation. At the beginning of the interview, some teachers seemed to dominate the discussion, but the researcher tried to draw out less vocal participants by soliciting their opinions. It was also important not to influence the participants towards any particular point of view by giving researcher's personal opinions.

3.3.3 Analysis of qualitative data

Many researchers (Cohen et al, 2007; Braun & Clarke, 2006; Holloway & Todres, 2003; Miles & Huberman, 1994) hold that a range of approaches to qualitative data analysis is complex and diverse, including discourse analysis, interpretative phenomenological analysis, narrative analysis, and grounded theory. Holloway & Todres (2003: p. 347) consider 'thematizing meanings' as one of a few shared generic skills across qualitative analysing and, therefore, thematic analysis is regarded as a foundational method for qualitative analysis (Braun & Clarke, 2006). Thematic analysis was chosen for analysing the data related to the qualitative part of this study - written documents and transcripts of individual and focus group interviews. Thematic analysis is claimed to provide a flexible research tool which can describe the data set in rich detail and which can be used within different theoretical frameworks (Braun & Clarke, 2006).

In line with the interpretivist/constructivist paradigm employed in the qualitative part of this study, the researcher relied upon participants' views of the situation being studied (Bryman, 2012; Cohen et al, 2007; Braun & Clarke, 2006). The researcher explored the opinions of teachers and students who were expected to provide valuable insights in the challenges and opportunities created by the implementation of the new learning and instruction methods. This process resulted in the development of a large number of themes displayed in the scheme in Appendix 5. One can see that the themes presented in this scheme are developed from the data from different sources like

interviews, reports or instructional plans, and reflect participants' views on the use of the new educational methods and their perceptions of the changes to instruction and learning practices. However, as Miles & Huberman (1994: 58) argue, open coding is context-sensitive, its ultimate objective … is to match observations to a theory or set of constructs and, therefore, it is not at all a 'completely unstructured' process. The process of text encoding and theme development was guided by a variety of perspectives referring to the conceptualization of HOTS and development of intervention measures. For instance, such names of codes/themes as 'student-centered classroom', 'deductive instruction', 'formative assessment', 'problem-based learning', 'modifying scaffolding according to students' needs', and many others were suggested by the literature studied (Jordan et al., 2011; Zohar & David, 2008; Mayer, 2008; Jonassen, 2000; Perkins, 1992).

The first stage in the process of analysis was familiarization with the data. The transcripts of the interviews, texts of the teachers' reports and students' written responses to open-ended questions were read and re-read to become familiar with their content. Notes were taken on the ideas that were expected to be helpful for creating codes. For the process of coding, a simple sentence (either a standalone sentence or as subordinate clause) was decided to represent a meaning unit. In addition, the approach of 'inclusive' coding' (Hardy & Bryman, 2004: 539) was used. According to this approach, text encoding is based on the understanding of context which includes two simple closes of the compound sentence or two-three adjacent simple closes (Hardy & Bryman, 2004). Appendix 14 displays the principles of text encoding. In the table, sentences highlighted in blue represent the examples of inclusive text encoding, according to which the development of codes is based on the two or more related simple closes included in the compound one. Adjacent sentences (for instance, 23-24; highlighted in green) create the context in the following way: the first simple close serves to emphasise the meaning of the second one.

Text encoding, which had actually started at the familiarization stage, continued to the next phase. It involved generating of codes that that might be relevant to answering the research questions and concerned the methods for developing HOTS, participants' behaviours, attitudes, and experiences related to the programme implementation. The process of text encoding involved contrasting and comparison of the codes and then grouping similar codes into themes and sub-themes (Bryman,

2012; Cohen et al, 2007; Boyatzis, 1998; Miles & Huberman, 1994). Boyatzis (1998: 161) develops the following definition of a theme:

> A theme is a pattern in the information that at minimum describes and organizes the possible observations and at maximum interprets aspects of the phenomenon.

Some segments of data were coded with more than one code. As a result, a meaning unit and codes identified can fit into more than one theme (Graneheim & Ludman, 2003). For instance, encoding of some sentences (14 or 22, for instance) in the interview with the history teacher resulted in creating two codes for each sentence (see Appendix 14). Also, in students' comments referring to the transfer of knowledge, the theme emerged of having responsibility towards the local community. The theme prevalence was counted in terms of the number of data items (i.g. interview transcripts and the documents) in which the theme appeared (Chabot, 2011; Braun & Clarke, 2006). Braun & Clarke (2006) point out, however, that significance of a theme is not necessarily dependent on quantifiable measures, but whether it has an important meaning in relation to the overall research question. In the present study, the themes, which reflected the problems teachers' experienced during the programme implementation, were developed mostly from the interview data. In terms of appearing in data items, the frequency of these themes is lower than that of the themes describing the intervention measures and results of the student performance. However, they point to impeding factors in the implementation of the HOTS programme.

The development of themes followed the principle that themes should be internally coherent, consistent, and distinctive (Braun & Clarke, 2006; Bryman, 2001; Boyatzis, 1998). Braun & Clarke (2006) hold that there may be a number of codes that do not belong anywhere. A number of codes were reexamined across the whole set of data and some of them were finally discarded. Those referred to some details of students' written responses to open-ended questions that were irrelevant to the research questions (descriptions of the context related to the response topic). The analysis was an iterative process in which the data were constantly revisited (Braun & Clarke, 2006; Bryman, 2001). The purpose was to identify any additional data within themes that had been missed in earlier coding process (Braun & Clarke, 2006; Miles & Huberman, 1994). Devising and refining the whole thematic scheme were aimed at ensuring that the research questions were being

addressed. The themes identified were used to refine the first research sub-question. It was revealed, for instance, that many teachers were careful to describe how they used the methods for developing HOTS, paying attention to the process of the activity described. As a result, the first research sub-question was rephrased: instead of asking whether changes took place in instruction practices, the accent was placed on the process of the HOTS-based instruction.

3.3.4 Validity and reliability of the qualitative study

Since each paradigm requires paradigm-specific criteria for addressing research rigor, the concepts of validity and reliability, which have been used to judge quality of quantitative studies, cannot be entirely applicable to qualitative research (Cohen et al., 2007; Merriam, 1998). Some of the researchers (Patton, 2002; Mishler, 2000; Seal, 1999; Lincoln & Guba, 1985) considered the idea of 'trustworthiness' (which is intended to establish confidence in the research findings) more appropriate to qualitative investigations. When the reliability of qualitative research is concerned, it can be understood as a fit between researcher's records and what actually occurs in the natural setting being observed or, in other words, whether the collection and analysis of data are reliable and valid (Cohen et al., 2007). Researchers developed several validity categories to judge the validity of qualitative research. Those applied to the current research are described below.

3.3.4.1 Descriptive validity

The concept of descriptive validity refers to the accuracy of data. Descriptive validity is claimed to form the foundation on which all the other forms of validity are built upon (Golafshani, 2003; Maxwell, 1992). In the present study, the researcher tried to transcribe the recorded interviews as soon as possible after they were conducted. The primary goal in transcribing the interviews was to provide an accurate account of what was said by respondents. (Maxwell, 1992). Interview transcripts were submitted to the interviewees to ensure accuracy.

3.3.4.2 Interpretive validity

Interpretive validity means how well the participants' meaning of events and behaviours are understood by the researcher and how accurately they are reported (Maxwell, 1992). In the present study, the researcher followed the principle of 'low-inference descriptors' introduces by LeCompt & Goetz (1982) and defined by Seal (2006: p.148) as reporting the data 'in terms that are as

concrete as possible, including verbatim accounts of what people say, for example, rather than researchers' reconstructions of the general sense of what a person said…'. In reporting qualitative findings, a large amount of verbatim quotations from the research participants were used to support researcher's inferences. At the time of transcribing the interviews, details were noted of the body language of a respondent (a smile or laughing, for instance) in order to ensure an accurate evaluation of his/her tone (Maxwell, 1992). Also, to reduce the influence of researchers' personal perspectives on reporting, respondent validation was used. The findings of thematic analysis were submitted for checking by teachers and students in order to ensure that their views, thoughts and experiences were accurately understood by the researcher.

Since qualitative research is a creative and interpretative process, whereby the researcher not only collects data, but rather constructs qualitative interpretations, researcher bias and subjectivity are claimed to be inherent in qualitative study (Bryman, 2004; Merriam, 1998). In the process of text encoding, the researcher was assisted by 'critical friends' - the university and college lecturers who had the experience in text encoding. Their purpose was to review the results of encoding in order to ensure that the themes identified were representative of the interview and documentary data. A reinforcement of the interpretive validity implies that researchers must be constantly self-critical and reflexive to ensure the analytical description and interpretation of the case. Merriam (1998) holds that researchers expect readers to judge that the results of their studies make sense and are consistent and dependable. To achieve the transparency of the research process, the researcher articulated his experiences and assumptions in reflective memos written during the data collection and analysis.

Sources of bias might be the characteristics of the interviewer, characteristics of the respondents, and the content of questions (Cohen et al., 2007). These factors include the attitudes and expectations of the interviewer, seeking answers that support preconceived notions and misconceptions that may emerge when researcher's questions or respondents' answers are misunderstood. To reduce bias, the researcher was careful to clearly formulate questions and make questions as neutral as possible to avoid wording which might influence the answers of respondents. The researcher was advised by 'critical friends' how to conduct an interview properly (Cohen et al., 2007).

In addition, the researcher was aware of the inclination to more easily accept the evidence that supports his prior beliefs about the phenomenon being studied, rather than the facts that contradict his convictions. Such an inclination is known as 'confirmation bias' (Regehr, 2004; Kaptchuk, 2003). For instance, researcher's belief that older teachers would be more reluctant to use intervention methods was challenged. This belief was based on the fact that education in Arab sector is characterised by a high level of formalism and authoritarianism (Abu-Asbah, 2012; Arar, 2012). However, some of the intervention group teachers (who themselves claimed that they were educated traditionally) appeared to be more inclined to the HOTS-based instruction than their younger counterparts. This evidence required reviewing researcher's perspectives on the views of Arab teachers on education and pointed out to the necessity of further investigation into the possible relations between Arab teachers' education, working experience and their beliefs about knowledge and learning.

An additional method for ensuring descriptive and interpretative validity was data triangulation. It refers to the use of various data sources and examining evidence from the sources used in order to build a coherent justification for themes (Hammersley & Atkinson, 2007; Creswell, 2002). In the qualitative part of this study, the data from interviews, written narratives and documents served the purpose of the within-method triangulation which involved varieties of the same method to investigate the research issues (Denzin, 1989).

3.3.4.3 Theoretical validity

Theoretical validity seeks to evaluate the validity of the researcher's concepts and how well the findings explain the phenomenon under study (Maxwell, 1992). It means that patterns, concepts, categories and dimensions developed by researchers must fit together to create the valid theoretical constructs (Auerbach & Silverstein, 2003). For this purpose, the researcher was careful to support his inferences and explanations by the concepts presented in the relevant research literature. The process of investigation was constantly discussed with researcher's supervisors. In addition, the method of peer reviewing was used: the research results were submitted for examination to two Israeli Arab scholars working in the field of educational research. Peer review is considered an essential arbiter of the scientific quality of research and is aimed to provide an independent and

critical assessment of the research findings (Rooyen, Godlee, Evans, Black & Smith, 1999; Wadsworth, 1997).

3.3.4.4 Generalizability

Generalizability of qualitative research means the ability to generalize the findings of qualitative research to other contexts or settings, or to universally apply the theory resulting from the study (Walsh, 2003; Maxwell, 1992). Merriam (1998) argues that in order to have any effect on educational theory or practice, educational research studies must be rigorous and present results that are true to other educators and scholars. Being analogues to the external validity of quantitative research, generalizability was put by some researchers under the heading of 'transferability' (Walsh, 2003; Guba & Lincoln, 1985). According to Guba & Lincoln (1985), a qualitative researcher ensures transferability by doing a thorough job of describing the research context in order to help readers make a decision concerning the transfer of these findings to another situation. By collecting the data through various tools, this research sought to obtain the amount of information which would ensure a rich description of the phenomenon being studied.

3.4 The quantitative research strand

3.4.1 Sampling techniques

The intervention and control groups were formed of teachers and students populating the school in which the research was conducted. In what follows, there is a description of the sampling techniques employed.

The student participants were randomly assigned to the intervention and control groups. Since every population member is given equal opportunities of being selected, the advantage of random sampling techniques is that they are very likely to produce a representative sample (Wallen & Fraenkel, 2013; Onwuegbuzie & Collins, 2007; Kendall, 2003). At the first stage, lists of intervention and control group students were created, representing the sampling frames for both groups. Each sampling frame consisted of two classes from the grade 10 and one from the grade 11. The grade 12 was excluded, as the implementation of the programme would take more than a year. Therefore, those students would not be able to participate in the post-implementation test.

The sampling frame for the intervention group included 121 students who participated in the intervention programme. The sampling frame for the control group consisted of 123 students from the classes where the HOTS programme was not implemented. A unique number was then assigned to each member of the frame. Further, the size of a sample was defined by using the table developed by Krejcie & Morgan (1970) for determining sample size from a given population. The sample size (n=90) representative of the 120 participants (the closest number to those of the above sampling frameworks) was chosen. The lottery method was used to obtain random sample. The numbers representing each element in the target population were placed on paper cards, then placed in a container and thoroughly mixed. Next, cards were blindly selected from the container until the desired sample size was obtained. The members of the student population who appeared on the selected cards made the simple random sample. However, at the day of completing a questionnaire a number of students from both groups were absent from school for different reasons. Finally, 87 students formed the intervention group and 90 students were the members of the control group.

The teacher intervention group (n=20) consisted of those who completed the in-service training programme for developing HOTS in 2010 and participated in the implementation of the intervention. Teachers who had not yet received the in-service programme formed the control group. Consequently, 23 teachers agreed to take part in the study, representing, thus, a number of participants close to that of the intervention group. The fact that the control group teachers had volunteered for this study introduced a non-random selection bias, since the respondents who decided to participate might not well represent the entire target population. There is evidence that volunteer self-selection can impact on the representativeness of samples (Mitchell & Jolley, 2012; Ewert & Sibthorp, 2009), but in the current study, there was no possibility other than forming the teacher control group on a voluntary basis.

3.4.2 Characteristics of variables

Each type of quantitative research deals with variables that are manipulated (independent variables) and those that are measured (dependent variables) (Smith, 2004; Patton, 2002). Smith (2004) holds that the goals in an evaluation research are dependent variables which represent the

outcomes one might see as a result of the intervention programme regarded as an independent variable.

3.4.2.1 Independent variable: the HOTS intervention programme

Prior to implementing the HOTS programme at school, teachers studied the materials of the HOTS programme under the continuing education programme (in-service training course) initiated by the Israeli Ministry of Education. The course was developed by so-called "subject's chief supervisors" (college lecturers selected and trained for disseminating the new policies) on the grounds of a number of regulatory documents (Pedagogical horizons, 2007; Ministry of Education of Israel. Goals and Aims for Years 2009-2012) and the research conducted by a large number of Western and Israeli authors working in the field of HOTS.

The developers of the HOTS programme adopt a complex concept of HOTS that encompasses a range of cognitive and metacognitive skills and thinking dispositions which are considered necessary for students to be productive and competitive in the modern society (Yoad & Levin, 2007; Paul & Elder, 2006; Kuhn, 2005; ten Dam & Volman, 2004; Anderson & Krathwohl, 2001; Goleman, 1995; Resnik, 1987). HOTS also refer to the ability of solving problems and making decisions by employing critical analysis and logical reasoning skills (Kuhn, 2005; Zohar and Dori 2003). The guidelines regarding the development of students' thinking dispositions involve a range of activities the goals of which are to increase the student motivation and independent learning skills and develop social competence skills (ten Dam & Volman, 2004; Paul & Elder, 2002; Adele & Daniels, 1999; Johnson & Johnson, 1999; Goleman, 1995).

The programme adopts an 'infusion' approach whereby learning should be arranged to facilitate the use of HOTS across various content areas and beyond the school and to consider the development of HOTS as an explicit instruction target (Zohar & David, 2008; Yoad & Levin, 2007; Carr, 2007; Halpern, 1998). The programme emphasises the learning approaches based on an active involvement of students in learning process and construction of knowledge (Dean & Kuhn, 2003; Hofer & Pintrich, 2002; Jonassen, 2000; Vygotsky, 1978), and the role of the teacher as a facilitator of learning. The focus is put on solving real-world problems through guided and

unguided enquiry (Jonassen, 1997; 2000), classroom discussions and brainstorming sessions, and developing students' cognitive and social skills by the peer and cross-age tutoring.

The HOTS intervention programme shows the role of thinking strategies in developing the HOTS of students (Yoad & Levin, 2007; Schraw et al., 2006; Anderson, 2004; Perkins, 1992; Marzano et al., 1988). The programme developers use the term 'strategy (instead of 'skill') because, as they claim, this makes the learner to focus on the action which targets a specific goal. For each strategy, a list of key words and expressions is displayed, representing "a language of thinking" in order to help students formulate an intellectual process involved. An emphasis is placed on developing metacognitive thinking which helps students use thinking strategies across various contexts and which makes links between new and established knowledge. It is recommended that teachers develop the plans, according to which students would organize their actions by employing thinking strategies, and use scaffolding as the means of assisting students to acquire HOTS.

The programme addresses the issues of summative and formative assessment practices (Zohar, 2008; Tamir, 2006; Ennis, 2002; Kohn, 2000). A great deal of importance is attached to a detailed teacher verbal and written feedbacks that are considered effective tools to assess thinking dispositions to reasoning performance, student open-mindedness, and attitudes toward learning in general. Teachers are encouraged to exert more effort in their work with low academic achievers while implementing thinking strategies and various pedagogic techniques. The guidelines suggest using intensive scaffolding techniques that adjust the pace of activities to address students' needs, breaking up a complex task into simpler components, adding more examples, and peer coaching so that weaker students can learn from the more successful ones.

3.4.2.2 Dependent variables

The definitions of dependent variables used in this study are associated with the cognitive and affective (dispositional) domains of HOT presented first in Bloom's taxonomy Krathwohl, Bloom & Masia 1965; Bloom, 1956) and developed in the more recent literature (Paul & Elder, 2002; Anderson et al., 2001; Facione, 2000; Goleman, 1995). In the current study, the cognitive domain is associated with the student's cognitive and metacognitive skills applied to learning activities. The affective (dispositional) domain is related to student's thinking dispositions to learning. The

cognitive thinking skills of students and their thinking dispositions become the aims of pedagogical strategies which are represented by the four dependent variables associated with teachers' pedagogical practices. Each of them contains a number of categories reflected in the corresponding questionnaire items (see appendices 3 and 4):

1 Student cognitive skills (4 categories; questionnaire items 1 – 11):

- the learner's capacity of organizing the work on learning tasks (1, 2);
- controlling and modifying cognitive learning processes (meta-cognition) (3-5);
- formulating and solving problems (6-8);
- transferability of knowledge and skills (9-11).

2 Student thinking dispositions (7 categories; items 12 – 26)

- the level of the learner's self-confidence (12-14);
- respect and tolerance of other's beliefs (15, 16);
- attitude to a team work (17-19);
- pervasiveness of HOT (20-22);
- self-directed learning as indicator of learning motivation (23-24);
- the influence of positive emotions on learning motivation (25);
- students' civic responsibility (26).

3 Methods for developing cognitive skills of students (6 categories; items 1 – 14):

- teaching students to properly organize the work on the learning tasks (1,2);
- fostering metacognition skills (3-4);
- developing reasoning and argumentation skills and tackling problems requiring alternative solutions (5-7);
- developing thinking creativity by encouraging divergent thinking (8-10);
- instilling HOTS in low achievement students (11, 12).
- increasing the transferability of thinking skills (13-14).

4 Methods for developing student thinking dispositions (6 categories; items 15 - 25):

- encouraging pervasive thinking in students (15, 16);

- involving students in a team-thinking process guided by the teacher (17-21);
- educating independent and motivated learners (22);
- the use of student's positive emotions for increasing learning motivation (23);
- promoting tolerance of others' beliefs (24);
- developing students' civic responsibility (25).

One can see that a great deal of attention is paid to the role of the student thinking dispositions which are claimed to be an important part of critical thinking (Paul & Elder, 2006; Facione et al., 2000) and be of importance for a citizenship competence (Hofstede & Hofstede, 2005; Dam & Volman, 2004). The disposition-related variables also include positive emotions (feelings of satisfaction/joy) that result from the successful accomplishment of a learning/pedagogical task and which are claimed to create motivation towards further actions (Elder, 1996; Goleman, 1995).

3.4.3 Creating data collection tools

The data were collected by using the questionnaires that were developed based on the Critical Thinking Diagnostic Questionnaire (CTDQ) (Weiss, 2010) intended for measuring the college students' perceptions of their HOTS. It was administered in the form of a mixed design that integrated 24 self-report, Likert style items and a number of qualitative questions. The CTDQ was elaborated by analysing a large number of the instruments intended for measuring critical thinking skills and dispositions and related to the two main domains of thinking skills: cognitive and affective (Thayer-Bacon, 2000; Ennis, 1990; Paul, 1990; Alvino, 1990; Bloom, 1956). In the study of Weiss (2010), it was administered to the students of an Arab college in Israel and was found to have high reliability: 0.874**.**

It was decided, therefore, that the CTDQ could serve as the basis for developing the new instruments in order to measure the perceptions of HOTS of teachers and the students in an Israeli Arab high school. Self-report questionnaires are frequently used in education research because of their utility (Cottrell & McKenzie, 2010; Wilcox, 2005; Mayer, 1999). Their disadvantage is that there might be reliability and validity problems, as participants may deceive themselves or others. A self-report questionnaire may actually measure respondents' perceptions of their instruction or learning practices instead of actual behaviour during lessons (Cottrell & McKenzie, 2010; Wilcox,

2005; Mayer, 1999). These problems can be countered through the careful design and application of self-report measures which are addressed further in this section.

Two questionnaires were developed: one for teachers and another for students. The former includes twenty five closed items reflecting teachers' perceptions of the methods they use for developing the HOTS of students. The latter contains twenty six closed items related to students' perceptions of their cognitive skills and thinking dispositions. In the second part of the questionnaire, students are asked to provide written responses to four items (see Appendix 3, part A). These items refer to the level of metacognition in thinking (statement 2), problem-solving abilities (6), transfer of thinking skills (11), and teamwork abilities (15). Respondents rated the items by using a six-point Likert scale, ranging from 1 = 'strongly disagree' to 6 = 'strongly agree'. Each participant was required to rate each item on the same response scale. Items in both scales were written in a clear manner to ensure that respondents fully understand the questions. The use of both positively and negatively worded items was intended to offset any affirmation/negation response bias (Fisher, 2004; White et al., 1993).

As to the second part of the questionnaire for students, it was considered an open-ended component of the questionnaire format (addressing open-ended questions). Drawing upon available empirical evidence, Ku (2009) recommends using instruments of mixed item format, both multiple-choice and open-ended, which will allow for a more complete representation of both the cognitive and dispositional aspects of HOTS. Such a format may help obtain the unique views of respondents and enhance the questionnaire's internal reliability by clearing up possible misunderstandings and validating the quantitative survey (Boynton & Greenhalgh, 2004; O'Cathain &Thomas, 2004; Currall & Towler, 2003). It has been recommended that researchers determine the status of open-ended questions at the design stage of a study. A strategy can be used of treating them as a source of qualitative data, although, the depth of answers to open-ended questions tend to be more limited than with almost any other method of research (O'Cathain &Thomas, 2004; Bailey, 1994). In the current study, it was decided to conduct a preliminary analysis that involved reading the responses and considering whether they contributed to answering research questions (O'Cathain &Thomas, 2004; Boynton, 2004). Open-ended questions were included only into the questionnaire for students due to the amount of time needed for the analysis of a large amount of qualitative data.

A number of steps were taken to ensure the construct validity of the quantitative part of both tools. An analysis was performed of a wide body of research into students' cognitive skills and thinking dispositions and pedagogical methods for developing these qualities in students, as can be seen in Appendix 4 (parts A and B). It was decided to enlarge the body of literature used for the construct conceptualization in the CTDQ. More attention is paid to the items that were considered important by the HOTS programme developers. These refer to students' perceptions of their reasoning and problem solving skills, their abilities to establish connections between the previously obtained and new knowledge (metacognition), and application of knowledge in daily life (transferability of knowledge and skills) (Dean & Kuhn, 2003; Halpern, 2001; Csapo, 1999). In comparison with the CTDQ, the following items were added in accordance with the HOTS programme. As the programme promotes the constructivist approach to learning, the issue of solving complex problems was addressed. In addition, the HOTS intervention programme deals with the development of HOTS of low-achieving learners and the increase in social responsibility of students. It was concluded, therefore, to include these issues into the questionnaire. In both questionnaires, the area of thinking dispositions is enlarged by including the items referring to positive emotions that are expected to increase students' learning motivation and responsibility towards school and community (Bailin, 2006; Hofstede & Hofstede, 2005; Goleman, 1995).

To assess content validity, researcher's colleagues (a group of 'critical friends'), who were well-acquainted with the field of HOTS, rated each item for its consistency with these areas and helped to decide whether the content of items pool are relevant and representative. The next phase of construct validation involved examining items for internal consistency. Cronbach's coefficient alpha was used as the most commonly employed statistic used to measure internal consistency (Gleim & Gleim, 2003). The questionnaire for teachers was pre-tested with the help of friends - the Arab high school teachers with whom the researcher was acquainted through the internet forums and teacher seminars and workshops. Those teachers engaged some of their students to test the questionnaire for students. Together with 'critical friends', the researcher analysed the data and improved the questionnaire according to the remarks and comments received from the pilot. As to the results of the Cronbach's coefficient alpha test, Alpha levels below 0.7 are considered

acceptable (DeVellis, 1991). The results of testing show that both questionnaires have good internal reliability: all α-Cronbach scores range from 0.60 – 0.79 (see tables 3.2 and 3.3).

Table 3.2. The results of Alpha Cronbach coefficient test for the questionnaire for teachers

Variables	Questionnaire items	Likert scale	Alpha Cronbach
Pedagogical methods for instilling HOTS in students.	1 - 14	1 - 6	0.757
Pedagogical methods for developing dispositions to HOT.	15 - 25	1 - 6	0.703
Total	1 - 25	1 - 6	0.789

Table 3.3. The results of Alpha Cronbach coefficient test for the questionnaire for students

Variables	Questionnaire items	Likert scale	Alpha Cronbach
Students' thinking skills	1 - 11	1 - 6	0.690
Students' thinking dispositions	12 - 26	1 - 6	0.711
Total	1 - 26	1 - 6	0.794

3.4.4 Analysis of data

All dependent variables were measured prior to and after the HOTS intervention programme implementation. Data distributions of the following variables were tested for normality, using the Kolmogorov-Smirnov Test (see Table 3.4). Normality tests are used to determine whether data follows a normal distribution. The Kolmogorov-Smirnov test has a number of functions. It supplies the equality of continuous, one –dimensional probability distributions in order to compare two samples (Corder & Foreman, 2009). Further, it quantifies 'the distance between the empirical distribution function of the sample and the cumulative distribution function of the reference distribution. It also calculates the distance between the empirical distribution function of two samples' (Corder & Foreman, 2009). One of the most effective nonparametric methods for comparing two samples lies in the use of the dyad-sample k-s test. The sensitivity to the differences in the location and shape of the empirical cumulative distribution function of the two samples turns this test into one of the most useful tools for a comparison of the two samples (Corder & Foreman, 2009). Null hypothesis of the Kolmogorov-Smirnov test is that the data distributions do not differ from a normal distribution N (0, 1). The results of the above test demonstrate that, since the variables differ significantly ($p>0.05$) from a normal N (0, 1) distribution, null hypothesis is

rejected. The variables do not meet the assumptions of parametric tests which, therefore, are not supported for these variables.

Consequently, it was decided to employ the non-parametric Mann-Whitney U test in order to compare the medians of sample distributions based on ranked data. The Mann-Whitney U-test is a non-parametric test that is employed to compare differences between two statistically independent samples (i.e. results from one sample do not affect results in other sample) (Corder & Foreman, 2009). It was used in order to examine whether significant statistical differences exist in each group and between the intervention and control groups prior to and after the HOTS programme implementation.

Table 3.4. The results of the Kolmogorov-Smirnov Test for normality of distributions of variables of the student's cognitive skills and thinking dispositions and teachers' methods for developing student cognitive skills & thinking dispositions.

Participants	**Variables**	**Intervention group**		**Control group**	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Students	Cognitive skills	0.039	0.003	0.141*	0.011
	Thinking dispositions	0.005	0.000	0.029	0.012
Teachers	Methods for developing student cognitive skills	0.200 *	0.200 *	0.200 *	0.200*
	Methods for developing student thinking dispositions	0.043	0.045	0.200*	0.174*

Mark "*" indicates the lower bound of true significance

3.4.5 Validity and reliability of the quantitative study

The concepts of internal and external validity and research reliability are central to quantitative investigation. Reliability refers to the consistency, stability and repeatability of results (Carter & Porter, 2000). Internal validity in quantitative research can be defined as 'the extent that one can say the independent variable causes the effects on the dependent variables…' (Newman & Newman, 1994: 274). Furthermore, the research design is claimed to be internally valid if it has measurement validity and reliability (Trochim, 2006). Measures for ensuring the validity and

reliability of the measurement instrument were addressed in section 3.4.3. Further, other factors are discussed that are of importance to the validity and reliability of the quantitative study.

Quantitative research includes factors (confounding variables) that may have an effect on the dependent variables. One of the confounding variables in this study might be pre-knowledge of HOTS with which the control group teachers were acquainted, following the release of the 'Pedagogical Horizons for Learning' (2007). It can be also suggested that some of the control group students learned about HOT from various sources. Other possible confounding variables related to individual characteristics of each participant which may have an impact on their performance (Pelham, 2006). An important goal in doing research is to minimize the impact of confounding variables as much as possible. In the current study, the same researcher conducted testing, the same questionnaires were used for pre-and post-testing and they were completed under the same conditions. The researcher constantly monitored the implementation of the intervention, being in contact with the teachers from both groups. He was told by the control group teachers that they knew about the new educational policies, but worked by using mostly conventional instruction methods. The intervention measures recommended by the HOTS programme (using thinking guides, cross-curricular connections or brainstorming sessions, for instance) were implemented only by the intervention group teachers. There has been no participant dropout during the implementation of the programme. Also, using a randomized sampling technique for the student research population as well as the sound operationalization practice were expected to minimize the influence of confounding factors. Although the control group teachers volunteered for this study, they represented almost the half of the teacher staff in the school under study (out of 45 teachers, 23 teachers formed the control group). This factor helped to offset a non-random selection bias.

External validity refers to the extent, to which the research findings can be generalized to wider populations, cases or situations (Cohen et al., 2007). Bryman (2004) refers to the concept of external validity as the research reliability or whether the results of a study are repeatable. In the current research, the threats to external validity include a self-selection bias among the control group teachers, confounding variables that refer to teachers' and students' potential pre-knowledge of HOTS, and participants' individual characteristics that might influence their perceptions. These

factors reduce the ability to make generalizations from the samples in this study to wider populations. The measures used to improve external validity include randomized sampling among the student population; using the research design and statistical analysis techniques that are appropriate to the types of data collected; and constant monitoring the implementation of the programme.

3.4.6 Research ethics

Since any social research has the potential to impact on the lives of people participating in it, consideration must be given to the ethical issues associated with the research processes (Cohen et al., 2007). This research was conducted in accordance with the principles of good practice set forth in such documents as BERA Ethical Guidelines for Educational Research (2011), the Code of Practice on Research Ethics developed by the University of Derby (2011), as well as the Israeli 1981 Privacy Protection Act (Israel. Ministry of Economy, 1981).

The fundamental principles, which are regarded as the cornerstone of ethics in human research, are beneficence (do positive good) and non-malfeasance (do no harm). The Code of Practice on Research Ethics developed by the University of Derby (2011: 1) articulates that beneficence implies the obligations to serve the interests and wellbeing of others, including respect for their rights, and must be based on the principle of "doing good in the widest sense". Beneficence also means that the research results should contribute to knowledge. The BERA guidelines hold that the aim of educational researchers is to extend knowledge and understanding in all areas of educational activity and from the perspectives of learners, educators, policymakers and the public (BERA Ethical Guidelines for Educational Research, 2011). In the present study, the investigation was driven by the necessity to examine the effectiveness of the HOTS intervention programme in order to examine the impact thereof on the instruction and learning practices in an Arab school. It was expected that the results of this study would serve the interests of Arab teachers and students by identifying the ways of a more effective implementation of the new educational policies.

Non-malfeasance refers to the principle of 'doing, or permitting, no official misconduct' (University of Derby. Code of Practice on Research Ethics, 2011: 1). This means that the concern for the interests of participants and maintaining ethical standards of integrity and respect for them

must always prevail over the interests of research. The researcher was aware of the necessity of protecting the research participants from psychological harm, avoiding the situations that may cause them to experience negative feelings or emotions (Cardwell & Flanagan, 2005). Following this principle, the researcher accorded due respect to the study participants.

Following the principle of non-malfeasance, participation in the research should be on the basis of the informed consent, with the rights of privacy of participants being guaranteed. The BERA guidelines (2011) emphasise that researchers ensure that all participants in the research understand the process in which they are to be engaged. The participants should be given accurate information as to why their participation is necessary and how the research will be reported. Appendix 1 includes the informed consent from the school teachers, students and parents of the students involved in this study, providing information about the purpose of the research. The researcher informed the participants about how the research data will be stored and how it will be used. This consent was requested by the researcher in advance of the collection of data. During the meetings with the potential participants, the researcher provided accurate explanations of the research purpose and methods and possible applications of this study, as well as the benefits it might provide for improving the teacher and student performance. The research design was transparent and the data collected were discussed with the informants and peer researchers.

The participants were assured that their right for confidentiality and anonymity would be preserved, unless they expressly waive this right (University of Derby. Code of Practice on Research Ethics, 2011).Their anonymity was maintained by using coded data and fictitious names, including the name of the school which served as the research setting. At the same time, researchers must also recognize the rights of participants to be identified with any publication of their original works or other inputs (BERA Ethical Guidelines for Educational Research, 2011). Researchers must have permission from participants if there is a need to disclose personal information to third parties. The researcher assured the participants that once they had decided to participate, they would be able to withdraw from participation at any time and with no penalty if they found the process unacceptable to them for any reason whatsoever. The safety, wellbeing, rights and dignity of the research participants would be maintained.

The researcher was well aware of the fact that he has influence over participants in terms of the research design, implementation, and the final reporting of the data (Blakeslee & Fleischer, 2007). This particularly concerns the qualitative part of this study which was intended to produce the detailed data on participants' experiences, thus increasing the risk of participant exposure (Creswell, 2013; Charmaz, 2006). Ethical issues such as confidentiality and non-malfeasance are particularly important in conducting an insider research (Smyth & Holian, 2008). Being an insider researcher, on the one hand, has the advantage of having a greater understanding of the environment being studied and an established intimacy that promotes telling and interpreting the information (Sema, 2012; Smyth & Holian, 2008). As insider researchers know the institution from inside, they know how to best approach and interact with people. On the other hand, there are problems associated with balancing the insider role and researcher role (Smyth & Holian, 2008).

Because of the familiarity with research participants and awareness of institution's politics, a greater sense of protection must be ensured to participants (Mercer, 2007). In case of this study, the researcher is a member of the school staff, but does not possess any power and authority over the staff, which may have a negative impact on the data collection process (Sema, 2012). The researcher also tried to overcome some of the disadvantages of insider research by taking a preventative approach. Potential participants were informed that the researcher would follow the principle of 'empathic neutrality' (Patton, 2002: 50) so that the familiarity with respondents would not affect the process of collecting and interpreting the research data. Constant reflexivity and self-scrutiny were aimed to reduce prejudice in collecting and interpreting the research data as much as possible.

It is important, therefore, that the aims and process of the research are as transparent as possible to ensure that it is clear what the researcher intends to achieve. Sufficient time was given for potential participants to understand and consider the information about the research and what was expected of their participation. The researcher was careful to avoid the exploitation of participants for the purposes of his study, including the use of participants' goodwill and the lack of power by participants to resist demands and requests. He sought to adhere to the ethic of 'minimal intrusion'

into participants' lives in order to minimise the impact of his research on them (BERA Ethical Guidelines for Educational Research, 2011).

3.4.7 Summary

In the current research project, a mixed method study was chosen to carry out the holistic examination of a single phenomenon within its social context. It has been stated previously that the implementation of the HOTS programme in the Arab educational sector is in its initial phase. It was decided, therefore, to conduct a mixed method design investigation in one school in order to identify the factors associated with the programme implementation. Within scholarly discussions of school effectiveness, the use of mixed methods research is justified in situations where "complex and pluralistic social contexts demand analysis that is informed by multiple and diverse perspectives" (Sammons, Siraj-Blatchford, Sylva, Melhuish, Taggart & Elliot, 2005: p. 221). More weight was attached to qualitative tools, since it was important to examine the process of the programme implementation through exploring the views of the research stakeholders.The results were expected to create a basis for the reflection on the impact of the HOTS programme on the Arab school culture.

There are some noteworthy limitations of this study. It should be noticed that in both strands of the mixed method study, the researcher deals with participants' perceptions of the methods used or skills applied. Due to the time constraints on the part of the researcher and study's participants, no additional tests were carried out at the time of conducting this in order to measure participants' thinking skills and receive the data which might confirm the improvements in their thinking abilities. Such methods were planned for further investigations of implementing the HOTS programme in the school under study. According to an interpretivist approach, subjectivity is pervasive, as the data collected by qualitative tools reflect different perceptions of social phenomena and researchers have the tendency to be subjectively immersed in the subject of the study (Cohen et al., 2007; Charmaz, 2006; Bryman, 2004). Quantitative surveys, on the other hand, do not create the opportunity to study things in a natural setting and discuss the meaning social phenomena have for different people. In addition, questionnaires have some disadvantages in that the wording of questions might affect respondents' responses and their answers can be inaccurate and questionable (Brown, 2001; Gillham, 2000).

In the quantitative strand, the teacher control group was formed on a voluntary basis, which might cause a non-random selection bias. Open-ended questions, which might shed more light on participants' perceptions of the HOTS-related activities, were included only into the questionnaire for students. In the qualitative strand, using classroom observation as a data collection tool was considered by the researcher, but since teachers were not in favour of this activity, observations were not conducted. At this stage of investigation, individual interviews with student participants, which could provide more insight into students' understanding of the HOTS-based learning, were not conducted. Instead, students' written responses to open-ended questions in the questionnaire were considered the sources of data on the perceptions of a large number of students. Interviews with students were planned for further investigation of implementing the HOTS programme.

Several features of this study's methodology are expected to serve as measures for overcoming the limitations of this study. The qualitative approach dominates during the investigation and the interpretation phase of the study. It has been argued that, in some instances, qualitative dominant mixed methods have the power to capture the complexity of some educational and social issues (De Lisle, 2011; Creswell et al., 2006). Although observations were not conducted, teacher individual and focus group interviews were used as well as a wide range of documentary sources. As to the quantitative part of the study, the use of instruments with mixed item format, both multiple-choice and open-ended, is intended to enhance the questionnaire's internal reliability and allows for a more complete representation of both the cognitive and dispositional aspects of HOTS (Ku, 2009; Boynton & Greenhalgh, 2004; O'Cathain &Thomas, 2004). The assumption was that by comparing qualitative and quantitative results, a reliable basis could be established for the research inferences (Creswell & Plano Clark, 2011; Morse & Niehaus, 2009; Teddlie & Tashakkori, 2009). A concurrent mixed method design is considered to offer a strong basis for triangulation and it is useful in offsetting the weakness within one method with the strength of another method (Creswell & Plano Clark, 2007; Bryman, 2006).

To ensure the validity and reliability of the data collection methods and sampling strategies, the researcher explicitly explained different procedures of collecting data and tried to be constantly self-critical and reflexive with regard to the process of study. To reduce the influence of

researchers' personal perspectives on reporting, peer reviewing and respondent validation were used. A number of steps were taken to ensure the construct validity of the questionnaires and internal consistency of the questionnaire items. There were attempts to minimize the impact of confounding variables. The same questionnaires were used for pre-and post-testing and they were completed under the same conditions. The researcher constantly monitored the implementation of the intervention, being in contact with teachers from the intervention and control groups. There has been no participant dropout during the implementation of the programme. Although the control group teachers volunteered for this study, they represented almost the half of the teacher staff in the school under study (out of forty five teachers, twenty three teachers formed the control group). This factor helped to offset a non-random selection bias. Writing methodological memos and continuous revision of in the cyclical analysis helped to prevent the problem of overlooking certain routine processes and behaviours (Sema, 2012). The factors that reduced the limitations of study's methodology are also discussed in chapter 5.

4. FINDINGS

This chapter presents the findings of the mixed method study that has examined the process and outcomes of developing HOTS of students from an Arab high public school. The qualitative and quantitative investigations were carried out concurrently, with the two types of data being collected and analysed separately and results being merged at the point of interpretation (Creswell & Plano Clark, 2011; Creswell et al., 2011; Johnson et al., 2007). Accordingly, this chapter consists of the two major sections: the results of qualitative investigation and results of quantitative study.

4.1 Results of the qualitative study

This part of the chapter presents the results of thematic analysis of the data collected by qualitative data collection tools. The sources of data include the transcripts of individual and focus group interviews with the intervention group teachers (further referred to as 'teachers'), the documentary sources of data contain annual instruction plans prepared by the intervention group teachers for the 2011-2012 academic years and teachers' written reports on their experiences in implementing the HOTS programme, as well as written responses provided by the intervention and control group students to the questionnaire's open-ended questions. Appendix 5 presents a large variety of themes emerged as a result of thematic analysis of the data obtained. The themes included in this scheme reflect the intervention methods used by teachers on the basis of the HOTS programme recommendations, the results of the implementation of intervention, and participants' attitudes to the programme. In this chapter, the main themes and relevant sub-themes are grouped according to the research questions and are displayed as thematic sections and subsections. Sections 4.1.1 - 4.1.6 (the first research sub-question) present the themes and sub-themes that describe intervention measures and processes of implementing thereof and show changes in instruction practices. Sections 4.1.7 - 4.1.11 pertain to the second research sub-question, showing changes in student performance. Other groups of themes and sub-themes, which reflect the attitudes of teachers and students towards the HOTS-based educational practices and problems experienced during the intervention (section 4.1.12 - 4.1.13), relate to the third research question. In Appendix 13, the results of thematic analysis of the intervention and control group students' written responses are presented and compared to identify the differences and similarities between the two groups. Conclusions drawn from the qualitative findings are included in the summary (4.1.14) to this part of the chapter.

4.1.1 Using thinking strategies for enhancing students' cognitive and metacognitive abilities

This section is concerned with the issues related to the first research question. The section presents the themes and sub-themes that describe intervention measures and processes of implementing thereof. It also suggest the changes to instruction practices, based on teachers' claims to start using the HOTS-promoting methods in the area of developing students' cognitive and metacognitive skills.

a) Using thinking strategies for developing critical analysis and reasoning skills

Teachers reported that they started to use a range of thinking strategies recommended by the HOTS programme for developing their analytical and reasoning skills. Students were taught to employ thinking strategies for developing the critical analysis and reasoning skills across different subject areas. Appendices 6 - 8 include the examples of thinking guides. Appendix 6 represents a guide showing the types of scientific reasoning and scientific inquiry. The guide for analysing a scientific article is presented in Appendix 7. It demonstrates that reading and understanding a scientific article is an iterative process and shows students how to keep focused on the task. Appendix 8 includes an example of a cause and effect chart created by the intervention group student who analysed a story. It is seen in the extract below that students were encouraged to exercise their cognitive skills by using thinking guides.

> *It was the first time that students were taught how to use a reading organizer when reading the novel. I showed them how characters and events, which may seem unrelated at first, become connected as the plot develops* (Interview with the Hebrew teacher).

b) Teaching students to use metacognitive skills for self-directed learning

On the basis of the HOTS programme recommendations, teachers developed the plan according to which students would organize their actions, employing thinking strategies and evaluating the outcomes against agreed criteria. An example of such a plan is displayed in Appendix 10, presenting a general scheme. Each step in the plan includes reflective questions in order to help students become self-aware of their actions and evaluate their knowledge as they are learning. The following extract shows that teachers planned to vary questions in accordance with their purposes.

We developed for them the plans that would help them in self-directed learning. First, we developed the general scheme. Each teacher then added the details according to the discipline taught and also according to the individual abilities of students (Interview with the social work teacher).

c) Increasing the transfer of thinking skills through cross-curricular connections

Teachers tried to encourage a reflective stance toward learning that would help students reflect on their thinking processes, using the language of thinking. Teachers drew students' attention to the integration of mathematics and science subjects. Wherever it was possible in the curriculum, they encouraged students to analyse the relations between technical, social and political decisions, addressed historical issues in studying literature and language, and so on. From teacher's words below, one can see how he emphasizes the significance of technical achievements for economic and industrial issues.

While learning the use of direct current and alternating current, I told my students about the times of industrial revolution in the USA and the rivalry between different corporations and, in particular, between Tesla and Edison. I found it important to show students how technical issues become closely connected to the economic and political ones (Interview with the technical education teacher).

Some of the teachers' responses point to teachers' willingness to increase their competence needed to use a cross-curricular teaching.

We realized that this (cross-curricular approach – A.) *would require intensive preparation and collaboration between teachers, but it seemed* (he smiles) *that most of us would prepared to get over this challenge* (Interview with the teacher of history).

d. Developing students' cognitive and metacognitive skills through problem solving activities

By involving students in the problem solving activities, teachers implemented a move toward a problem based learning in a variety of curriculum areas. Problem solving tasks were carried out

both through individual and collaborative learning projects, and within classroom and extra-classroom activities like workshops and inter-classroom contests. Students were instructed on how to implement specific steps of a particular problem-solving process, both concerning algorithmic and complex, open-ended problems. In the following extract, one can learn about some problems that future family social workers may face in their work.

> *One of the curriculum topics concerned an impact of the Arab religious and cultural traditions on the life of Israeli Arab women. This issue present many complex problems which students have to deal with when engaged in social work practice. This is particularly important in the work with those Arab families in which women want to advance professionally, but encounter resistance from their husbands and immediate relatives* (Interview with the social work teacher).

Based on what has been described in section 4.1.1, one can see that teachers claimed to use a variety of methods for developing the cognitive and metacognitive skills of students and many of these methods had been used for the first time in their teaching practices. The above methods are recommended by the HOTS programme and are supported by a large number of authors (Yoad & Levin, 2007; Ormrod, 2006; Kalmes, 2005; Anderson, 2004). But there has been a tendency, to consider subject teaching and cross-curricular learning as opposites. It is based on the arguments that the latter may lack coherence and depth, mostly due to teachers' little experience or competence with cross-curricular themes or approaches (Savage, 2010; Rocard, 2007). It seems, however, that teachers in the current study were actively involved in cross-curricular learning and were prepared to address these challenges by elevating their professional level (see also section 4.1.12.3).

4.1.2 Increasing students' cognitive abilities through student-centered, collaborative learning

The sub-themes below refer to the different aspect of student-centered learning, showing teachers' efforts to use an inductive instructional approach and engage students in a variety of collaborative leaning activities.

a) Implementing inductive instruction

Teachers described how they used inductive instruction in the classroom. This process included determining the suitable topic, depending on the amount of information to be covered and time available. Teachers' instructional plans include the examples of inductive instruction in various subjects: defining the concepts of arithmetic and geometric sequences and series; providing a definition of the electrolysis solution of potassium iodide; realizing grammatical rules by using examples provided by the teacher (including excerpts from fiction texts, newspaper articles, etc.), and other examples. Teachers posed prompting questions to engage students in the observations of data and the consequent determination of the concept, as it can be seen from the extract below.

> *We have usually started the lesson from the explanation of a concept. Now I try to take a different approach when time allows for it: to present students with the concept elements, ask them questions and then lead them to building the idea of the concept* (Biology teacher's report).

b) Enhancing students' cognitive abilities through collaborative learning activities

In their working meeting records and instructional plans, teachers noted the necessity to increase instruction involving discussions and brainstorming. These were designed as a whole classroom activities and were also conducted in small groups in the framework of extra-classroom work. It was done for several reasons: examining students' comprehension of the course material and increasing the cognitive abilities of students. The description in Appendix 11 shows how the social work teacher conducts the brainstorming session on violence and the ways to eliminate it in society. As it can be seen from teachers' words below, they emphasise the importance of a proper conduct of the discussion and brainstorming sessions.

> *I was careful to remind students that during discussion or brainstorming, they should speak clearly and present logical arguments in an organized fashion* (Hebrew teacher's report).

All the teachers emphasized the importance of brainstorming for Arab students.

> *I believe it is so important to do this* (brainstorming – A.), *even it is time-consuming. You yourself know how it has been in the past: we explain, they listen, and that's it. All our education has been built on this. Now we have to teach them to use their brains more effectively and speak out freely* (Focus group interview).

c) Developing inquiry skills by involving students in collaborative learning projects.

According to the HOTS programme's recommendations, most of the collaborative inquiry projects were implemented by teachers in the form varying from structured to guided inquiry. Collaborative projects included collecting data in the fieldwork, searching for online resources, analysing and interpreting the data collected, and a presentation of findings. During the interviews, teachers claimed that unguided inquiries were not used because of time constraints. In fact, most of the teachers were in favour of structured inquiry, claiming that other types of inquiry are more appropriate for post-secondary institutions. Teachers noted that their main goal was to teach students the research basics and techniques of using various procedures and equipment that can be later used in more complicated and independent investigations. The data from teachers' written reports and interviews revealed that in two of the five collaborative projects, opportunities for more independent work were provided. In the biology project, for instance, students developed research questions. The extract below demonstrates that in the history project, students were more independent in conducting research activities.

> *The students searched through the links I recommended to them and picked up the theme for the project and identify the issues to address. They decided to prepare an oral presentation on the nature of modern fascism and present findings by using a PowerPoint slideshow and audio recordings* (History teacher's report).

d) Promoting students' cognitive and metacognitive skills by the peer and cross-age tutoring

Teachers reported that working in pairs or small groups was used in the form of peer and cross-age tutoring in order to enable low-achievement students to learn from the more successful peers. Prior to implementing peer tutoring, teachers examined the ability of students to explain the material and provided necessary recommendations. The following extract from teacher interview demonstrates the belief that peer tutoring is important for reinforcing students' subject knowledge and metacognitive skills.

> *We decided that some good students would have to be responsible for one or two classmates or younger students who were challenged with learning assignments. The strong students enhance their skills through teaching. They will knew that they are doing something useful with their knowledge* (Interview with the teacher of English).

It can be seen from the said above that teachers attached a great deal of importance to student-centered learning and collaborative activities, and seemed to understand the significance of inductive instruction. By drawing on the cognitivist teaching approaches, some researchers (Klinger, 2007; Rowe, 2006; Kirschner et al., 2006) believe, however, that carefully planned direct instruction can be more effective than student-centered learning. Teachers' beliefs that only structured inquiry should be used in secondary schools differ from the HOTS programme guidelines and from the perspectives of researchers (Krystyniak & Heikkinen, 2007; Berg et al., 2003) who claim that open inquiry is most effective to become more familiar with the nature of scientific knowledge. Teachers' responses, however, show that they were careful to follow the recommendations of the HOTS programme that placed an emphasis on constructivist learning approaches.

4.1.3 Developing students' thinking creativity by employing problem-based and collaborative learning methods

This section concerns the important part of the HOTS intervention which attaches much importance to developing creativity in thinking, based on the perspective that this is an aspect of good, purposeful thinking because it requires the ability to generate intellectual products (Paul & Elder, 2006).

Following the HOTS programme guidelines, teachers engaged students in the problem-based activities that helped students use thinking strategies to develop their convergent and divergent thinking. These activities were implemented through a variety of tasks, albeit not frequently due to the curriculum pressure. Solving open-ended problems in math and science subjects was considered the way to develop creativity in students' thinking, as it is shown in the following extract.

> *At one of the workshops, I showed them an example of solving a complex problem offered by the Russian mathematician Friedman .....Students were introduced to a number of heuristics rules which may lead to the solution of the problem* (Interview with the mathematics teacher).

Students performed open-ended tests like how many uses one can imagine for a given object. They also wrote essays describing their understanding of newly learned concepts. They involved students in simulation games, including reproduction of possible situations. As it can be seen from the extract from teacher report, students also had to show their creativity within the implementation of collaborative and individual learning projects.

> *For the project, students were offered to create the plan of renovating our school building which is more than forty years old. In the work on the project, students were required their knowledge of construction standards and show their skills in dealing with technical problems. It was a good opportunity to present creative decisions in designing the plan* (Architecture teacher's report).

Teachers strongly believed that group brainstorming is an effective way to develop divergent thinking.

> *I then asked them about processes and methods they consider alternative to those already used and combine seemingly disparate ideas to solve the problem. I encouraged everybody to speak up, not only strong students* (Social teacher's report).

The above section shows that teachers were guided by the HOTS programme that the ability to think creatively is an integral part of HOTS. They support the belief that creative thinking is necessary for innovative problem solving and emphasize the need to use brainstorming for developing divergent thinking. Some authors (Isaksen & Gaulin, 2005; Brown & Paulus, 2002; Sutton & Hargadon, 1996) suggest, however, that group brainstorming often produce fewer good/relevant ideas than those produced by individuals. Both this and preceding sections demonstrate that teachers are in favour of group brainstorming, considering it important for turning Arab students from passive learners into active participants in the classroom learning processes.

4.1.4 Using scaffolding as a teaching strategy

This section is about the intervention method which has been supported by many learning approaches and is also recommended by the HOTS programme, particularly in the work with low-achieving students. Through scaffolded instruction, teachers instructed students how to properly plan and accomplish a learning task and modeled the tasks in which students had no or little experience, such as teaching to use thinking organizers or resolving complex problems. Appendix 6 presents the scientific reasoning guide that includes explanations about science and stages of scientific inquiry. The extracts below provide the examples of how Students were taught about the process of inquiry, working with documentary sources, searching techniques to find relevant information on the Web, and presenting their findings in an appropriate form.

> *It was clear that most of the work would include using electronic resources and my task was to teach students how to use them … We worked on preparing a search plan, using keywords in search, Boolean operators and other techniques …* (Social work teacher's report).

> *After we have discussed the components of the work, they started to work independently. …… The first draft of the presentation was too long. There was a big amount of needless facts. It took time to explain to students how to present information concisely and clearly* (Technical education teacher's report).

The amount of teacher support varied, based on the needs of particular students. Teachers acknowledged that, with the increase in the tasks requiring critical thinking and analytical skills,

they had to increase their assistance to students, particularly in scaffolding weaker students up to the level required. This concerned making learning tasks more manageable by breaking them into easier steps, using mind mapping to visually outline the information explained, shared writing, and other techniques. Below is the example of how scaffolding has been done at the lesson of English.

> *I did the actual writing, while students assisted me by contributing ideas and sentences to the construction of text and by thinking aloud about writing. They could also pick up sentences from the thematic sheets we prepared when working on the topics from the textbook* (English teacher's report).

According to the interview data and records from teachers' instructional plans, the level of scaffolding should be gradually reduced as students become more able to perform on their own.

> *I realized, at some point, that I could reduce my help when I saw things were working better...* (Hebrew teacher's report).

Teachers held that, in previous years, curriculum included few tasks requiring HOT. The majority of interviewees argued that they knew the abilities and personalities of many of their students and believed that the majority of students would be highly challenged by the new learning experiences. Teachers claimed that given time constraints and the large amount of the factual knowledge to be learned for examinations, students with average and low abilities would feel confused and unmotivated. It was decided to pay more efforts to the modelling of learning activities in the classroom. The advanced students were provided with additional, more complex learning tasks. Weaker learners required more attention and teachers decided to increase the number of consultations for students who struggled with problem solving, text analysis, and other tasks. The following extracts demonstrate that teachers put much effort in scaffolding activities.

> *I preferred being in constant control of the students' work, since the majority of students had very little experience in critical reading and weaker students were really challenged by it..... This is required additional work beyond the classroom hours. We worked on the text time*

and again until some of the students understood what they are required to do.... (Interview with the Hebrew teacher).

The problem was to find enough time to provide sufficient support to all the students. They did well when collecting waste samples, but many of them required a lot of help when they developed research questions and in the work on the collected samples (Biology teacher's report).

It can be sum up that following the HOTS programme recommendations, teachers used scaffolding as an important means of assisting students to internalize knowledge and develop thinking skills in a variety of content areas. There is the belief that intensive scaffolding is very time-consuming and may lead to cutting short the time allocated for each student (McDevitt & Ormrod, 2002). One can see that teachers in the current study preferred to use scaffolding whenever it was possible, although it required working beyond classroom hours.

4.1.5 Combining summative and formative assessment of learning outcomes

Teachers reported that they assessed the learning outcomes of students through the combination of summative and formative assessment and increased the amount of formative assessment. The latter included several aspects, such as going over the homework as a class and two-way discussions providing the teacher feedback on the students' work in individual and collaborative learning tasks. Teacher feedback was used to help students understand and evaluate their abilities and teach them how to deal with success and failure in learning. Appendix 9 presents a detailed plans that include the formative assessment guidelines and questions for student self-evaluation and peer evaluation sheets. The former served to present students' written reflections on their own work on a task, the latter was used to comment on peers' written works. The extract below shows an example of how students were required to assess their performance.

After the project presentation, I asked them to reflect on the work they did and write a short summary of what they have learned by using a self-evaluation scheme. ... In their first attempt of self-evaluation, students paid more attention to the factual knowledge they learned when

working on the project, but seemed to be challenged by evaluating of their thinking skills ... (History teacher's report).

From teachers' words below, it can be seen that teachers used formative assessment to identify the students who needed extra assistance in studying the curriculum subjects.

It was important not to discourage those students who tried hard, but did not succeed. I had to make them understand why they failed and what they should do to perform better (Interview with the teacher of English).

From the said above one can see that teachers were careful to follow the HOTS programme recommendations to increase the amount of formative assessment, particularly in assessing the work of low-achieving students.

4.1.6 Using the HOT-based instruction for developing students' thinking dispositions

This section is about an important part of the HOTS intervention which is dedicated to developing thinking dispositions of students, including a range of activities for increasing the student motivation, tolerance, independent learning skills, and social competence skills as well.

a) Enhancing students' self-confidence and the ability of self-directed learning

It was acknowledged by teachers that engaging students in the HOTS-based learning should improve their self-confidence, as students would exert their mental efforts to process information and make inferences. Teachers reported that, with the help of the HOTS programme recommendations, they taught students to engage in their own learning process and in self-directed learning. The extract below demonstrates the necessity of appropriate assessment of students' abilities and achievements, praising them for successful performance, and of being careful not to discourage weaker learners.

Students are more motivated when they believe they have a chance for success. We have to give students a realistic view of their strengths and weaknesses and define realistic learning objectives (Focus group interview).

b) Achieving the pervasiveness of students' HOTS through problem-based learning.

In individual and focus group interviews, teachers expressed the hope that by engaging students in problem solving in the classroom, they helped them become prudent in making judgments and decisions in the course of daily interactions, professional activities, and coping with critical life events. Teacher's response below shows the hope that solving problems in the classroom will contribute to the transfer of thinking skills across different areas and make the HOTS of students pervasive.

> *When embarking on independent life, young people are exposed to many challenges. I hope that analytical and reasoning skills we try to instill in students will help them to make thoughtful judgments and decisions* … (Interview with the mathematics teacher).

The necessity was emphasized of including more the complex problems into textbooks.

> *Regretfully, our textbooks contain few problems related to real life situations. I believe that the authors of books should think more about that because such tasks can help our children solve the problems they have to deal with in their professional activities* (Interview with technical education teacher).

c) Developing the tolerance and open-mindedness of students

Teachers believed that the involvement of students in collaborative problem solving, particularly through discussion and brainstorming activities, should contribute both to the enhancement of their cognitive skills and development of such qualities as tolerance and open-mindedness. Teachers acknowledged that they had implemented an important change. The discussions teachers held in the classroom were quite rare and teacher-dominated. Teachers increased the number of open-ended questions for discussions (for instance, "how would you describe the role of women in the Israeli Arab society?"). By doing this, teachers want the students to recognize that there are questions that allow for a variety of possible answers and make students understand an issue from a variety of standpoints. From the extract below, one can see that students were encouraged not

to be afraid of voicing their opinions and to be tolerant to the opinions of other discussion participants.

> *We discussed the issues involving sensitivity to the life in our community and how students would deal with ethical problems. This was an opportunity to involve the whole group in discussion because some students were reluctant to speak up. I tried to encourage some shy students to speak out and not to be afraid that their classmates would laugh at them. Also, students had to be taught how to respond to someone's comment without being offensive* (Social work teacher's report).

d) Developing students' communication and interpersonal skills through collaborative activities

Another important goal in implementing collaborative inquiry projects and discussion activities was to develop students' communication skills so that they would be able to work in team. Teachers reported that, in the course of the work on the project, they encouraged students to reflect on the activities and interactions of their group, support one another as they accomplish their tasks, and work out ethical problems among themselves. Teachers also noted that peer and cross-age tutoring could be an important means for developing students' interpersonal skills and responsibility for the school student community. The example below how teachers constantly helped students work in group, as it is demonstrated in the extract below.

> *Students worked in little groups and soon it was revealed that there were many arguments among them. Some of them insisted on taking their decisions, claiming that they knew things better than others. The other ones were reluctant to acknowledge that they misunderstood something ...In the beginning, I had to constantly intervene, helping to resolve conflict situations. In the course of time, students learned to handle problems among themselves* (Social work teacher's report).

e) Enhancing students' motivation in learning.

In order to enhance student motivation, teachers tried to devise learning activities that would be of interest for students. Teachers noticed that when working with students, they paid attention to various learning motivators: the issues of personal success and failure and emotional factors, both

positive and negative. Teachers noted that in order to build student self-confidence and help students stay motivated, it is important to demand high expectations from students and at the same time promote supportive learning climate by being responsive to students' needs, as can be seen from the following extract.

> *I believe that motivation is the most important value, particularly with regard to weak learners. If you know how to spark their interest and keep them motivated in mastering the subject you teach, consider it your best achievement as a teacher* (Interview with the teacher of English).

Teachers' opinions varied on the role of collaboration and competition in the student learning performance and motivation. In general, teachers agreed that to be competitive in today's world students must be taught to collaborate effectively. It was pointed out that Arab society becomes more individualistic and many parents promote the spirit of competition in their children. On the other hand, they held that in the modern society and educational framework competition is valued over cooperation. The main challenge, they believed, was how to integrate competitiveness into the collaborative learning environment. The extract below presents the idea of organizing the competition so that all participants have a chance to show best their abilities.

> *It is important to praise students for the efforts they put in learning regardless of their achievements. Students should be enabled to compete against peers with similar ability. We should educate students in such a way that one student would not feel that his own success would hurt the others (Focus group interview).*

<u>f) Teaching students to understand and productively use their emotions</u>

Teachers reported about the discussions conducted with students to explore the issues of the personal success and failure in learning and examine the emotional aspect of this issue. Teachers noted that through the means of formative assessment, they could learn about how the issues of learning success and failure were interpreted by students. It can be seen in the following extract that teachers guided students to use their own feelings to improve learning performance.

Students felt happy because they had done well on this assignment. Those who failed were dissatisfied and seem to be in a sour mood. I had to address their frustrations and explain to them their mistakes .... It is much to be done to teach them to use their emotions in a constructive way (Mathematics teacher's report).

Many teachers noted that they tried to act as role models for students by being positive, confident in themselves and by maintaining good working relationships with students.

g) Teaching students to use HOTS for the wellbeing of the local community

Teachers were careful to devise inquiry projects that linked curriculum subject areas to real life problems and the issues that would promote students' responsibility for the wellbeing of the local community. It was decided to deal with waste management problems (biology), contemporary political and social issues (history), and other areas. The topics chosen for collaborative projects in the professional training courses concerned electrical safety in buildings, social help to large families, or developing an internet site highlighting the needs of the local community. The following extract demonstrates launching the project for the needs of the local community.

Our area have many resources at hand for inquiry field work. There are green spaces that provide habitat for wild plants and animals, but there is also a site for the disposal of waste materials not far from our village. I decided to launch an environmental project on waste awareness .... . (Biology teacher's report).

From the description of teachers' activities presented in section 4.1.6, one can see that teachers paid much effort to the work on developing thinking dispositions of students. They showed special attention to discussion and brainstorming activities, believing that these are particularly important for developing team work skills of Arab students who have been not traditionally involved in such activities. Some authors (Poole, 2008; Larson, 2000) hold, however, that brainstorming may not be effective for developing social skills because of participants' diversity. This may increase conflict and disagreement when students challenge one another or students may not understand each other because of different abilities and competence. It was noticed by teachers in the current study that weaker students were encouraged to speak out and would hopefully develop their team

work skills. Teachers have also argued that many parents promote the spirit of competition in their children and Israeli Arab society is becoming more individualistic. These issues, however, are rarely reflected in the literature relating to the characteristics of Arab society in Israel (Abu-Asbah, 2012; Abu-Asbah & Avishai, 2007).

4.1.7 The effectiveness of the intervention with regards to the student learning performance

In the first part of this section, the themes are presented that clarify students' performance and attitudes toward the HOT-related activities. These data were obtained from teacher interviews and written reports, as well as from students' written responses to the questionnaire open-ended questions. The responses of students (also referred to as 'records') were made to the open-ended questions referring to planning and monitoring the work on some task (question 2); approaches to problem solving (6); the comprehension of how the thinking skills obtained in school help students in daily life (11); and to which extent the opinions of others are taken in consideration when seeking solutions (15). Appendix 13 includes the results of thematic analysis of the intervention and control group students' responses which emerged from their experiences in the tasks required by the school, work around the home, a search for something on the web, planning a trip, and other activities. The text of each response was taken as a data item and coded inductively sentence by sentence. On the basis of coding, a theme was identified, representing the characteristics of the student's behaviours or attitudes. At general, one theme emerged from each data set, although two themes were developed from the same data set. The themes developed from students' responses were merged into broader categories that reflected the results of the HOTS programme implementation. The sub-sections presented below reflect the results of implementing the HOTS programme within the intervention group students.

4.1.8 An improvement in students' cognitive and metacognitive skills

These section shows the results of the methods which were used for developing cognitive and metacognitive skills of students and which were described by teachers in the previous sections.

<u>a) An increase in students' ability to use thinking strategies in critical analysis and reasoning</u>

On the grounds of summative and formative assessment, teachers held that at the initial stage of the programme implementation, many of students experienced difficulties in the comprehension

of thinking strategies and their systematic use. They claimed that improvements were visible among strong and some of the average students, but very little changes occurred in the cognitive and metacognitive performance of weak learners. The following extracts show how teachers indicate an increase in student cognitive performance.

> *I believe that students have grown in their ability to reflect on their work and the quality of their judgments* (Interview with the Hebrew teacher).

> *After several discussion sessions, the students' performance became better. I noticed that the quality of their argumentation seemed to improve. They showed the ability to present the facts that supported their claims and could better articulate their thoughts* (The social work teacher's report).

b) An improvement in students' problem solving skills

Teachers of mathematics and sciences reported that prior to intervention, many students encountered difficulties in problem-solving, particularly because of the nature of the language used in the problem text and failure to understand the nature of complex problems and think strategically when solving a problem. Students' poor problem-solving skills are evident in the results of the analysis of the pre-intervention responses to the open-ended question six (approaches to problem solving). Only 16% of responses reflect students' ability to solve problems, including complex ones (3%). The extracts below show the difficulties students experienced when solving problems in mathematics and sciences.

> *They have difficulties in various aspects of problem solving. Many students are challenged with understanding the wording of problems or how to approach the solution of the problem at all* (Interview with the mathematics teacher).

> *I am not good in solving problems. When someone explains to me patiently how a problem is solved, I understand, but I am struggling to solve problems independently* (a 10th grade student).

When I have a problem, I don't think about several possible solutions. I just don't have patience for this. At the end, things are worked out somehow (An 11th grade student).

When doing my homework, I read textbooks and records done in the classroom. When I have difficulties in math, I call my friends to consult them about how to move forward (A 10th grade student).

The post-intervention responses related to problem solving show a 12% increase in the records reflecting the awareness of the problem solving process, including complex, open-ended mathematics problems (a 7% percent increase) (see Appendix 13).

c) An increase in students' metacognitive abilities

Teachers stated that before the intervention, more than the majority of the students participating in the intervention programme had low metacognitive skills. It was noticed by teachers that the large majority of students did not know how to properly plan and monitor the accomplishment of learning assignments. An extract below shows an example of the claim about students' low awareness of thinking processes.

Many of students were struggling to identify the key points in the information because everything seemed to be important to them… We have used the plan for text analysis to learn about how the thinking process develops... We had to review the process of analysis in the classroom and clear up misunderstandings (The history teacher's report).

The pre-intervention results show that only 25 % of students' responses reflect the wish and ability to plan and evaluate the process of work and only 16% of responses suggest that students have the awareness of the problem solving process.

I don't plan my tasks. When I start to work, I usually have a general idea of what I want to do (A 10th grade student).

When we have to fix something around home, my parents decide what and how to do it and I follow their instructions (A 10th grade student).

As it can be seen in the post-intervention students' responses below, they have improved their skills for planning and evaluating their work on a task (40 % of the responses to the open-ended question 2) and seem to have a better awareness of the problem solving process (28 % of responses to the open-ended question 6).

When doing our project, we had to deal with a lot of material from the internet, newspapers and periodicals. First, we worked on an article with the teacher. We then read the articles and marked the most important points and also what was unclear to us. We also had to decide whether the authors' arguments were convincing (An 11th grade student).

When I solve a problem, I ask myself, "What are you trying to accomplish?" Further, I make a plan. Also, I have to know whether there are enough information to solve a problem … (An 11th grade student).

The first step is to understand the problem. I then have to find out what information I need to get the answer (An 11th grade student).

It depends on the type of a problem. Open ended problem usually have multiple correct answers that can be obtained by multiple solution methods (An 11th grade student).

A comparison of the pre- and post-intervention students' records presented in this section suggest an increase in cognitive and metacognitive skills of students. Hu and associates (2011) believe, however, that in the first years of intervention, and increase in students' learning performance may be little, if at all noticeable. In the current study, the post-intervention students' perceptions of their abilities to plan and evaluate the process of work and their better awareness of the problem solving process allow for the suggestion that results can be visible in the first years of intervention.

4.1.9 An indication of the transfer of knowledge and thinking skills

This section is about the level of students' abilities to use their thinking skills in different disciplines. Teachers were guided by the HOTS programme that instructing students to use thinking strategies with the help of critical analysis schemes and thinking maps would enhance the transfer of thinking skills across different areas.

An analysis of the students' pre-intervention responses to the questionnaire open-ended question eleven (how the thinking skills obtained in school help students in daily life) reveal that the majority of students (74%) understand the transfer of thinking skills as the practical usefulness of knowledge obtained in school. No responses include the idea that in school students obtain thinking skills that can be helpful in everyday life. It is shown in the following extracts that some of the students (26%) are uncertain about the applicability of the knowledge learned in school.

> *The things we learn in the electricity classes are useful in daily life* (A 10th grade student).

> *I don't see much connection between what we learn in school and what we do in life, but one has to complete school to get some job or to learn further* (An 11th grade student).

The post-intervention students' responses also suggest a change in students' thinking. There are only 3% of those who believe that the knowledge learned in school is not applicable in daily life. The 13 % of all respondents show the awareness of thinking skills that can be used across different domains.

> *I have adapted the plan for self-directed learning to some activities I do beyond the school and sometimes it is helpful* (An 11th grade student).

> *We were taught to pose questions when working on an assignment. It seems to me that I pose more questions to myself when I am going to do something and want to clarify how I would do this* (A 10th grade student).

Teacher interviews and written reports include very few suggestions about the transfer of students' thinking skills and no ideas about how these are used beyond the school. On the grounds of the said in section 4.1.9, in can be suggested that there is little evidence of the transfer of students' thinking skills across different areas of their activities.

4.1.10 Demonstrating creativity in thinking

The development of creativity in thinking was an important part of the HOTS programme. Teachers were recommended to increase the engagement of students in the tasks that required conscious exertion of mental effort and the development of students' divergent thinking.

The post-intervention data from teacher interview and documentary sources suggest that the use of the methods for cognitive and metacognitive development has raised the level of creativity in students' thinking. Teachers noticed that students demonstrated creativity by presenting interesting results of learning projects in architecture, computer science, social work training, and other learning activities. Teachers argued, however, that a creative approach to problem solving was seen only in the performance of strong students and some of the average students, but were pleased with the results of collaborative learning projects, as it is seen from the extracts below.

> *The most creative decisions were those demonstrating an effective use of the school premises, with relatively little alterations to the building* (The architecture teacher's report).

> *The presentation was a big success. After it was finished, we sat together with the teachers and students from the Jewish school and they praised our students for the great and creative work they did and wished to meet again to share experiences* (The Hebrew teacher's report).

Some of students' post-intervention written responses suggest the increase in students' creativity in formulating and solving problems.

> *When I have to solve a complex problem, I usually write down as many ideas and thoughts as I can think of. This is good for mind stretching* (An 11th grade student).

The positive results that pertain to the increase in the creative thinking abilities of students oppose to those obtained in the studies of other authors (Cheng, 2011; Hu et al., 2011) who show that in the first years of intervention, an increase in thinking creativity of students was almost unnoticeable.

4.1.11 An impact of the intervention on students' thinking dispositions

This section highlights the results of developing students' dispositions to thinking, ranging from their performance in collaborative activities to the willingness to use HOTS for the wellbeing of the local community.

a) A positive change in the student performance in collaborative learning activities.

During the interviews and in their written reports, teachers claimed that with regard to collaborative learning, the most significant changes occurred in students' performance during discussion activities. Students significantly improved their performance during discussions by not only improving their argumentation, but demonstrating a higher tolerance of different opinions. Teachers reported that in collaborative work, the large majority of students demonstrated high responsibility for completing one's share of the work, providing assistance to other group members, and showing the willingness to engage in constructive discussions of the problems emerged. There are fewer reports about the problems which, according to the results of other studies (Poole, 2008; Larson, 2000), may affect collaborative work: conflicts between individuals due to different abilities and uneven distribution of the workload.

In the pre-intervention responses to the open-ended question fifteen (the level of considering the opinions of other people in seeking solutions), students describe their attitudes to the opinions of friends and family members in the decision making process. The records also reflect students' behaviour in the group of peers, including a collaborative task accomplishment. It has been revealed that in 15 % of the pre-intervention responses, little consideration is given to the opinions of family members or friends. At the same time, there are also records (22 %) that show respondents' respect to the views of a family member or a friend when making decisions.

My friend A. is a bit younger than me, but he is a smart and honest guy. I can share my thoughts with him and I know that he can offer me a good idea when I am stumped over some problem (A 10th grade student).

The 38 % of the pre-intervention responses show that there is a low level of cooperation in the group of peers involved in some activity. Some of the records (25%) suggest that respondents understand the rules for collaboration among the group of peers.

When we have some assignment from the school, I and my friends often disagree on how to get things done. What is more annoying is that some guys think that they are cleverer and other have to comply (A 10th grade student).

I am a member of the School Student Board. When we plan the activities for students, we have a draft of the annual plan of school activities. We then meet and discuss what activities we can add to the plan. Sometimes, I don't agree with the ideas of other members, but the final decision is taken by voting (An 11th grade student).

In the post-intervention responses, there is a higher percentage of those related to group activities, including the work on the school projects, and relationships among group members (72 % against 62 %). Among them, 43 % of the records demonstrate the group members' awareness of the principles of team behaviour (an increase of 18 %, compared to the pre-test data). In the post-test data that concern attitudes to considering the views of family members or a close friend, there is a 5% decrease in the responses that reflect patronizing behaviour patterns (10 % against 15 %).

In our team of friends, we support each other. If there are arguments, we know how to resolve them and do not fight over silly things.

When I am faced with some problem, I am looking for my sister's advice. If you discuss your problem with somebody else, you may be offered a workable solution.

d) An increase in self-confidence and the ability of self-directed learning

Teachers reported that an increased involvement of students in their own learning, including individual and collaborative problem solving, and engagement of students in classroom discourse contributed to their self-confidence and self-esteem. An examination of students' post-intervention responses to open-ended questions two and six reveals that students demonstrate a better self-confidence and inclination for self-directed learning and seem to be more enthusiastic and persistent in solving complex problems, as it can be seen from their records below.

> *I've been never really good in math. This year we've worked hardly and I've also participated in workshops. I feel like I can do more on my own now* (A 10th grade student).

> *I was pleased to hear from the teacher that I did well in writing up an essay. I showed her an online step-by-step guide for writing essays. I found it on the internet and the teacher agreed with me that this guide was helpful* (A 10th grade student).

> *It is important to never give up when solving a problem. I do not always succeed in this, but I keep trying* (A 10th grade student).

According to teachers' opinions, the assignment of learning tasks that were aimed to develop students' metacognitive skills led to better results with regard to student ability of self-directed learning. As to weaker learners, they struggled to meet the learning goals set by the HOTS programme and required an increased teachers' assistance to comprehend the material.

e) Differences in students' reactions to success and failure

It was reported by teachers that students were highly motivated by good grades and the successful task accomplishments, but, at the early stage of the intervention, the majority of them failed to respond constructively to setbacks, both in the individual and collaborative work.

> *They argue that that the task is too difficult, that the teacher's explanations are not clear, or they were not in good physical or emotional state to succeed. This, of course, can be true,*

but very few of them find courage to say that they put too little effort in doing the work (Interview with the teacher of English).

Teachers reported that toward the end of the intervention, there had been a change in students' attitude to failure and some of the weaker learners seemed to better understand that it was not a reason to give up. Teachers believed that this was the result of the strategy recommended by the HOTS programme: praising weaker students for the efforts they put into learning, not only for their achievements.

<u>f) Students' low aspirations to use their knowledge and skills to improve their community life.</u>

The issue of the students' responsibility to the local community was highlighted from the two aspects. On the one hand, teachers reported that students had actively assisted in the community service projects (which represent an aspect of student civic education in Israeli schools – A.). Students participated in the improvement of the public places, cleaning the community cemetery, charity projects, and so on. The School's Student Committee was involved in planning the school activities, part of which was related to the community issues. Teachers claimed, however, that classroom discussions and an examination of the essays written in social studies revealed that few students showed their willingness to reflect on how their knowledge and skills could be used to improve the life of the local community (although the importance thereof was emphasised during the intervention). The following extract from teacher interview offers an explanation of this problem.

It's not easy to find a good job around here. Students, particularly the advanced ones, leave the village after having completed education and pursue a career elsewhere in Israel or abroad (Interview with the teacher of mathematics).

In the pre-intervention questionnaire, there are 2% of the responses (the results obtained on the basis of the comments to the open questions eleven and fifteen) demonstrating students' reflection on the use of their knowledge and skills for improving the welfare of their community. The post-intervention responses (such as that cited below) show only a 3% increase (2% against 5 %) in this regard.

If one would look attentively at how our village is constructed, one would conclude that a large part of it needs reconstruction. It is a complex problem which is difficult to solve because there are many things to be changed. I am going to study town planning and hope I would be able to deal with some of these problems (A 11th grade student).

It can be summed up that positive result have been achieved in many aspects of developing students' thinking dispositions. Teachers were pleased by student performance in collaborative learning projects, pointing to positive interdependence in groups of students and to the fact that those with 'average' and 'weak' educational attainment demonstrated a great deal of motivation, trying to comprehend and accomplish inquiry procedures. At the same time, the ability of self-directed learning, improvements were evident among strong and some of the average students. In addition, students demonstrated low aspirations to use their HOTS to improve the life of the local community.

4.1.12 The attitudes of teachers towards the HOTS-based intervention

The themes displayed in this section reflect the attitudes of teachers to the implementation of the HOTS programme policies. They relate to teachers' reflections on their role of the HOTS-based in-service training and instruction in the context of Arab school culture, including the disagreements on some of the aspect of the HOTS intervention as well as problems teachers experienced when implementing the intervention. These factors are considered important with regard to the impact of the new educational practices on the Israeli Arab school culture.

4.1.12.1 Changes in teachers perceptions of the HOTS-based instruction

This section highlights a variety of issues related to the positive changes that have occurred as a result of in-service training, which teachers received before implementing the intervention, and the process of intervention.

<u>a) An impact of the in-service training at personal level</u>

Teachers opined that the participation in the in-service course was considered an interesting and meaningful experience. An analysis of the interview and documentary data demonstrated that in-

service training and the implementation of the HOTS programme guidelines had an impact not only on teachers' perception and use of instructional methods, but also contributed to their personal growth, as it is shown in the following extract.

> *I believe that the knowledge we obtained in the course and the intervention practices had a positive impact on me, both at the professional and personal levels.... It was good to me because I believe I began to think in a more organized way* (Interview with the social work teacher).

b) Understanding the necessity of a systematic use of thinking strategies for developing students' HOTS.

All the teachers reported that the knowledge acquired through the training programme helped them better understand how thinking strategies can be used in facilitating thinking processes and in developing metacognitive thinking in students. Extracts below show teachers' acknowledgement of the usefulness of thinking guides of different kinds.

> *I believe that using thinking organizers was good for my thinking as well* (teacher smiles). *I believe that it helped me to think more systematically and act in a more organized way* (Focus group interview).

> *Before moving forward in our project, we used a problem solving scheme that I introduced in previous lessons. By doing so, we could discuss technical issues in a more systematic way* (Computer science teacher's report).

d) A better comprehension of the interrelation of the HOT affective and cognitive dimensions

All the teachers stated that studying under the training programme and implementing the intervention made them better understand the relationship between the affective and cognitive dimensions of HOTS and the necessity to educate independent, fair minded thinkers. The importance was acknowledged of teaching Arab students to not accept or reject beliefs they do not understand, but to orient their cognitive skills toward critical reflection on the issues and problems

they encounter. Teachers emphasised the need of making students aware of the connection between intellectual and moral virtues in critical thinking.

> *In fact, we have to be analytical about everything around us. Each of us can fall prey to manipulation by propaganda and demagoguery. To avoid this, we need to be reflective to be able to discern between what is right and what is wrong* (Interview with the technical education teacher).

> *I tell my students that very smart people do much evil in many ways, but they are punished somehow, someday. We need to instill moral virtues in our students and persuade them to use their knowledge to be socially responsible people* (Focus group interview).

c) Understanding the necessity of adjusting to the student-centered classroom environment

All the teachers reported that they had to adjust themselves to the learning environment, which was more student-centered, and to the role of the teacher as a facilitator of learning. They also acknowledged that they learned to act as discussion facilitators rather than instructors who ask questions and guide students' answers.

> *We were taught in the course on how lead the discussion smoothly, allow for everyone's ideas to be heard and respected, and many other things. But the most important aspect, which I believe was most difficult to us, was not to pressure the participant into a decision* (Interview with the teacher of Hebrew).

Teachers also noted that it was the first year when they used brainstorming in their instructional practices. Four out of the ten teachers interviewed reported that they had to adjust to the idea that the teacher could exercise his/her authority through collaborative and reflective relationships with students, instead of using authoritarian educational methods.

> *At the beginning, students were challenged by following the rules of discussion. I felt like an inexperienced orchestra conductor who tried to unify different musicians ....* (The social work teacher's report).

I was brought up with the idea that one should not tend to challenge the superior or authority, and teacher's domination in the classroom was undisputed. But times are changing. The parental authority is getting eroded. The ability to think independently is required at many workplaces." The teacher continued, smiling: "*Sometimes, I felt that when I encouraged students to pose more questions and to openly voice their views, my authority was crumbling* (Interview with the history teacher).

It can be concluded from the data obtained from teachers that studying under the in-service training programme and implementing the intervention caused significant changes in their perceptions of instructional methods. According to teachers' opinions, some aspects can be considered particularly important in the context of Arab school culture. Those are the belief that students should use their cognitive skills toward critical reflection on the issues and problems they encounter and that they need to think objectively about opposing views, and be loyal to the ideas of different peoples and societies. Teachers noticed that they had to reflect on their beliefs, try to think objectively about opposing views, and be loyal to the ideas of different peoples and societies. Another important factor was understanding that teachers should be facilitators of learning instead of dispensers of knowledge.

4.1.12.2 Teachers' disagreements over the collaborative work of students in the classroom

This section shows that not all the teachers were unified in their standpoints about some of the aspects of constructivist learning, including student-centered learning and the place of discussion and brainstorming activities in learning process.

The data obtained from teacher interviews and written reports that 13 out of the 20 teachers were in favour of quiet and orderly classrooms. They acknowledged that with regard to implementing inductive instruction through student-centered, collaborative classroom, they followed the programme guidelines rather out of the necessity to do so, but not because of the belief that these measures would be effective in the existing conditions. The following extract demonstrates their perspective on the working conditions in the classroom.

In calm and orderly classrooms, students could be more concentrated on the tasks they have to perform and on the material described by the teacher (Focus group discussion).

All the teachers agreed, however, that at the time of completing tests assignments students should sit quietly and be focused on their tasks. Many teachers believed that discussions or brainstorming sessions should be held during separate classes or extra-classroom activities. It has been argued that given a large amount of material to cover and because of having to work in the oversized classrooms populated by students with diverse abilities, many of students would be not able to communicate their reasoning to classmates and critique the arguments of others in a productive manner. In the plans of those who supported "silent and orderly" classrooms, discussion and brainstorming activities were mostly planned as an extra-classroom activity, as it is shown in the following extract.

Discussions should be conducted mostly in the framework of extra-classroom work until students would learn to debate and contribute ideas (Interview with the teacher of Hebrew).

An analysis of teachers' instructional plans also revealed differences between the ways teachers implemented discussion sessions. The advocates of the collaborative learning environment noted in their instructional plans that along with the lessons, part of which was planned for discussion or brainstorming activities, any opportunity should be used in the classroom for exchanging students' opinions on the issues raised during the instruction of a topic.

It can be summed up that teachers' views differed in terms of the student-centered learning environment and the role of classroom discussions and brainstorming. More of the half of the teachers were in favour of quiet and orderly classrooms, giving the constructivist learning a secondary role. Yet those teachers who favoured the traditional way of instruction were careful to follow the programme recommendations despite their personal viewpoints on the student-centered learning.

4.1.12.3 Perceiving the school as a learning community

This section highlights an important aspect in teachers' perceptions of the school learning environment and their understanding of the significance of long-life learning.

Most of the teachers acknowledged that participation in the training programme and implementing the intervention made them understand that they have to continuously raise their professional level. It was acknowledged, as it is seen in the extracts below, that more education is needed to implement intervention methods systematically and learning is a long-life process.

> *I believe that participating in the training programme was the first step on the way toward deep understanding of the use of the methods for developing HOTS* (Interview with the teacher of English).

> *We are also learners, not only our students. Actually, we need to learn all the time and there always remain something to learn and to improve* (Focus group interview).

Some teachers emphasized the importance of the problem-based learning for the personal and professional development of teachers, particularly in Arab schools heavily based on traditional teaching and learning.

> *How many of us have a willingness to explore? If students don't see this willingness, they won't follow us.... We should show them persistence and how to strive to reach a solution...* (Interview with the biology teacher).

> *The education based on critical thinking is critical for Arab teachers... In many aspects, we still lag behind of Jewish schools. Many of us still think in old ways ...* (Focus group interview).

All the teachers acknowledged that since the implementation of the intervention programme, there had been a change in their professional interactions which became more frequent and deeper, and there seemed to be a change toward a greater sense of collegiality. Teachers argued that discussing

their activities at working meetings helped them to elaborate their instructional plans. The hope was expressed that with the ongoing implementation of the HOTS programme, all the teachers in their school will be more active in sharing their instructional experiences. As it is expressed in the extract below, teachers also told that the practice of sharing instructional experiences with other schools, including schools in the Jewish sector, should be done on a regular basis to elevate the level of Arab schools.

> *The healthy functioning of our school* (Arab schools – A.) *requires sharing the experience with other schools in the region and being open to what is going in the Israeli society at large* (Interview with the history teacher).

The majority of teachers voiced the opinion that the Arab school culture is still influenced by the social and cultural conservatism of the Arab society in Israel and changes are required in order to give teachers more control over the processes taking place in schools.

> *They* (local and school authorities – A.) *should understand that the HOTS-based curriculum in our schools requires changes in their policies. Not only students have to be independent in the classroom, but we also need to freely express ourselves with regard to what happens in schools* (Focus group interview).

One can conclude from the described above that many teachers have a deep understanding of the issues that concern the school as learning community, including the awareness of life-long learning and increasing intra and inter school interactions. It was emphasised that implementing the new educational policies is expected to transform both teachers and students into active members of a learning community.

4.1.12.4 Problems experienced by teachers when implementing the HOTS programme

This section concerns a very important part of the process of implementing the HOTS programme, as it highlights the factors that, according to teachers' reports, were considered stumbling blocks in their work on intervention.

a) Considering time constraints a serious obstacle in the programme implementation

Teachers unanimously expressed the view that time constraints was one of the major factors that impeded the implementation of the intervention. They argued that due to the pressures they experienced in covering the curriculum and preparing students for exams, they had less time and energy for employing the HOT-based instructional methods. The following extract shows the complaints voiced regarding the insufficient time to provide formative assessment for all students and increasing student motivation for the subjects they are not good in.

> *All learning activities have strict time constraints. The matriculation examinations are pressing us and so are the superiors' demands to deliver good results. We simply don't have enough time to let our students struggle with complex tasks and involve them in divergent thinking* (Focus group interview).

Developing motivation' is not simply a slogan. It is an energy-draining task that requires a lot of time. We work under the pressure of curriculum coverage and examinations. If some students are not gifted in math and science, but are good in sport or music, why should we motivate them to learn mathematics? We simply don't have time for this. Let's focus on their talents! (Focus group interview).

b) Expressing the belief that the curriculum reform is slow and inconsistent

Most of the teachers voiced the opinion that the Education Ministry's policies with regard to restructuring the curriculum are slow and at times inconsistent. It was noted, for instance, by some teachers that the new Minister of Education raised test scores on national and international tests, which generated considerable pressures to 'teach for the test' across the school system and comes at odds with teaching on HOT. Teachers acknowledged, however, that the Education Ministry's work on adapting the testing system towards HOT is still in the development stage, particularly with regard to combining elements of on-going school-based assessment with the scores of external examinations. There were general guidelines on formative assessment during the in-service course, but teachers claimed that the Education Ministry had not yet set forth clear regulations concerning the use of the formative assessment results, particularly incorporating the

results of individual projects into final tests in vocational subjects. This can be seen in the extracts below.

> *In fact, instruction is still geared for the average student and teaching students to pass the standardised tests* (Interview with the English teacher).

> *There are no guidelines on how to use the products of inquiry learning or students' individual projects in the assessment of the final examination results* (Interview with the social work teacher).

Teachers noted that notwithstanding the requirement that students should have more opportunities of making comprehensive use of their mathematical knowledge and skills, the district-adopted mathematics and science textbooks mostly contain closed, well-structured exercises and very few open-ended problems. It was also noted that word problems in mathematics textbooks often have little relevance to the real life contexts.

c) Problems concerned with teaching social disciplines

Another problem concerned developing students' ability to apply HOTS in social subjects. Teachers of social disciplines have argued that some aspects of the history, culture and identity of the Palestinian Arabs are ignored or inappropriately addressed, as it is demonstrated in the extract below.

> *The history curriculum authorized by the Israeli Ministry of Education is based on the Zionist narrative and recognition of Israel as a Jewish state. We have our own history which is of little importance for the Ministry of Education* (Interview with the teacher of history).

It has been also noted by teachers that during the in-service course, more attention was paid to improving the performance of students in mathematics, natural sciences and ICT. The programme guidelines on studying social disciplines were of a more general character and were set in line with the state-approved history and civics curricula. However, it became clear from teachers' responses that they did not comment on or criticize the Education Ministry policies during and after the in-

service course. As it is seen in the following extract, teachers preferred to comply with the official ideology rather than get the reputation of a politically disloyal teacher.

> *We do not discuss these issues. Students just learn what is described in their textbooks* (Focus group interview).

d) Having disagreements over the role of a teacher in creating the HOT-based curriculum

The views of teachers split over the level of the teacher's role in creating the HOTS-oriented curriculum. Four of the ten teachers interviewed believed that the Education Ministry should describe in detail the ways of implementing and assessing the HOTS-related learning activities in each curriculum area, including connections between different areas of learning. These teachers were aware that curriculum reform is aimed at increasing the diversity of instructional strategies and teacher involvement in the decision-making process, but they insisted that the Education Ministry should set clear standards for the HOTS-based curriculum and provide good examples of lesson plans and activities that model HOTS.

> *The nature of the school system requires uniformity and consensus on educational goals and outcomes. Various political concerns and pressure for accountability will not disappear with the implementation of the new educational standards. To hold accountable, we need to know exactly what and how to achieve our goals* (Focus group interview).

The other group of teachers criticized the intention of placing a priority on the "top-down" approach in building the HOT curriculum.

> *We were told during the course that grassroots initiatives are encouraged by the curriculum developers. Teachers can offer ideas on the types of materials and activities that need to be included* (Focus group interview).

Those who advocated a greater teacher's participation in creating the HOTS-based curriculum emphasised that educational standards do not prescribe the instructional practices and materials. They allow teachers to be flexible and to insert personalized components in the curriculum and

select learning activities. Seven working groups were formed, with each teacher group dealing with a particular subject area: Hebrew language and literature (five teachers), English (two), history (two), mathematics (two), natural sciences (four), social sciences (two), technical education and computer sciences (three). Working group members periodically met to talk about their experiences and develop consolidated instruction strategies, but there was an uncertainty among some teachers as to what should be centralized or decentralized curriculum decisions, both at the district and school levels.

d) Increasing the amount of extra-classroom activities to provide additional help

All the teachers reported that due to time constraints and curriculum load, a significant amount of the work related to implementing the new teaching methods was done beyond the classroom hours. This concerned a variety of activities: assistance in conducting collaborative projects, developing instruction plans, preparing learning materials, and helping low-achieving students. Working long hours was not new for teachers who had to prepare for classes, grade papers, and communicate with students' parents. Teachers reported that due to the implementation of the new educational policies, they needed additional time to model learning tasks, such as critical text analysis, solving complex problems, modelling discussion and brainstorming skills, and other activities. Additional time was needed to provide formative assessment of student performance. An increase in the extra-classroom work was also attributed to the necessity of investing more time to help weaker students.

> *There was simply not enough time to help all the students who were challenged with using reading organizers. We scheduled to meet once a week on the day when I had less classes* (Interview with the teacher of English).

> *Unlike during classes, we had more time at these meetings to talk about what went well and what was challenging* (Computer science teacher's report).

e) Having a challenge in developing HOTS in students with diverse educational attainment

The HOTS programme contained no separate section on developing thinking skills in low-achieving students. Comments on this task were provided across different aspects of instruction. Following the programme recommendations, teachers used intensive scaffolding techniques across

different content areas. Teachers reported that they faced many problems, working in oversized classes and having to deliver instruction responsive to the needs of a diverse student population. Teachers of mathematics, science and English pointed out that due to the fact that many students had not obtained the required prerequisite knowledge, teachers needed to deliver the curriculum and cover the prerequisite material as well.

> *Our superiors require us to show good results. There are students who are moved from grade to grade, having received a minimum passing mark and having learned about half of what they should* (Interview with the mathematics teacher).

Teachers emphasised that school must be a place where each student is respected. They supported the idea that weak learners were able to deal with tasks requiring HOTS. They held, however, that the development of HOTS in low achieving students was a very time-consuming process. It was argued that given such factors as overcrowded classrooms, time constraints and curriculum pressure, sound results would not be achieved over the period of the intervention.

> *We are recommended to help weak students by breaking critical thinking tasks into smaller, more manageable steps. This means that we have to proceed slowly and gradually* (Interview with the mathematics teacher).

> *The intervention requires being responsive to the needs of different students. We have to enhance the abilities of talented students and not to kill the motivation of those who are less gifted, but strive to achieve good results* (Interview with a Hebrew teacher).

It can be summed up that section 4.1.15 highlights a wide range of the problems that teachers have faced during the implementation of intervention. These problems include ones that concern the Education Ministry's policies and conditions existing in schools and ones related to teachers' personal standpoints about the role of the teacher in creating the constructivist, HOTS-based environment. The problems were identified of the necessity to deliver curriculum and cover the prerequisite material, when working with low-achieving students, and increasing the amount of

extra-classroom activities. Many curriculum decisions had been made by teachers collaboratively, through working groups in different disciplines.

4.1.13 Students' attitudes to the HOTS-based learning activities

The data collected from teachers and students revealed different opinions of the latter on the HOTS programme and their perceptions of learning in general. Students' responses were considered important in reflecting the developments in the HOTS intervention and significance thereof for the Arab school culture.

a) Adopting a generally positive attitude to the involvement in the HOTS-based learning

It was stated in teacher's written reports and during interviews that there had been an improvement in the attitudes of students to the tasks requiring HOTS. Prior to the intervention, students were explained that it would help them to perform better in terms of thinking and learning performance, but many of them exhibited mixed attitudes toward the programme, as it is demonstrated by the extract below.

> *In general, students were interested to engage in something new. At the same time, they seemed to feel overwhelmed with the amount of work that they would have to do. I could understand their mixed feelings. An overloaded curriculum, the pressure of examinations and also other responsibilities they had* (The history teacher's report).

Another extract shows student's opinion on the use of a thinking map when it was first introduced in the classroom.

> .... *I believe it is a good thing and maybe it will be also useful in the college* (A 10th grade student).

Teachers reported that in the course of the intervention, there had been a positive change in students' interest in the HOTS-related activities. It was found that before the intervention, around 30 % of all the responses reflected a positive attitude toward the new educational policies while almost 70 % of expressed mixed and unfavourable feelings. Toward the end of intervention, more

than 60 % seemed to understand how they could benefit from the HOTS-based activities. Teachers reported that more students became engaged in self-directed learning, such as using the information resources additional to those recommended by teachers, expressing the desire to solve more challenging mathematical problems, and learning more than required by the standard high school curriculum. This increase was reported not only among the advanced students, but also among average ones. Compared with the beginning of the intervention, there had been an increase in the number of students who showed persistence and self-confidence in accomplishing the tasks that required HOTS. The understanding of the usefulness of the HOTS-based tasks and persistence in achieving the goal are evident from the following extract.

> *We carried out a waste management project ... It was really hard to deal with research questions and analysis of the information, but I believe that it was worth doing because we know now how to deal with waste and how to dispose of it* (An 11th grade student).

b) Demonstrating a negative attitude or indifference toward the HOTS-based learning

Despite the fact that there had been a general improvement in students' attitudes to the HOTS-based learning, some of them failed to improve their attitudes towards new learning tasks. Teachers reported that those who were persistent in their negative view on the tasks requiring HOTS were mostly weak learners and some of the average students. This part of student population considered new learning challenges a burden and an obstacle both in learning the curriculum and preparation to tests, which can be seen in one of the post-intervention written responses.

> *These open-ended problems are a real headache. I have not enough time to do all homework. Why do we need this stuff*? (An 11th grade student).

The important change to be emphasized in this section is an increase in the positive attitudes of students to the HOTS-based methods and activities, including a higher persistence in accomplishing the tasks. The above findings are different from those presented in some other studies of the HOTS-based interventions (Barak et al., 2007; Zohar, 2003) in which the authors do not regard students' perspectives on learning success or failure as important factors in implementing the intervention.

4.1.14 Summary

Prior to the discussion of the qualitative study findings, which is provided in the next chapter, some preliminary conclusions can be drawn on the basis of thematic analysis of data. The data obtained from the interviews with teachers and their instructional plans suggest an improvement in their knowledge and skills needed for the implementation of the HOTS-promoting instruction. The findings from teacher interviews suggest that positive results were achieved in terms of developing the cognitive and metacognitive skills of students and their performance in collaborative activities. In addition, the data obtained from teachers create the basis for an indication of the transferability of learning skills acquired by students in school. It can be suggested that during the period of intervention, teachers made student-focused activities more frequent and more student-centered and their goal was to make this change sustainable.

An analysis of students' written responses to open-ended questions provided valuable information on engagement of students in the HOTS-based tasks which contributed to an apparent increase in their awareness of problem solving strategies and principles of team behaviour. Unlike the pre-intervention responses, the post-intervention ones indicate a higher interest in the HOT-related activities and more persistence in accomplishing thereof. They suggest the signs of the transfer of thinking skills from learning activities to real life situations. Appendix 13 includes a comparison of the pre-intervention written responses provided by the student control and intervention groups. It shows that the characteristics of both groups are close in terms of the ability to plan and evaluate the work on a task, approaches to problem solving, attitudes to collaborative activities, views on the usefulness of the knowledge obtained in school, and the reflection on the ways to improve the welfare of their community. Post-intervention results point to higher differences between the two groups of respondents: the intervention group demonstrates an improvement in the perceptions of their HOTS and their academic performance.

In addition, interview and documentary data point to the challenges and problems faced by teachers and students during the implementation of the intervention. Themes indicate teachers' complaints about time and curriculum pressure, inconsistency in implementing the HOTS-related reforms, and the necessity to increase the amount of extra-classroom work. Findings also revealed

disagreements among teachers concerning students' collaborative work in the classroom and creating the HOT-based curriculum. It seems that not all the teachers were completely convinced by what they learned under the in-service training, being more in favour of traditional ways of instruction. Their efforts to teach students how to apply their thinking skills in many aspects of community life had little impact on students' to use their HOTS for the good of the local community. In addition, almost 40% of students either failed to improve their attitudes towards the intervention or had mixed feeling about it.

In terms of the theme recurrence, the most salient themes are related to the description of the instructional methods for developing the HOTS of students, emerging from the data collected by the five and four data collection tools. They appear in all interviews with teachers and their instructional plans, and in the majority of teachers' written reports. The themes, which reflected teachers' attitudes to the HOTS-based instruction and problems they experienced during the intervention were developed from the data contained in the individual and group interviews with teachers and in some of the teachers' reports. Although the frequency of these themes in terms of appearing in data items is lower than that of the themes reflecting the intervention measures and intervention results, they point to the factors impeding the implementation of the HOTS programme.

It can be also concluded that the results of thematic analysis are congruent with the research conceptual framework which is based on the ideas of the constructivist pedagogy and the concept of an "infusion" approach to teaching HOTS. They are in line with a complex concept of HOTS, which includes both cognitive and affective dimensions of thinking (thinking dispositions), and reflect a complex, multi-aspect process of developing HOTS. It can be suggested that the themes that emerged from the interview and documentary data provide valuable material for the reflection on how the Arab school culture might benefit from the HOTS programme implementation.

4.2 Results of the quantitative study

This part of the chapter presents the results of analysing the data collected through questionnaires. Four groups were formed: teacher intervention and control groups and student intervention and control groups. On the basis of the teacher and student questionnaire items, four dependent variables were identified: perceptions of student cognitive skills, perceptions of student thinking dispositions, perceptions of methods for developing student cognitive skills, and perceptions of methods for developing student thinking dispositions. Each variable includes a number of categories that reflect various aspects of the HOTS intervention. In order to examine whether the HOTS intervention programme affected the perceptions of academic and pedagogical skills of teachers and thinking habits of students, all dependent variables and associated categories were measured by using Likert scales (1 – 6: Strongly disagree to Strongly agree respectively), prior to and after the intervention. Data distributions of the variables were tested for normality, using the Kolmogorov-Smirnov Test (see Methodology, Table 3.4). The results of the above test demonstrate that, since the variables differ significantly ($p>0.05$) from a normal N (0, 1) distribution, null hypothesis is rejected. The variables do not meet the assumptions of parametric tests which, therefore, are not supported for these variables.

4.2.1 Mann-Whitney U-test for comparing the teacher control and intervention groups

Mann-Whitney U test was used to compare differences between two statistically independent samples (i.e. results from one sample do not affect results in other sample) (Gorder & Foreman, 2009). Four tests (1-4) were conducted to make comparisons between the pre- and post-intervention scores for the control and intervention teacher groups and between the scores for each group.

Table 4.1: Mann-Whitney U-Test comparisons of the intervention and control teacher groups

Teachers	**<u>Intervention group</u>** **Pre-intervention**	**<u>Control group</u>** **Post-intervention**
<u>Control group</u> **Pre-intervention**	**Test 1** H_0: There is no difference between the distributions of the responses of the intervention group teachers and the control group responses. H_1: There is a difference between the distributions of the responses of the intervention group teachers and the control group responses.	**Test 2** H_0: There is no difference between the distributions of the pre-intervention and post-intervention control group responses. H_1: There is a difference between the distributions of the pre-intervention and post-intervention control group responses.
<u>Intervention group</u> **Post-intervention**	**Test 3** H_0: There is no difference between the distributions of the pre-intervention and post-intervention responses of the intervention group teachers. H_1: There is a difference between the distributions of the pre-intervention and post-intervention responses of the intervention group teachers.	**Test 4** H_0: There is no difference between the distributions of the post-intervention responses of the intervention group teachers and the control group responses. H_1: There is a difference between the distributions of post-intervention responses of the intervention group teachers and the control group responses.

Test 1: The pre-intervention comparison of the responses of the intervention group teachers with the control group teachers' responses

Table 4.2: Pre-intervention results for the measures of central tendency and interquartile range of the parameters for the teacher intervention and control groups

Variables	**Intervention group (N=20)**		**Control group (N=23)**		
	Md	**IR**	**Md**	**IR**	**U**
Methods for developing the cognitive domain of students' HOTS - total scores	**4.07**	**0.77**	**4.14**	**0.64**	**-0.68**
Teaching to organize learning	4.50	1.00	4.00	0.50	-0.78
Fostering meta-cognition skills	4.25	1.00	4.00	1.00	-1.35
Developing reasoning and argumentation skills	4.17	1.00	4.33	0.67	-0.75
Developing thinking creativity	3.33	1.00	4.00	0.67	-1.60
Instilling HOTS in low achievement students	3.75	1.38	4.00	1.00	-1.38
Increasing transferability of thinking skills	4.50	0.38	4.50	0.50	-1.98
Methods for developing thinking dispositions - total scores	**3.45**	**0.64**	**4.09**	**055**	**-3.43****
Encouraging pervasive thinking in students	3.25	0.50	4.00	0.50	-3.07**
Involving students in teamwork	3.50	0.90	4.00	0.80	-2.13*
Educating independent learners	4.00	1.00	4.00	1.00	-1.55
Using positive emotions for increasing learning motivation	4.00	1.00	4.00	2.00	-1.48
Promoting tolerance of other' beliefs	4.00	0.00	4.00	1.00	-1.98*
Developing students' civic responsibility	4.00	1.00	5.00	2.00	-2.98**

* P<0.05, ** p<0.01, Md: Median; IR: inter- quartile range; U = calculated U-test statistic

The above results show that no statistically significant difference has been found between the pre-intervention scores for control and intervention teachers with regard to developing the cognitive domain of students' HOTS. Some significant differences were found in the parameters for the development of student's thinking dispositions: total scores (U = -3.43, p<0.01); encouraging pervasive thinking in students (U = -3.07, p<0.01); involving students in a team work (U = -2.13, p<0.05); promoting tolerance and cooperative behaviour (U = -1.98, p<0.05); and educating to be socially and ethically responsible community members (U = -2.98, p<0.05). In terms of quantitative experimental study, the control group's increases in perceptions of these intervention areas can be explained by the influence of confounding variables like pre-knowledge of the methods for developing HOTS. For an additional explanation, see section 4.2.3.

Test 2: A comparison of pre- and post-intervention responses of the control group teachers

Table 4.3: Pre- and post-intervention results for the measures of central tendency and interquartile range of parameters for the control group teachers

Variables	**Pre-intervention results (N=23)**		**Post-intervention results (N=23)**		
	Md	**IR**	**Md**	**IR**	**U**
Methods for developing the cognitive domain of students' HOTS - total scores	**4.14**	**0.64**	**4.14**	**050**	**-0.154**
Teaching to organize learning	4.00	050	4.50	1.00	-0.158
Fostering meta-cognition skills	4.00	1.00	4.00	1.00	-0.183
Developing reasoning and argumentation skills	4.33	0.67	3.67	1.00	-4.29***
Developing thinking creativity	4.00	0.67	4.33	0.67	-3.45***
Instilling HOTS in low achievement students	4.00	1.0	4.50	1.00	-2.39*
Increasing transferability of thinking skills	4.50	0.50	4.50	0.50	-0.136
Methods for developing thinking dispositions - total scores	**4.09**	**0.50**	**4.09**	**0.64**	**-1.17**
Encouraging pervasive thinking in students	4.00	0.50	4.00	1.00	-1.11
Involving students in teamwork	4.00	0.80	4.20	1.00	-0.64
Educating independent learners	4.00	1.00	4.00	2.00	-0.35
Using positive emotions for increasing learning motivation	4.00	2.00	4.00	1.00	-0.98
Promoting tolerance of other' beliefs	4.00	1.00	5.00	1.00	-0.87
Developing students' civic responsibility	5.00	2.00	5.00	2.00	-0.011

* P<0.05, ** p<0.01, *** p<0.001; Md: Median; IR: inter- quartile range; U = calculated U-test statistic

The above findings indicate that there are no statistically significant difference between the pre-test and post-test results, except for the following parameters: developing reasoning and argumentation skills (U = -4.29, p<0.001); developing thinking creativity (U=-3.45, p<0.01); and, instilling HOTS in low achievement students (U=-2.39, p<0.05) The results show that, in general, the control group teachers had not changed their beliefs about their skills. As it is with the results obtained in test 1, the control group's increased perceptions of the intervention areas indicated above can be explained by the influence of confounding variables like pre-knowledge of HOTS and self-education in this area. An additional explanation is provided in section 4.2.3.

Test 3: A comparison of the pre- and post-intervention responses of the intervention group teachers

Table 4.4: Pre- and post-intervention results for the measures of central tendency and interquartile range of parameters for the teacher intervention group

Variables	**Pre-intervention results (N=20)**		**Post-intervention results (N=20)**		
	Md	**IR**	**Md**	**IR**	**U**
Methods for developing the cognitive domain of students' HOTS - total scores	**4.07**	**0.77**	**4.71**	**0.39**	**-4.08*** **
Teaching to organize learning	4.50	1.00	5.00	1.00	-2.56*
Fostering meta-cognition skills	4.25	1.00	5.50	0.50	-4.30***
Developing reasoning and argumentation skills	4.17	1.00	5.00	0.67	-3.60***
Developing thinking creativity	3.33	1.00	4.00	0.67	-2.21*
Instilling HOTS in low achievement students	3.75	1.38	4.00	0.50	-2.30*
Increasing transferability of thinking skills	4.50	0.38	5.00	1.00	-2.95**
Methods for developing thinking dispositions - total scores	**3.45**	**0.64**	**5.00**	**034**	**-5.28*** **
Encouraging pervasive thinking in students	3.25	0.50	5.00	0.50	-5.16***
Involving students in teamwork	3.50	0.90	5.00	0.40	-5.13***
Educating independent learners	4.00	1.00	5.00	0.00	-5.26***
Using positive emotions for increasing learning motivation	4.00	1.00	5.00	1.00	-4.36***
Promoting tolerance of other' beliefs	4.00	0.00	5.00	0.00	-4.09***
Developing students' civic responsibility	4.00	1.00	5.00	0.00	-4.88***

* P<0.05, ** p<0.01, *** p<0.001; Md: Median; IR: inter- quartile range; U = calculated U-test statistic

The results show that, when comparing the pre-and post-intervention phases, significant differences can be found in all parameters for the teachers' perceptions of their pedagogical skills and, therefore, the null hypothesis for test 3 is rejected. The parameters for the post-intervention perceptions are higher than the pre-intervention ones. These results suggest that, due to the participation in the HOTS programme, there was a considerable improvement in teachers' perceptions of the HOTS-based pedagogy and pedagogical skills. The most visible increases occurred in the area of developing the thinking dispositions of students (U = -5.28, p<0.001).

Test 4: The post-intervention comparison of the responses of the intervention group teachers with the control group teachers' responses

Table 4.5: Post-intervention results for the measures of central tendency and interquartile range of the parameters for the teacher intervention and control groups

Variables	**Intervention group (N=20)**		**Control group (N=23)**		
	Md	**IR**	**Md**	**IR**	**U**
Methods for developing the cognitive domain of students' HOTS - total scores	**4.71**	**0.39**	**4.14**	**0.50**	**-4.45*** **
Teaching to organize learning	5.00	1.00	4.50	1.00	-3.36*
Fostering meta-cognition skills	5.50	0.50	4.00	1.00	-5.34***
Developing reasoning and argumentation skills	5.00	0.67	3.67	1.00	-5.34***
Developing thinking creativity	4.00	0.67	4.33	0.67	-2.75**
Instilling HOTS in low achievement students	4.00	0.50	4.50	1.00	-2.37*
Increasing transferability of thinking skills	5.00	1.00	4.50	0.50	-3.50***
Methods for developing thinking dispositions - total scores	**5.00**	**0.34**	**4.09**	**0.64**	**-4.49*** **
Encouraging pervasive thinking in students	5.00	0.50	4.00	1.00	-3.63***
Involving students in teamwork	5.00	0.40	4.20	1.00	-4.30***
Educating independent learners	5.00	0.00	4.00	2.00	-3.47*
Using positive emotions for increasing learning motivation	5.00	1.00	4.00	1.00	-2.47*
Promoting tolerance of other' beliefs	5.00	0.00	5.00	1.00	-1.82
Developing students' civic responsibility	5.00	0.00	5.00	2.00	-0.74

* P<0.05, ** p<0.01, *** p<0.001; Md: Median; IR: inter- quartile range; U = calculated U-test statistic

There are significant differences in the most of parameters between the control and intervention groups and, therefore, the null hypothesis for test 4 is rejected. The results suggest that compared to the control group, there has been a considerable improvement in the intervention group teachers' perceptions of the pedagogical methods after the participation in the HOTS programme. There are also parameters indicating that the difference between the two teacher groups is insignificant (promoting tolerance and cooperative behaviour; educating to be socially and ethically responsible community members) (for an explanation, see section 4.2.3).

4.2.2 Mann-Whitney U-tests for comparing the student control and intervention groups.

Four tests (5-8) were conducted to make comparisons between the pre- and post-intervention scores for the control and intervention groups and between the scores for each group.

Table 4.6: Mann-Whitney U-Test comparisons for the student intervention and control groups

Students	**Intervention group** **Pre-intervention**	**Control group** **Post-intervention**
Control group **Pre-intervention**	**Test 5** H_0: There is no difference between the distributions of the responses of the intervention group students and the control group responses. H_1: There is a difference between the distributions of the responses of the intervention group students and the control group responses.	**Test 6** H_0: There is no difference between the distributions of the pre-intervention and post-intervention control group responses. H_1: There is a difference between the distributions of the pre-intervention and post-intervention control group responses.
Intervention group **Post-intervention**	**Test 7** H_0: There is no difference between the distributions of the pre-intervention and post-intervention responses of the intervention group students. H_1: There is a difference between the distributions of the pre-intervention and post-intervention responses of the intervention group students.	**Test 8** H_0: There is no difference between the distributions of the post-intervention responses of the intervention group students and the control group responses. H_1: There is a difference between the distributions of post-intervention responses of the intervention group students and the control group responses.

Test 5: Pre-intervention comparison of the responses of the intervention group students with the control group students' responses

Table 4.7: Pre-intervention results for the measures of central tendency and interquartile range of parameters for the student control and intervention groups

Variables	**Intervention group (N=87)**		**Control group (N=90)**		
	Md	**IR**	**Md**	**IR**	**U**
Cognitive domain of students' HOTS – total scores	**3.91**	**0.82**	**4.00**	**0.68**	**-1.17**
Work organization	4.00	1.00	4.00	1.00	-1.67
Metacognition skills	3.67	0.67	4.00	1.00	-1.83
Formulating and solving problems	4.00	0.67	4.00	0.67	-0.374
Transferability of knowledge and thinking skills	4.00	1.33	4.00	1.33	-0.397
Thinking dispositions - total scores	**3.43**	**0.64**	**3.50**	**0.61**	**-0.62**
Learner's self-confidence	3.67	1.00	3.67	1.17	-0.52
Respect and tolerance of other' beliefs	3.50	2.00	3.50	2.00	-0.79
Attitude to team work	3.33	0.67	3.33	0.67	-0.89
Pervasiveness of HOTS	3.33	1.00	3.33	1.00	-0.11
Self-directed learning	4.00	1.00	4.00	1.00	-0.12
Positive emotions in learning motivation	4.00	1.00	4.00	1.00	-0.39
Students' civic responsibility	3.00	1.00	3.00	1.00	-0.31

* $P<0.05$, ** $p<0.01$, *** $p<0.001$; Md: Median; IR: inter- quartile range; U = calculated U-test statistic

The above results suggest that, in the pre-intervention phase, there were no statistically significant difference between control and intervention groups regarding any HOTS-related parameters. These results attest for the fact that both groups began at the same starting point with regard to their perceptions of cognitive and metacognitive skills, transferability of knowledge and thinking skills, and their perceptions of thinking dispositions.

Test 6: A comparison of pre- and post-intervention responses of the control group students

Table 4.8: Pre- and post-intervention results for the measures of central tendency and interquartile range of parameters for the control group students

Variables	**Pre-intervention (N=90)**		**Post-intervention (N=90)**		
	Md	**IR**	**Md**	**IR**	**U**
Cognitive domain of students' HOTS – total scores	**4.00**	**0.68**	**4.09**	**0.59**	**-1.28**
Work organization	4.00	1.00	4.00	1.00	-0.832
Metacognitive skills	4.00	1.00	4.00	0.67	-1.55
Formulating and solving problems	4.00	0.67	4.00	0.67	-1.40
Transferability of knowledge and thinking skills	4.00	1.33	4.33	1.00	-0.654
Thinking dispositions - total scores	**3.50**	**0.61**	**3.50**	**0.54**	**-0.961**
Learner's self-confidence	3.67	1.17	3.67	0.67	-0.515
Respect and tolerance of other' beliefs	3.50	2.00	3.50	1.75	-0.623
Attitude to team work	3.33	0.67	3.33	0.67	-1.80
Pervasiveness of HOTS	3.33	1.00	3.67	1.00	-0.67
Self-directed learning	4.00	1.00	4.00	1.00	-0.29
Positive emotions in learning motivation	4.00	1.00	4.00	1.00	-0.56
Students' civic responsibility	3.00	1.00	3.48	1.00	-1.22

* $P<0.05$, ** $p<0.01$, *** $p<0.001$; Md: Median; IR: inter- quartile range; U = calculated U-test statistic

The above results show that there is no statistically significant difference between the pre- and post-intervention scores for the control group. These findings suggest that there was no positive changes in the control group students' perceptions of cognitive and metacognitive skills, understanding of the skill transfer, and their thinking dispositions.

Test 7: A comparison of the pre- and post-intervention responses of the intervention group students

Table 4.9: Pre- and post-intervention results for the measures of central tendency and interquartile range of parameters for the student intervention group

Variables	**Pre-intervention (N=87)**		**Post-intervention (N=87)**		
	Md	**IR**	**Md**	**IR**	**U**
Cognitive domain of students' HOTS – total scores	**3.91**	**0.52**	**4.73**	**0.55**	**-8.49*** **
Work organization	4.00	1.00	5.00	1.00	-7.63***
Metacognitive skills	3.67	0.67	4.67	0.67	-9.03***
Formulating and solving problems	4.00	0.67	4.33	1.00	-5.81***
Transferability of knowledge and thinking skills	4.00	1.33	4.67	1.00	-4.81***
Thinking dispositions - total scores	**3.43**	**0.64**	**5.07**	**0.57**	**-11.07*** **
Learner's self-confidence	3.67	1.00	5.00	1.00	-9.72***
Respect and tolerance of other' beliefs	3.50	2.00	5.00	0.50	-8.96***
Attitude to team work	3.33	0.67	5.00	0.67	-10.70***
Pervasiveness of HOTS	3.33	1.00	5.00	1.00	-10.81***
Self-directed learning	4.00	1.00	5.50	0.50	-9.48***
Positive emotions in learning motivation	4.00	1.00	5.00	1.00	-5.77***
Students' civic responsibility	3.00	1.00	5.00	1.00	-7.48***

* P<0.05, ** p<0.01, *** p<0.001; Md: Median; IR: inter- quartile range; U = calculated U-test statistic

The above results indicate the statistically significant difference between the pre- and post-intervention scores and, therefore, the null hypothesis for test 7 is rejected. The parameters for the post-intervention students' perceptions are higher than those for the pre-intervention period. These findings suggest that, due to the participation in the HOTS programme, there has been a considerable improvement of students' perceptions of their cognitive and metacognitive skills, and thinking dispositions.

Test 8: Post-intervention comparison of the responses of the intervention group students with the control group students' responses

Table 4.10: Post-intervention results for the measures of central tendency and interquartile range of the parameters for the student control and intervention groups

Variables	**Intervention group (N=87)**		**Control group (N=90)**		
	Md	**IR**	**Md**	**IR**	**U**
Cognitive domain of students' HOTS – total scores	**4.73**	**0.75**	**4.09**	**0.59**	**-7.48*** **
Work organization	5.00	1.00	4.00	1.00	-6.27***
Metacognition skills	4.67	0.67	4.00	0.67	-7.23***
Formulating and solving problems	4.33	1.00	4.00	0.67	-4.53***
Transferability of knowledge and thinking skills	4.67	1.00	4.33	1.00	-4.73***
Thinking dispositions - total scores	**5.07**	**0.57**	**3.50**	**0.54**	**-11.58*** **
Learner's self-confidence	5.00	1.00	3.67	0.67	-9.95***
Respect and tolerance of other' beliefs	5.00	1.00	3.50	1.75	-9.31***
Attitude to team work	5.00	0.67	3.33	0.67	-10.89***
Pervasiveness of HOTS	5.00	1.00	3.67	1.00	-10.78***
Self-directed learning	5.50	0.50	4.00	1.00	-9.46***
Positive emotions in learning motivation	5.00	1.00	4.00	1.00	-5.79***
Students' civic responsibility	5.00	1.00	3.00	1.00	-7.24***

* P<0.05, ** p<0.01, *** p<0.001; Md: Median; IR: inter- quartile range; U = calculated U-test statistic

The results show that there are statistically significant difference between the pre- and post-intervention scores for control and intervention groups. The post-intervention medians for the intervention group are higher than those for the control group. This suggests that the HOTS programme significantly contributed to the improvement of students' perceptions of their cognitive skills and thinking dispositions.

4.2.3 Summary

The results obtained in the quantitative part of this study suggest that the implementation of the HOTS programme had an impact on the intervention group teachers' perceptions of the methods for developing the cognitive and dispositional domains of students' HOTS. Findings show that there is a significant difference between all the pre- and post-intervention parameters for teachers' perceptions of the intervention measures. The most statistically significant differences are visible in the domain of methods for developing thinking dispositions (see Table 4.4). These results allow for a suggestion that a more effective work was done by teachers in this area of intervention.

The post-intervention comparison of the intervention and control teachers' responses show that almost all the parameters for the intervention group teachers' perceptions are higher than those of the control group, as a result of acquiring the knowledge on HOTS and participating in the intervention. At the same time, the pre-intervention comparison of the two groups reveals that the control group teachers have significantly higher scores for the perceptions of some measures for developing student thinking dispositions (Table 4.2) Findings also show that there are higher control group's post-intervention parameters for developing students' thinking creativity and instilling HOTS in low achievement students (Table 4.3). In addition, there are areas in which the difference between the post-intervention scores of the two teacher groups is statistically insignificant: promoting tolerance and cooperative behaviour and educating to be socially and ethically responsible community members (Table 4.5).

As it was mentioned previously, the fact that the control group teachers have higher scores for the perceptions of some of the intervention areas can be explained by the influence of confounding factors like pre-knowledge of HOTS, self-education in the area of HOTS, as well as personal characteristics, such as the level of interest in the task being performed (when completing a questionnaire, for instance). In addition, participants' beliefs about the level of their pedagogical skills can be misplaced, but the U-test does not allow for such an interpretation. Explanations regarding the control group results are to be found in the qualitative part of this study, since according to the principles of the qualitatively-driven mixed method research, quantitative results should be explained by qualitative results. Figures 12.1 and 12.2 in Appendix 12 presents factors for the interpretation of qualitative and quantitative findings which are obtained from the analysis

of the interview and documentary sources and students' written responses as well, and which were considered important for the interpretation of both qualitative and quantitative findings. These include aspects like teacher self-education, professional contacts among teachers, and teachers' beliefs about instruction and learning, and some details of teachers' work reflected in the written responses of students.

In the cognitive and dispositional domains of students' HOTS, all the parameters for the post-intervention intervention group students' perceptions are significantly higher than those for the pre-intervention period. The scores for the intervention group students' perceptions of their thinking dispositions are higher than those for the perceptions of their cognitive skills (Table 4.9). This correlates with the scores reflecting the intervention group teachers' perceptions of their skills for developing thinking dispositions and supports a suggestion that students have achieved better results in this domain of their HOTS. Also, a comparison of the post-intervention parameters for the intervention and control groups indicates that the intervention group students have significantly higher perceptions of the HOTS-based activities than their peers from the control group (Table 4.10). On the basis of these findings, it can be suggested that the HOTS intervention programme has contributed to the development of the cognitive and dispositional domains of students' HOTS.

5. DISCUSSION

5.1 Introduction

The purpose of this chapter is to present meta-inferences based on the corroboration of quantitative and qualitative findings, following the concept of the between method triangulation (Creswell & Plano Clark, 2011; de Lisle, 2011; Morse & Niehaus, 2009; Denzin, 1978). This study employs a mixed method design in which qualitative and quantitative studies have been carried out concurrently, with the two types of data being collected and analysed separately. The qualitative investigation is considered a core component of the study (Creswell et al., 2011; Morse & Niehaus, 2009; Johnson et al., 2007). According to the principles of the qualitatively-driven mixed method research, the qualitative data are used for the interpretation of quantitative findings (Wisdom & Creswell, 2013; Morse & Niehaus, 2009; Brannen, 2005).

In the qualitative study, findings were cross-checked for internal consistency or reliability by using the method which Denzin (1978: 301) referred to as 'within-method triangulation' (the use of several techniques within a given method to collect and interpret data). Minor differences were found between the data contained in teacher interviews and those obtained through interviewing some of the students' parents. For instance, all teachers argued that they endeavoured to assess students' skills and performance as objectively as possible, being responsive to the needs of particular students. At the same time, none of the student written responses to questionnaire statements contains such a claim.

In what follows, qualitative findings will be corroborated with the results described in research literature and with quantitative results, following the order in which the research questions are set. Final inferences are drawn on the basis of the comparison of qualitative and quantitative findings. This chapter includes a discussion of the validity of findings and factors are presented that might reduce the limitations of this study. The conclusion to the chapter outlines such aspects as the importance of this research project in comparison with other studies and the relevance of findings to the research questions. In order to give the reader a clearer idea about the integration of qualitative and quantitative results in the current study, two schemes were developed (see Appendix 12, figures 12.1 and 12.2). Both schemes are based on the principles of triangulation of qualitative and quantitative findings in the qualitatively-driven mixed method research (de Lisle,

2011; Creswell & Plano Clark, 2011; Morse & Niehaus, 2009; Teddlie & Tashakkori, 2009). Each scheme divided into the two broad domains referring to the qualitative and quantitative studies. Both the part of the scheme, which relates to the results of students' performance (Figure 12.1), and that referring to instructional methods (Figure 12.2) include two groups – themes from the qualitative study and definitions of the quantitative variable categories. Themes and categories are juxtaposed, showing the intervention aspects in which results of both studies are to be compared. The sign '+' indicates that quantitative results related to the intervention groups are compatible with qualitative findings. The sign '-'indicates that qualitative data and quantitative results are incompatible. Both figures display the issues which may serve as the factors for the interpretation of qualitative and quantitative findings and are based on the themes developed in the qualitative part of this study.

5.2 Research sub-question 1: How was the programme implementation reflected in teachers' pedagogical practices?

5.2.1 Developing the cognitive and methacognitive skills of students

One of the goals stated in the HOTS programme's guidelines was the development of students' analytical and reasoning skills. For the first time in their learning experiences, students were taught about thinking strategies across different subject areas and were encouraged to use thinking guides like graphic organizers, sets of guiding questions, and mind maps. These activities are compatible with the cognitivist and constructivist methods for developing the cognitive skills of learners by building schemata for processing information (Kalmes, 2005; Anderson, 2004; Rumelhart & Norman, 1981), combining visual and verbal learning (Butcher & Aleven, 2007; Pavio, 1986), and text concept mapping (Tishman & Perkins, 1997; Perkins, 1992).

When implementing the HOTS intervention, teachers followed the HOTS programme guidelines by using an infusion approach whereby thinking skills (strategies) were explicitly taught in the context of a subject area. An infusion approach has been used in many interventions conducted over the past decade in Israel and abroad (Hu et al., 2011; Cheng, 2011; Brookhart, 2010; Kaberman & Dori, 2009; Zohar & David, 2008; Barak et al., 2007). As it has been mentioned earlier in this thesis, the large majority of scholars, particularly Israeli educational researchers (Barzilai & Zohar, 2012; Caesar & Lazarowitz, 2010; Kaberman & Dori, 2009; Lunetta et al.,

2007) find it most important to explore the impact of interventions on students' cognitive and metacognitive skills within the mathematics and science curricula. An infusion approach was supported by all the teachers in the current study. The focus of their criticism was the way in which an infusion approach is used in studying social disciplines and how this problem is reflected in the HOTS programme (see Findings, section 4.1.12.4).

Following the HOTS programme's recommendations, teachers helped students take control of their learning activities. They drew students' attention to relationships between different concepts and different domains in order to connect knowledge taught in school to real life situations. They encouraged students to analyse the relations between technical, social and political issues wherever it was possible in the curriculum. The methods used by teachers are consistent with those recommended by many researchers (Muijs & Reynolds, 2011; Hu et al., 2011; Yoad et al., 2009; Dean & Kuhn, 2004; Crowl et al., 1997; Perkins, 1992; Marzano et al., 1988) who claim that increasing students' meta-cognition is an essential tool for improving self-regulated learning and skill transfer and the use of cross-curricular learning is helpful in overcoming the fragmentation of curriculum and isolated learning of skills. Yet, there have been the arguments that the cross-curricular learning may lack coherence and depth, mostly due to teachers' little experience or competence with cross-curricular themes or approaches (Savage, 2010; Rocard, 2007). But the data obtained from teachers in the current study suggest that they were aware of this problem. Teachers were prepared to overcome these problems through elevating their professional competence.

As to the implementation of the inquiry-based learning, many researchers (Zion & Mendelovici, 2012; Banchi & Bell, 2008; Mayer, 2008; Hung & Chen, 2002) agree that there need to be a transition of students' learning from structured inquiry to guided and open inquiry. Some other researchers (Krystyniak & Heikkinen, 2007; Berg et al., 2003) claim that open inquiry is most effective, enabling students to become more familiar with the nature of scientific knowledge and engage in HOT. The findings of the current study show that most of the collaborative inquiry projects have been implemented in the form varying from structured to guided inquiry, following the recommendations of the HOTS programme. The majority of teachers believed, however, that only structured inquiry should be used in schools to teach students basic inquiry skills while other

types of inquiry-based learning are appropriate for post-secondary education. It seems that these views are more supportive of traditional approaches, whereby students are passive learners and teachers provide all information, and are closer to the views of those researchers (Klinger, 2007; Rowe, 2006; Kirschner et al., 2006) who believe that direct, strong instructional guidance of cognitive processes in learning can be more effective than student-centered learning.

An important means of developing HOTS in a variety of content areas was task scaffolding and task modeling techniques depending on the needs of particular students. The practices described in teacher interviews and documentary sources are congruent with the views of many researchers (Brookhart, 2011; Maynes et al., 2010; Mayer, 2008; Zohar & Dori, 2003; Chang et al., 2002; Hogan & Pressley, 1997; Vygotsky, 1978) who believe that scaffolding is an important teaching strategy and that teachers should employ a variety of methods to instill HOTS in students with diverse abilities. In practice, the teachers in the current study were careful to follow the HOTS programme recommendations that the level of scaffolding should be gradually reduced as students become more able to perform on their own. Some researchers (McDevitt & Ormrod, 2002) hold that intensive scaffolding is very time-consuming and lead to cutting short the time allocated for each student. But the views of many teachers were very supportive of an intensive scaffolding, at least during the first years of intervention (see pp. 89-90). Their opinions concur with the views of those researchers (Kirschner et al., 2006) who advocate a strongly guided learning.

The qualitative data referring to the methods for developing the cognitive and methacognitive skills of students are compatible with quantitative findings related to this area of intervention. Teaching on thinking strategies, including use of a variety of thinking organizers, is compatible with the quantitative results, according to which the most salient differences between pre- and post-intervention parameters were identified in the areas that refer to fostering meta-cognition skills ($U = -4.30$ $p<0.001$) and developing reasoning and argumentation skills ($U = -3.60$ $p<0.001$). As to the use of scaffolding, teachers' reports about the use of intensive scaffolding measures, particularly in assisting weak learners, are consistent with the post-intervention quantitative results suggesting a considerable improvement in the intervention group teachers' perceptions of the work with low-achieving students ($U = -2.30$ $p<0.05$). It can be suggested that, as a result of implementing the HOTS programme, there has been a positive change in teachers' perceptions

pointing to the increase in the methods for developing the cognitive and metacognitive skills of students.

5.2.2 Fostering creative thinking

The activities reported by teachers concerning the development of students' thinking creativity (discussion and brainstorming sessions, solving open-ended problems, posing open-ended questions when introducing or revising the material, and other methods) are supported by research literature. Many authors (Conclin & Williams, 2011; Cheng, 2011; Cropley, 2001) argue that in the recent decades, the most popular method to increase creativity has been teaching on divergent thinking and the idea-generation strategies. In the current study, teachers seemed to understand the importance of developing students' abilities like seeing existing situations in new ways or combining components to form something original, but acknowledged that tasks involving divergent thinking were not frequently used due to the curriculum pressure. Teachers placed an emphasis on the idea-generation strategies through discussions and brainstorming sessions, concurring with the suggestions that the above activities have been very effective ways for developing creativity in thinking (Conclin & Williams, 2011; Cheng, 2011; Cropley, 2001; Plucker & Runco, 1999). Some authors (Isaksen & Gaulin, 2005; Brown & Paulus, 2002; Sutton & Hargadon, 1996) suggest, however, that group brainstorming often produce fewer good/relevant ideas than those generated by individual brainstorming. Teachers in the current study pointed to the significance of group brainstorming in Arab schools, both for the development of creativity in thinking and for the ability to voice their opinions. The importance was emphasized of turning Arab students from quiet, passive learners into active performers in the classroom. Teachers also acknowledged that brainstorming was new to them and that they had to learn more to make it more effective.

The qualitative findings obtained in the current study are consistent with quantitative results: there was a considerable improvement in the intervention group teachers' perceptions of developing creativity in students' thinking ($U = -2.21$ $p<0.05$). In addition, a comparison of the pre-intervention results with the post-intervention ones shows a higher increase in the intervention group's scores for developing students' thinking creativity than in the teacher control group (intervention group - MD 3.33 against 4.00; control group - MD 4.00 against 4.33). Both

qualitative and quantitative findings suggest that as a result of the training the intervention group received and implementing in the HOTS programme, there has been an improvement in teachers' perceptions of the methods for developing creativity in thinking.

5.2.3 Enhancing the pervasiveness of students' HOTS

Teachers claimed that the participation in the HOTS training programme helped them better understand that many methods, which were used for improving the cognitive domain of students' HOTS, might also contribute to the development of students' thinking dispositions. This is consistent with researchers' suggestions (Yoad et al., 2009; Paul & Elder, 2006; Facione, 2000) that fostering cognitive skills and thinking dispositions is a complex process in which the methods used are often multipurpose and interrelated. Yet, Hu and associates (2011) believe that pervasiveness in HOTS is hardly achievable in the first years of intervention. Teachers in the current study believed that educating students to be able of making precise and thoughtful judgments as well as developing their metacognitive abilities is an effective way to enhance the pervasiveness of students' HOTS. The problem is that few of teachers have payed attention to students' performances that suggest transferability of thinking skills from curriculum subjects to activities beyond school. Research literature (Gallagher et al., 2012; Yoad et al., 2009; Zohar & David, 2009) supports the belief of teachers that more tasks contributing to the transfer of thinking skills across different domains should be included in textbooks and exam items. Yet, school education in Israel has not addressed this issue efficiently (Gallagher et al., 2012).

With regard to encouraging pervasive thinking in students, the quantitative findings obtained in this study confirm qualitative results. The parameters for the post-intervention perceptions of the intervention group teachers are higher than the pre-intervention ones ($U = -5.16$ $p<0.001$). This group also outperforms the teachers from control group ($U = -3.63$ $p<0.001$).

5.2.4 Increasing students' self-confidence and the ability of independent learning

Teachers related the ability of independent learning not only to the cognitive and metacognitive abilities of students, but also to their motivation and attitudes to learning. This is consistent with the idea that HOT is a pervasive and purposeful phenomenon of human activity (Facione, 2010; Paul & Elder, 2006; Brown, 2004; Halpern, 1998). Teachers held that the HOTS-based instruction,

particularly the methods for developing metacognition and detailed assessment of student performance, could help students strengthen their self-confidence and ability of self-directed learning. Many researchers (Heritage, 2010; Goertz et al., 2009; Paul & Elder, 2006) agree that proper instruction and teacher feedback can serve as effective tool to evaluate students' dispositions to reasoning performance and their attitudes toward learning in general. In addition, teachers increased the level of student-centered activities which had been considered by many researchers (Mayer, 2008; Savery, 2006; Ferretti et al., 2001; Zohar, 2004) an effective method for providing students with greater learning autonomy.

The ideas of teachers on the measures for improving students' self-confidence and independent learning skills are compatible with the quantitative findings obtained in this study: the parameters for teachers' post-intervention perceptions of this area of intervention are higher than the pre-intervention ones ($U = -5.26$ $p<0.001$). The intervention group teachers also show better results than their counterparts from control group ($U = -3.47$ $p<0.05$).

5.2.5 Increasing students' motivation in learning.

Teachers believe that the importance of the issues of personal success and failure as learning motivators and the role of emotional factors, both positive and negative, might impact on students' self-confidence and attitudes to learning. Teachers' opinions reflect the discussions highlighted in the literature related to the use of competition in the classroom. The arguments that competition may increase hostility between students and losing may lead to lower student self-esteem (Lam, Law & Cheung, 2004) are opposed by the claims that competition is not always antithetical to collaboration (Hunzer, 2012). Teachers in the current study seem to understand that failure may encourage greater learning, as long as it leads to more reflection and critical thinking (Hunzer, 2012; Shindler, 2010). They agree that competition should be organized in such a way that students compete against peers with similar abilities and all participants have a chance to show their skills. Yet, teachers have pointed out that Arab society becomes more individualistic and many parents promote the spirit of competition in their children. These issues, however, have been rarely discussed in the literature relating to the changes in Israeli Arab society (Abu-Asbah, 2012). In addition, the importance teachers attach to emotional factors in learning is supported by researchers' perspectives on the role of emotional factors in learning and the need to manage

emotions in order to use them as a positive force (Bailin, 2002; Goleman, 1995; Paul, 1993). Teachers' reports on the efforts they put in teaching students to constructively use their emotions are consistent with quantitative findings. It can be suggested that as a result of the participation in the HOTS programme, the intervention group teachers show a considerable improvement in their perceptions of this aspect of intervention ($U = -4.36$ $p<0.001$). They also outperform the teachers from control group ($U = -2.47$ $p<0.05$).

5.2.6 Improving students' communication and interpersonal skills through collaborative learning

The data collected from teachers demonstrated that they paid more attention to students' involvement in collaborative inquiry projects and peer tutoring. Many researchers (Hu et al., 2011; Cook, 2008; Jordan et al., 2008; Driscoll, 2005; Zohar, 2004) agree that effective learning occurs when students work collaboratively and teamwork contributes to the development of their interpersonal skills. Researchers (Zohar & David, 2008; Gordon, 2005; Rogoff, 1990; Vygotsky, 1978; 1986) hold that more knowledgeable peers can function as teachers and peer tutoring might encourage the acquisition of both metacognitive and interpersonal skills. At the same time, there are arguments that some group members perform effectively while others contribute very little, if anything at all (Makewa et al., 2014; Pool, 2008; Ormrod, 2006). Because of shyness and fear of criticism, some members do not feel comfortable participating in a group setting (Larson, 2000). Also, the amount of information that a group generates may be difficult to compile individually. In the current study, post-intervention teachers' and students' responses show that they realize that group members inevitably encounter differences and have to build the capacities for tolerating or resolving these differences and for caring how others are doing. The importance of such teamwork capacities is emphasised by many researchers (Makewa et al., 2014; Cook, 2008; Zohar & David, 2008) and can be regarded as a constructive factor in students' collaborative activities in the current study.

The quantitative results obtained in this study confirm teachers' perceptions of the measures for improving behaviour of students in collaborative learning activities. They suggest an improvement in the intervention group's perceptions of such aspects of intervention as involving student in

teamwork (U = -5.13 p<0.001) and promoting students' tolerance of other's beliefs (U = -4.09 p<0.001).

5.2.7 The use of HOTS to increase students' civic responsibility

One of the important goals pursued by teachers within the implementation of the HOTS programme was educating students to use their HOTS for the development of the local community. It has been argued (Bernacki, & Jaeger, 2008; Hofstede & Hofstede, 2005) that if democracy is to endure in any meaningful way, school educational system must develop skills of participation in and responsibility to the larger community. Some other researchers (Fitzgerald, Burack & Seifer, 2010) add that civic engagement is not a measure to tackle societal ills or weak academic performance. They point out that civic engagement opportunities that are poorly planned and used are more likely to have subtractive rather than transformational effects. In the current study, teachers payed much effort to plan collaborative learning activities that would promote using HOTS for the good of the local community and would increase students' awareness of important historical and political issues.

Teachers' perspectives are compatible with the claims that teaching on HOTS should be included in studying social sciences within the undergraduate curriculum (Willingham, 2007; Edmonds et al., 2005; Hofstede & Hofstede, 2005; Dam & Volman, 2004). Teachers also agree that students need to learn concepts of democracy and democratic leadership through the involvement in socially important activities (Krogh, 2008; Dam & Volman, 2004). The quantitative findings obtained in this study also suggest an improvement in teachers' perceptions of this aspect of intervention (U = -4.88 p<0.001).

5.2.8 Improving the assessment of learning outcomes

A change in the instruction practices also concerned the assessment techniques employed by teachers. Teachers noticed that assessment of students' performance should be done with respect to every aspect of the HOTS-based learning, including both cognitive and dispositional domains of students' HOTS. Many educational researchers (Leshem & Markovits, 2012; Heritage, 2010; O'Donovan et al., 2008) believe that in order to effectively assess student performance, teachers should use formative assessment, as detailed teacher feedbacks and the involvement of students in

developing assessment criteria help them better understand and achieve their learning goals. Following the HOTS programme recommendations, teachers assessed students' learning outcomes by combining summative and formative assessment. They acknowledged that the amount of formative assessment methods was increased; teacher and peer feedback on learning performance was of greater importance than before the intervention. The majority of assessment techniques employed by teachers were consistent with the recommendations offered in research literature. However, there was the problem of incorporating the results of individual projects (in vocational studies) into final tests, as at the time of implementing the HOTS intervention, teachers claimed they had not clear regulations how to properly address this issue (see also section 5.4.2).

5.3 Research sub-question 2: Were there changes in students' cognitive skills and thinking dispositions, as a consequence of the HOTS intervention?

5.3.1 Developments in students' cognitive and metacognitive characteristics.

It is seen from the post-intervention teachers' reports, that there has been an improvement in the cognitive and metacognitive performance of the intervention group students (further: students), including critical analysis and reasoning skills, their ability to plan and control the work on the tasks, and think strategically when solving a problem. There is a 15 % increase in students' post-intervention responses (open-ended questions 2 and 6) that reflect the ability of planning and evaluating the process of work (against a 7 % increase in the control group) and a 12 % increase in the records showing the awareness of the problem solving process (against 6 % in the control group). These data allow for the suggestion that students' cognitive and metacognitive performance was improved as a result of implementing the intervention measures.

The above results are compatible with findings from other studies (Hu et al., 2011; Cheng, 2011; Kirkwood, 2010; Caesar & Lazarowitz, 2010; Kaberman & Dori, 2009; Barak et al., 2007) in which authors suggest that the HOTS-promoting interventions, which are rooted in well-established theories of cognitive development, can lead to positive impact on students' academic achievements. Teachers acknowledged, however, that the results of the intervention were mostly seen in the cognitive and metacognitive performance of strong students. More modest results were reported among average students and the improvement was insignificant in the performance of weak learners. These findings are consistent with the results obtained by Hu and associates (2011)

who claim that the implementation of their 'Learning to think' intervention has not had a significant impact on the abilities of weak students. On the basis of empirical studies, some researchers (Barak et al., 2007; Zohar & Dori, 2003; Zohar et al., 2001) claim, however, that low-achieving students can make considerable progress with respect to their initial scores. But none of the above studies is not concerned with the problem of poor prerequisite knowledge in low-achieving students (the problem that was mentioned by teachers in the current study). Since the level of pre-existing knowledge and skills have an impact on how students elaborate on in-coming information (Zohar & David, 2009; Hofer & Pintrich, 1997; 2004), the ability of low achievers to exercise cognitive and metacognitive activities is affected by the insufficient level of prerequisite knowledge.

The quantitative results of the current study confirm the above qualitative findings: there are statistically significant differences between the pre- and post-intervention parameters (the difference between total scores - $U = -8.49$ $p<0.001$) in the cognitive domain of students' HOTS. The most salient differences are seen between the pre- and post-intervention scores that relate to students' metacognitive skills ($U = -9.03$ $p<0.001$) and the ability to organize work ($U = -7.63$ $p<0.001$) which can be considered part of metacognitive skills.

5.3.2 An indication of the skill transfer

Teachers opined that positive results had been obtained through teaching students to use thinking strategies within and across different disciplines. They argued, for instance, that the use of thinking organizers in problem solving and text analysis and plans of self-directed learning had a positive impact on students' reasoning and argumentation skills, particularly in discussions and writing tasks. The post-intervention students' responses to open-ended question 11 indicated a change in their comprehension of HOTS which, prior to intervention, were associated by all student participants with specific professional skills. After the intervention, 13 % of all the intervention group's records (against 3 % in the control group) indicate the belief that the knowledge acquired in school includes cognitive and metacognitive thinking skills that are necessary for everyday decision making. The current study' quantitative results also suggest that there has been an improvement in the post-intervention students' perceptions regarding the transfer of thinking skills ($U = -4.81$ $p<0.001$).

The results on the transfer of thinking skills are consistent with those obtained by other researchers (Kirkwood, 2010; Zohar & David, 2009; Kuhn & Dean, 2004; Pintrich, 2002) who hold that there is a positive correlation between the development of metacognitive skills and transfer of learning form one context to another. At the same time, some scholars (Willingham, 2007; Pithers & Soden, 2000; Csapo, 1999) believe that transfer to new contexts is rare, or it is not important, as HOTS are domain-linked. Csapo (1999) points out that in some conditions the transfer of skills works well while in others the degree of transfer is almost zero. In addition, Hu et al. (2011) suggest that transfer is hardly achievable within short time periods. Teachers' opinions concur with the ideas that learning transfer is possible when students are explicitly and constantly taught about it (Perkins & Salomon, 2012; Kirkwood, 2010; Bransford, Brown & Cocking, 2001; Perkins, 1992), but the results of the current study show that there is still a lot to be done in this regard.

5.3.3 Demonstrating creativity in thinking

Teachers suggested that increased engagement of students in the tasks requiring HOTS, and the development of students' divergent thinking raised the level of creativity in their thinking. Teachers believed that the fact that many students showed good performance in the discussion and brainstorming sessions as well as the ability of some of the students to produce interesting creative results in learning projects could be the sign of an increased creativity in students' thinking. In addition, some of students' post-intervention written responses suggest the awareness of the ways to solve complex, open-ended math problems. Teachers reported, however, that a creative approach to problem solving was seen only in the performance of strong students. This is consistent with the results obtained by Cheng (2011): after the intervention, few students (4 out of 30) show the ability of developing creative strategies in their own thinking process.

In light of the time constraints that impeded the implementation of intervention (see section 5.4.2), it can be suggested that creative results produced by students during this period can be rather attributed to the natural abilities of students than to the results of the intervention. This suggestion is supported by the arguments of other authors (Cheng, 2011; Hu et al., 2011) who hold that in the first years of intervention, little results can be achieved in developing the creative thinking of students. The issue of students' creativity in thinking was not explicitly addressed in the

quantitative part of the present study, but an increase in their perceptions of formulating and solving complex problems (U = -5.81 p<0.001) might indicate the adoption of creative approaches to problem solving.

5.3.4 An indication of higher self-confidence and the ability of self-directed learning

It was reported by teachers that the involvement of students in the HOTS-based tasks boosted their self-confidence and self-esteem in learning these new skills. These findings are in line with the data obtained from students' post-intervention responses to open-ended questions 2 and 6. They reveal that there is a higher number of records that indicate a stronger self-confidence in problem solving and more inclination for self-directed learning. It was acknowledged by teachers that students improved their skills for organizing and managing the completion of learning tasks and they showed higher motivation to be involved in self-directed learning. Teachers claimed, however, that such an increase occurred mostly among strong and some of the average students. It has been held (Sungur & Tekkaya, 2006; Pintrich, 2003) that self-directed learning can be challenging, even for the strong and most motivated students, and particularly in schools based on traditional education. Quantitative results are compatible with qualitative ones, suggesting that there is an increase in the intervention group students' perceptions of self-confidence in learning (U = -9.95 p<0.001) and self-directed learning (U = -9.48 p<0.001).

5.3.5 A positive change in students' performance in collaborative learning activities

Teachers reported about many improvements in the collaborative performance of students, both in learning projects and in discussions and brainstorming sessions. Positive changes were noted in students' ability to work together in team, including positive interdependence in team decision making, responsibility for completing one's share of the tasks, providing assistance to group members, and showing the motivation to engage in constructive discussions of problems. The post-intervention students' responses to open-ended questions reveal that more students from the intervention group improved their understanding of teamwork and communicating with team members (43 % against 30 % of the control group). There is a lower percentage of the records reflecting patronizing behaviour patterns (10 % against 15 %) in students' responses that concern the consideration of the views of family members or a close friend. The quantitative results of the current study suggest that there was an increase in the intervention group students' perceptions of

such issues as flexibility of mind and tolerance of others' beliefs ($U = -8.96$ $p<0.001$) and attitude to a team work ($U = -10.70$ $p<0.001$).

An important role of collaborative learning for developing students' interpersonal skills was acknowledged by many authors (Cook, 2008; Barak et al., 2007; Driscoll, 2005) who claim that peer to peer interaction is extremely important in creating the HOTS-promoting learning environment. Ormrod (2006), however, claims that students may simply not have the skills to help one another learn and there are learners who will always work better alone. Other researchers (Brown & Ciuffetelli, 2009; McKinney & Graham-Buxton, 1993) concur, adding that some group members may feel unduly pressured, since they believe that they are taking on more responsibility and working harder than others. Some of the above problems were pointed out by the teachers in the current study. Teachers noticed that the most significant changes had occurred in students' performance during discussion activities: in the course of time, students had learned how to interact during discussions and how to resolve team work problems. These results are consistent with those documented in other studies (Leicester, 2010; Heeden, 2003) which emphasise that through constructive discussion, students can learn from each other by negotiating meaning and knowledge and become more open-minded and tolerant of different opinions.

5.3.6 Differences in students' emotional reactions to the success and failure

Teachers used many learning motivation strategies, particularly those increasing the intrinsic motivation of students for the involvement in the activities promoting HOTS. Researchers (Woolfolk, 2010; Lepper et al., 2005) explored the role of extrinsic and intrinsic motivation in learning and claimed that these two dimensions should not be seen as mutually exclusive. It was reported by teachers that students were highly motivated by good grades and encouraged by the positive feedback of teachers, but many of them failed to respond constructively to failures and were very sensitive to teachers' criticism. These findings contrast with the results obtained by Zhang & Cross, 2011) according to which Chinese students do not consider failures damaging to their self-esteem and they tended to persist after failure. Other authors (Ford & Smith, 2007) showed that students could be practical thinkers because they sought out and identified causes that would help them to understand their performance. Teachers in the current study acknowledged that toward the end of the intervention, there had been a change in some students' attitudes to

learning failures and there had been an increase in their motivation to engage in the HOTS-based learning. However, many studies of the HOTS-based interventions (Barak et al., 2007; Zohar, 2003; 2004; Zohar et al., 2001) do not examine students' perspectives on learning success or failure and how these could impact on the intervention process.

With regard to the influence of positive emotions on learning motivation, quantitative results show higher post-intervention scores for the intervention group ($U = -5.77$ $p<0.001$). Teachers believed that the improvement in student motivation was due to the strategy they adopted toward weaker learners: praising them not only for the achievements accomplished, but for the efforts they put into learning. This is consistent with the results obtained by a number of researchers (Rowell & Hong, 2013; Morisano, Hirsh, Peterson, Pihl & Shore, 2010; Ford & Smith, 2007) who argue that the students who are given praise for their efforts learn to be more resilient to academic failures which can be highly essential to learning. In the current study, it seems that teachers underestimated the importance of failure as the opportunity of improvement, giving more attention to praising students for their efforts.

5.3.7 Signs of the pervasiveness of students' HOTS

In interviews with teachers and focus group discussion, an opinion was voiced that students' engagement in problem-based learning and an improvement in their learning attitudes had a positive impact on the thinking performance of students in a variety of curriculum areas. Teachers, however, could not provide the evidence of how students used their thinking skills in real life situations. Reports about exercising HOTS in various situations, including the ability to plan and evaluate the process of work, collaborative work skills and the ability to make reflective decisions, can be found in a number of students' post-intervention responses to open-ended questions. However, the above evidence is insufficient to claim that there has been pervasiveness in the use of HOTS among students. There is a small amount of the data about the ways students used their thinking skills in real-life situations. In addition, teachers acknowledged that an increase in HOTS was evident only among strong and some of the average students.

With regard to this aspect of intervention, qualitative findings are not compatible with quantitative results. The latter suggest that there is a considerable increase in the intervention group students'

perceptions of the pervasive use of HOTS (U = -10.81 p<0.001). Qualitative part of this study provides a possible explanation for this incompatibility by drawing attention to the impact of context in which participants' perceptions were formed. The involvement of the intervention group students in the HOT-based activities and an increase in their interest in the new learning experiences could have an impact on their perceptions. It is possible, therefore, that the above results do not reflect the actual thinking abilities of students, but rather their motivation for the HOTS-related activities and awareness of the necessity of using HOTS in various contexts.

5.3.8 Students' low aspirations to dedicate their knowledge and skills for the future of local community

Despite teachers' efforts to instil in students the idea of using the acquired knowledge and thinking skills for the development of the local community, very few students demonstrated the will to do so. This was evident in some students' essays written in the social studies classes and in classroom discussions. Students substantiated their decisions by poor employment options in their region. In addition, in the 28 % of the post-intervention responses to open-ended questions students mentioned their participation in the community issues, but only 5 % of their records reveal the wish to use their knowledge and skills for developing the local community. A number of authors (Shehadeh, 2012; Abu-Asbah, 2012; Abu-Asbah & Avishai, 2007; Gavison, 2006) mentioned a low participation rate of Israeli Arabs in workforce. Students' low expectations of employment opportunities in Israel are also supported by statistical data: according to Central Bureau of Statistics (2011), the %age of the Arab population participating in Israeli labour market in 2010 reached only 41 %.

Quantitative results suggest, however, about an increase in the intervention group students' perceptions of the responsibility towards school and community (U = -7.48 p<0.001). Both teachers' responses and students' written comments provide the basis for conclusion that due to the HOTS intervention, the intervention group students have been more involved in school activities and community service projects than their counterparts from the control group. An increase in the participation in these activities could have an impact on the intervention group students' responses to the questionnaire.

5.4 Research sub-question 3: What are the HOTS programme implications for the Israeli Arab school culture?

In the previous sections, the attention was focused on the increase in teachers' pedagogical skills intended for creating the HOTS-based learning environment and the improvement in the performance of students taught by using the new educational methods. In what follows, the findings are discussed that reflect the attitudes of teachers and students towards the HOTS-based educational practices and relate to the problems experienced by teachers during the intervention. The latter were regarded by teachers as stumbling blocks in the process of improving the Israeli Arab school culture.

5.4.1 Teachers' attitudes to implementing the HOTS programme

The qualitative data obtained from teacher respondents reflect their belief that the facilitation of the intervention measures provides them with a good opportunity to reflect on the role of a teacher in delivering instruction. An increase in student-centered teaching and learning promoted the shift from using traditional authoritarian methods of teaching to developing collaborative and reflective relationships with students. Teachers claimed that both in-service training and implementing the intervention measures contributed to their better awareness of the continuous self-education, open-mindedness towards different beliefs, and of the necessity to enhance in-school and inter-school professional interactions. However, it was held by teachers that in Arab schools changes towards the HOTS-based learning environment are likely to occur slowly because of the dominance of the traditional pedagogy and low teachers' role in the whole-school decision making processes.

The above data concur with the results of empirical studies suggesting that pre- and in-service education initiate change in teachers' HOT-related beliefs (Torff, 2006; Barton, 2004; Patrick & Pintrich, 2001). The research literature dedicated to developing the HOTS of Israeli school students (Gallagher et al., 2012; Zohar, 2008; Tamir, 2006; Barak & Dori, 2005; Dori et al, 2002; Barnea & Dori, 1999) reflects a gradual move of the whole Israeli educational system towards the HOTS-based pedagogy. Following the adoption of the new educational policy (Pedagogical horizons for learning, 2007), changes have been more rapid and systematic. As it has been mentioned in the preceding chapters (Abu-Asbah, 2012; Arar, 2012), teacher education in Israeli

Arab sector is of lower quality than that provided in Jewish teacher training colleges and measures to bridge the disparities between the Arab and Jewish teacher training institutions are insufficient.

In addition, it has been revealed in the current study that the views of teachers differed as to how the new instructional methods should be implemented. Although all teachers expressed support for the new educational policies, most of them were actually in favour of traditional pedagogy and preferred calm and orderly classrooms over student-centered collaborative ones. In addition, their views split over the level of teacher role in creating the HOT-oriented curriculum. Those teachers who advocated a greater flexibility in creating and selecting teaching methods acknowledged that they had to increase their professional level to include personalized components into the existing curriculum. These findings are supported by the studies that explore the experiences and attitudes of teachers to innovations, including the HOTS-promoting interventions (Nair & Ngang, 2011; Barak & Dori, 2009; Torff, 2006; Zohar, 2004). Other perspectives on teachers' beliefs should be also taken in account. It is suggested (Turner, Christensen & Meyer, 2009; Calderhead, 1996) that beliefs might be affective, episodic and evaluative because they assert the existence or non-existence of such factors as stability or malleability of intelligence and motivation. It is also suggested that many beliefs that teachers hold about teaching originate from their personal experiences, social encounters, cultural environment, professional contacts and development, and from reading scholarly literature (Fives & Buehl, 2010; Hofer, 2008). Many researchers (Wilcox, Kruse & Herman, 2013; Clough, 2006; Patrick & Pintrich, 2001; Brooks & Brooks, 1993) hold that the beliefs of learners can be changed, as a result of intervention measures.

The differences in the perspectives of teachers regarding the use of intervention methods may point to another factor which refers to the interrelation between teachers' beliefs about instruction and learning. Researchers (Wong et al., 2009; Maggioni & Parkinson, 2008) suggest that when teachers perceive knowing as an accumulation of facts, they tend to adopt the traditional, teacher-centered pedagogy. In contrast, the perception of the process of knowing as construction of understanding and meaning make teachers more inclined towards the constructivist approach. There is a view, however, that when the reform is important, teachers should seek ways to align their beliefs with the reform (Davis & Andrzejewski, 2009; Davis, 2006). In case of the current study, the implementation of the HOTS programme was mandatory for all Israeli public schools and the

teachers who seemed to be less in favour of new methods acknowledged that they were careful to comply with the requirements.

5.4.2 Problems encountered by teachers in implementing the intervention

All the intervention group teachers repeatedly voiced the opinion that time constraints were one of the major factors that impeded the implementation of the intervention. Teachers' common complaint was that the Education Ministry's policies for restructuring the curriculum were slow and inconsistent. Teachers reported that they had less time and energy for employing the HOT-related methods, including implementing the methods of inductive instruction, increasing student creativity through solving complex problems, formative assessment, and other methods. In addition, some issues that concerned the assessment of students' HOTS (like incorporating the results of individual projects into the results of final tests, for instance) were still in the phase of development. Teachers claimed that the instructions received from the Education Ministry needed to be more detailed. Most of the teachers argued that because of time constraints and the complexity of the material to be covered, the opportunities for creating the constructivist-oriented learning environment decreased. They also acknowledged that they had little time to be involved in the tasks indicating the level of the transfer of thinking skills across different areas of curriculum and beyond the school.

The difficulties faced by teachers in implementing constructivist strategies are described by many researchers (Jordan et al., 2008; Kirschner et al., 2006; Driscoll, 2005; Scheurman, 1998) who argue that because of the pressures to cover curriculum, teachers have little time to respond to students' construction of knowledge, particularly in the classrooms populated by students with diverse abilities. Another problem revealed in this study concerns the development students' HOTS by means of history and civics. Discussions on Israeli Arab history and identity were not conducted in the classrooms, as teachers did not want to comment on or criticize the Education Ministry policies with this regard. Rather than seek some way to convey to students the complexities of the history between Jews and Arabs in Palestine, teachers found it more important to demonstrate their loyalty to the Israeli government policies. The question arises of how teachers can be the models for students in critical participation in social and political processes? As it was

mentioned previously, the issue of developing critical thinking by involving political and social problems escaped the attention of Israeli educational researchers.

5.4.3 Students' attitudes towards the intervention programme

The data obtained from teachers, parents and students' responses to open-ended questions indicate the diversity of students' attitudes towards the intervention programme. These data also show the way in which students perceive learning in general, knowledge obtained beyond the classroom, their responsibilities at home and in school, and interaction with family members and peers. The pre-intervention students' responses to open-ended questions include the records that demonstrate their high reliance on the teacher in the classroom and on parents and older siblings. The results of a number of comparative studies (Abed & Dori, 2013; Dkeidek et al., 2010; Abed, 2008; Yaar & Shavit, 2001) show that students from Arab schools are more dependent on their teachers during the implementation of learning tasks than their Jewish counterparts. Researchers (Abu-Asbah, 2012; Dkeidek et al., 2010; Abed, 2008; Yaar & Shavit, 2001) claim that teacher domination in Israeli Arab schools has been almost unquestionable for many decades and so has been the domination of rote learning.

In the current study, post-intervention data reflect positive changes in student performance, including a better understanding of the principles of collaborative work, a higher tolerance of different opinions, and decrease in patronizing behaviour toward peers and younger siblings. At the same time, some of the students were unmotivated toward the tasks for developing HOTS and their attitudes to the intervention had not changed. Students' diverse attitudes to the tasks requiring novel and innovative thinking are well-documented by Cheng (2011) in the report of his study of infusing creativity in the Eastern classroom. He reported, for instance, that some of the students considered the tasks requiring creativity a waste of time, especially during test preparation. It was reported that students' negative attitudes mainly came from the change in learning style, high demand in thinking, and time constraints. Hu and associates (2011) add, however, that the first experience of implementing the HOTS-promoting intervention is unlikely to result in significant changes among learners.

The data obtained in the qualitative study may indicate the connection between the beliefs of students and the socio-cultural milieu in which their beliefs develop and the impact thereof on students' learning attitudes. Researchers (Feucht & Bendixen, 2010; Fives & Buehl, 2010; Hofer, 2008; Perso, 2007) point to the sensitivity of personal epistemology to the socio-cultural context and suggest that these factors influence students' learning habits, approaches to problem solving, and patterns of group decision making. Researchers (Wilcox et al., 2013; Clough, 2006) believe that students' beliefs about learning can be reshaped, as a result of intervention measures.

5.4.4 Summary

The findings of this study, supported by the results obtained by other researchers, provide the basis for the conclusion that the HOTS-based interventions can lead to positive changes in teachers' and students' attitudes to the new educational practices and to consequent improvement of Arab school culture. Some of the teachers expressed the necessity of restructuring the learning environment in Arab schools, considering critical and creative thinking fundamental to effective learning across the curriculum. This idea was advocated by many educational researchers (Hu et al., 2011; Cheng, 2011; Zohar, 2008). Changes were seen in the way students perceived the construction and acquisition of knowledge: some of their records indicate the willingness to independently understand the information vital to making appropriate decisions. On the basis of the analysis of 70 studies, Scott, Leritz & Mumford (2004) found that that well-designed creativity training programs, which were focused on development of cognitive skills and the heuristics in skill application, induced gains in student performance. These findings are supported by other authors (Cachia et al., 2010) who also emphasise the potential of ICT in enabling innovative and creative school environments. It is the move from a highly traditional school to the HOTS-based one that is so vital to reshaping the Arab school culture in Israel. Many scholars (Gallagher et al., 2012; Dkeidek et al., 2010; Zohar, 2008) point out, however, that in Israeli schools additional years of careful work are necessary in order to create the constructivist-based learning environment and make it sustainable.

5.5 Drawing inferences on the basis of the comparison of qualitative and quantitative findings

In this part of the chapter, inferences are provided based on the results of the qualitative and quantitative parts of this study, according to the principles of qualitatively-driven research. On these grounds, explanations are provided about the higher scores in the control group teachers' perceptions of the HOTS-based pedagogy and the inconsistencies between qualitative and quantitative results. Prior to making conclusions about the significance of the HOTS intervention, an emphasis will be placed on the factors, which may contribute to the credibility of findings, and on those that may affect it.

5.5.1 Methods for enhancing the cognitive and dispositional domains of students' HOTS

With regard to the methods for developing the cognitive domain of students' HOTS, the findings from the quantitative and qualitative parts of this study support each other. Quantitative results show that there is a significant difference between the pre- and post-intervention parameters for the intervention group teachers' perceptions of the methods for developing the cognitive domain of students' HOTS (difference between total scores - $U = -4.08$ $p<0.001$). These findings are compatible with the qualitative data received from the intervention group teachers who described the use of a variety of methods and a big amount of extra-classroom work intended for developing the cognitive domain of students' HOTS. In addition, the post-intervention comparison of the responses of the intervention and control group teachers show that almost all the parameters for the intervention group teachers' perceptions are higher than those for the control group (difference between total scores - $U = -4.45$ $p<0.001$). The above results suggest that, as a result of the HOTS intervention programme, there have been positive changes in the intervention group teachers' perceptions of the methods and pedagogy for increasing the cognitive and metacognitive skills of students.

The findings from the qualitative study are consistent with the quantitative results that indicate the intervention group teachers' perceptions of developing the thinking dispositions of students. The parameters for the post-intervention perceptions are higher than the pre-intervention ones (the difference between total scores - $U = -5.28$ $p<0.001$). In addition, the post-intervention comparison of the control and intervention group results for developing thinking dispositions reveals that

almost all the intervention group parameters are higher than the control group ones (the difference between total scores - U = -4.49 $p<0.001$). The findings from both studies suggest that due to the participation in the HOTS programme, there have been improvements in the intervention group teachers' perceptions of the use of pedagogical skills for developing the thinking dispositions of students.

With respect to thinking dispositions, the intervention group post-intervention scores are higher than those for cognitive domain. This fact may indicate that teachers have attached a higher importance to developing this domain of students' HOTS. However, the qualitative study does not reveal teachers' preference to developing the thinking dispositions of students over enhancing their cognitive and metacognitive skills. A qualitative interpretivist approach may provide some insight in this issue by emphasizing the importance of the real-life context in which participants' perceptions are shaped (Morse & Niehaus, 2009; Teddlie & Tashakkori, 2009; Bryman, 2006). Given the complexity of the HOTS programme and the fact that many teachers have considered themselves learners during the programme implementation, their perceptions of the intervention methods may slightly vary, depending on the situation. It can be thus suggested that quantitative and qualitative findings do not conflict, but rather complement each other.

5.5.2 Suggestions about the higher parameters for the control group teachers' perceptions of the HOTS-based pedagogy

Prior to the intervention, a comparison of the two teacher groups show that there are significant differences in the following parameters for developing student thinking dispositions: encouraging pervasive thinking in students (U = -3.07, $p<0.01$); involving students in a team work (U = -2.13, $p<0.05$); promoting tolerance of others' beliefs (U = -1.98, $p<0.05$); and developing civic responsibility of students (U = -2.98, $p<0.05$). The quantitative study's findings reveal that control group has higher post-intervention scores for developing students' thinking creativity (U = -2.75 $p<0.01$) and instilling HOTS in low-achieving students (U = -2.37 $p<0.05$). In addition, statistically significant differences between pre-test and post-test results have been found in control group with regard to developing reasoning and argumentation skills (U = -4.29, $p<0.001$); developing thinking creativity (U=-3.45, $p<0.01$); and instilling HOTS in low achievement students (U=-2.39, $p<0.05$). As to the methods for developing thinking dispositions, there are areas in which the difference

between the post-intervention scores of the two teacher groups is statistically insignificant: promoting tolerance of different beliefs (U = -1.82) and educating civically responsible students (U = -0.74).

Several suggestions can be offered with regard to the pre-intervention scores, in which statistically significant differences have been found between the two teacher groups, and with respect to post-intervention scores in which the difference between the two groups is insignificant. The qualitative data obtained in this study indicate that the intervention group teachers have shared their instructional experiences with their colleagues who have not yet received the in-service training. Professional contacts might have an impact on the pedagogical skills of the control group teachers and this may explain an increase in the post-intervention scores for this group. The adoption of the new national educational policy (Pedagogical horizons, 2007) could contribute to the control group teachers' professional self-improvement and encourage them to reflect on the use of the HOTS-based instruction methods. It can be also assumed that some of these teachers were more inclined towards the HOTS-based constructivist approaches because of their beliefs. There is also a possibility that teachers from the control group have had good skills in these areas and continued to improve them. It is possible, however, that their belief that they are skilled in the HOTS instruction has influenced the selection of Likert scale options while, in fact, teachers' perceptions were misplaced.

5.5.3 Results of developing the cognitive and dispositional domains of students' HOTS

A comparison of qualitative and quantitative results indicates that qualitative findings are compatible with the quantitative ones. In the cognitive domain of students' HOTS, there are statistically significant differences between the pre-and post-intervention scores for the intervention group students (the difference between total scores - U = -8.49 $p<0.001$) and post-intervention scores are higher than the pre-intervention ones. The most salient differences are seen between the pre- and post-intervention parameters that relate to students' metacognitive skills (U = -9.03 $p<0.001$) and the ability to organize work (U = -7.63 $p<0.001$) which is can be considered part of metacognitive skills. A comparison of the post-intervention parameters for the intervention group with the control group's results indicates that the intervention group students outperform their peers from control group (U = -7.48 $p<0.001$).

Quantitative findings indicate that there is no significant difference between the pre- and post-intervention scores for the control group of students. The results obtained from the analysis of their written responses suggest that almost all post-intervention results are higher than the pre-interventions ones, but the differences between them are smaller than those in the intervention group (see Appendix 13). Together with quantitative findings, these results suggest that there might be improvements in the control group students' perceptions, but these improvements are insignificant. On the basis of pre- and post-intervention quantitative and qualitative results, one can suggest that there have been positive changes in the intervention group students' perceptions of their skills related to the cognitive domain of HOTS, as a result of the participation in the HOTS programme.

With regard to students' thinking dispositions, not all qualitative and quantitative findings are compatible. In the quantitative study, the parameters for the post-intervention intervention group students' perceptions are higher than those for the pre-intervention period (the difference between total scores - $U = -11.07$ $p<0.001$). The post-intervention parameters for the intervention group students are also higher than those for the control group. At the same time, the quantitative results related to students' perceptions of pervasiveness of their HOTS and the issue of social responsibility towards the local community are not consistent with qualitative data. The data collected in the qualitative study are insufficient to assess the pervasiveness of HOTS of students. In addition, the qualitative data obtained from teachers and students demonstrate that the latter have low aspirations to dedicate their knowledge and skills for the good of their community.

As in the case with teachers, the qualitative interpretation of findings draws attention to the impact of context in which participants' perceptions are formed. A higher involvement of students in the HOT-based activities in the course of intervention and an increase in students' interest in the new learning experiences could have an impact on their perceptions. In addition, an active involvement in community service projects might influence students' responses to the questionnaire statement related to the use of HOTS for the good of the local community.

Quantitative results show that the total scores for the post-intervention students' perceptions in the dispositional domain of their HOTS are higher than those in cognitive domain ($U = -11.07$ $p<0.001$ against $U = -8.49$ $p<0.001$). These findings are compatible with the data obtained from the intervention group students' responses to open-ended questions. They show that, in comparison with pre-intervention period, students have higher perceptions of different aspects of collaborative activities than the perceptions of their cognitive and metacognitive performance (see Appendix 14). The above results suggest that students have made a better progress in the dispositional domain of their HOTS.

5.5.4 Discussion of the validity of findings obtained in the present study

One of the main requirements of any investigation is the reliability of data and findings. In what follows, the question is addressed whether findings are valid enough to draw conclusions about the significance of the HOTS intervention programme.

5.5.4.1 Results of member and peer reviewing

In order to validate accuracy of data and credibility of findings, the results of this study were presented to other parties for review. At one of the professional school meetings, teachers and the school principal were informed about the goal and methodology of this research project. After the drafts of the quantitative and qualitative studies had been completed, the results and interpretations thereof were handed over to the intervention group teachers. In addition, the researcher scheduled a meeting with students' parents who participated in the study to acquaint them with the results of interview analysis. Teachers were mostly interested in the qualitative part of the project. They held that the author accurately captured their attitudes to the HOTS intervention, problems taken place during the programme implementation, and how the results reflected the students' pre- and post-intervention performance. Most of the teachers believed that the author should pay more attention to the problems they experienced when facilitating constructivist instruction and learning and the inconsistencies between the educational new policy requirements and the content of the existing textbooks and examination tests.

The results of the study have been also presented to the two Israeli Arab scholars who have been working in the field of HOTS – Ph. D. A. Abed and Ph. D. A. Amer. Both scholars emphasised

the importance of conducting the study that examines the impact of the HOTS intervention in an Arab school. They agreed that selection of the mixed method methodology was a right decision in terms of providing a deep insight into the processes and outcomes of the intervention. They held that data analysis and interpretations seemed plausible. They noticed, however, that interviews with students and conducting classroom observations would lead to a better understanding of the effects of intervention on students. Dr. Abed expressed the idea that additional pre - and post-intervention test could be performed to measure students' abilities in some aspects of HOTS. Both authors have admitted that it is necessary to develop critical thinking of Arab school students with regard to social and political issues. Dr. Abed was more in favour of increasing students' HOTS in math and science curriculum, arguing that Arab students lag behind their Jewish counterparts. Dr. Amer believed that the deeper examination of teachers' epistemic beliefs and relation thereof to teachers' cultural background and instructional practices would be beneficial to the study. He also noticed that this could be the subject of a separate investigation, as the research into Israeli Arab teachers' epistemic beliefs is scarce.

5.5.4.2 Findings that help reduce the limitations of the study's methodology

In the Methodology chapter, the limitations of the methodology of this study were outlined. In the following section, conclusions are drawn as to how the findings of this study helped overcome these limitations.

Insignificant inconsistencies in qualitative findings were found through triangulating the themes developed from the interview and documentary data. A comparison of qualitative and quantitative results indicates that most of the qualitative findings converge with the quantitative ones. The triangulation of the study's findings with the results of studies conducted by other researchers contributed to a stronger external validity of the findings obtained in this research. In addition, the results of member and peer validation show that the findings of this study and interpretations thereof seem plausible and this also increases the external validity of the study.

With respect to student performance, one can judge about the increase in their cognitive and dispositional domains of HOTS mostly from the reports of teachers. The intervention results, which were highlighted in students' post-intervention responses, reflect their perceptions of the

progress in their skills, but not the skills directly. On the other hand, the qualitative findings show that the perceptions of the intervention group teachers have been based on sound pedagogical practices and teachers' views were informed by the HOTS-related professional training and research into HOTS. Teachers' perspectives on the learning progress of students were based on the results of summative and formative assessment. Findings show that through intensive scaffolding and feedback, teachers could instruct students how to plan and accomplish learning tasks. Furthermore, written responses to open-ended questions appeared to be rich qualitative data represented the source of information about students' behaviour and learning patterns. It is most probably that this information does not reflect students' ability of using HOTS, but rather a high motivation to do so and their growing awareness of the usefulness of HOTS in every domain of life. On the basis of data obtained from teachers and students, it can be strongly suggested that positive developments have occurred in thinking of many students, as a result of intervention. Many students improved their attitudes to learning in general and to the HOTS-related activities in particular. Post-intervention records also suggest the signs of transfer of thinking skills obtained in school to real life situations.

With regard to the teacher and student control group population, the following can be suggested. As the data about the control group teachers were obtained only through administering a questionnaire, this group's higher parameters for some intervention areas can be ascribed to the factors which were mentioned by the intervention group teachers in the qualitative study. These refer to professional contacts among teachers, self-education, and teachers' attitudes to instructional methods. The confounding variables, which implies teachers' and students' potential pre-knowledge of HOTS and their individual characteristics, could have an impact on their perceptions. As to control group students, the results obtained from the statistical analysis of questionnaire responses are compatible with the data from their written responses to open-ended questions. A comparison of the student control and intervention groups suggests that the latter outperforms the control one in both cognitive and dispositional aspects of HOTS.

5.6 Summary

In summary, the researcher concludes that quantitative and qualitative findings complement each other to provide a holistic understanding of the goal and implementation of the HOTS intervention programme. In order to facilitate the merge of results from different strands, the author followed the principles of study design in which quantitative and qualitative data should address the same concepts (Bryman, 2006). The themes developed in the qualitative study correspond to the two groups of quantitative variables, which reflect the cognitive and dispositional aspects of the students' thinking, and the two groups reflecting the instructional methods for developing students' HOTS. The inconsistencies between different findings can be explained by the complementary approach (Slonim-Nevo, 2009; Bryman, 2006): conflicting findings can be integrated and consistency is achieved by acknowledging the complexity of the phenomenon under investigation.

Both qualitative and quantitative findings results point to the major importance of this research project in comparison with the findings of studies concerned with the performance of Arab school students (Abed & Dori, 2013; Dkeidek et al., 2010; Abed, 2008). This is not only the first study that describes the implementation of the new educational policies in the Arab educational sector. The study addressed the research questions by examining in detail the process of implementing the HOTS intervention in an Arab high school and by highlighting participants' achievements in the intervention areas. It revealed the factors which were not addressed by other researchers: the change in teachers' and students' attitudes to the learning for good thinking and importance thereof for Arab school culture. In the final chapter of his thesis, the author will use the findings obtained in this study to provide the recommendations for further improvements in implementing the new educational policies in Israeli Arab schools.

6. CONCLUSION

6.1 Introduction

The present mixed method study was conducted to evaluate the outcomes of the intervention HOTS programme developed on the grounds of the 'Pedagogical horizons' (2007) policies. The programme sets the goal of creating the HOTS-based constructivist learning environment, drawing upon a large body of research carried out by Western and Israeli scholars over more than forty years. The inferences drawn from the discussion of qualitative and quantitative results obtained in the present study has revealed that both types of findings complement each other. They provide the basis for the understanding of the intervention measures for developing HOTS and participants' beliefs about the acquisition of knowledge. Perspectives are presented on the effectiveness of the HOTS intervention programme in using HOTS for the development of the civic competence of students and their understanding of democracy, which are considered important factors for improving the Arab school culture in Israel. As the school under study can be regarded as representative of the majority of Arab high public schools, the results of this study may be generalized to other Israeli Arab high schools. In the following sections, conclusions are made from the research findings and literature reviewed. Recommendations are provided regarding the implementation of the HOT-based educational strategies and the directions for future investigations are identified.

6.2 Emerging conclusions

6.2.1 Results of the literature review

The review of research literature depicts a broad picture of the HOTS-related issues, including the conceptualization of HOTS across different approaches and disciplines and variety of pedagogical methods for developing HOTS. One can conclude that scholars' debates are not about whether certain approaches or methods should or should not be used for the acquisition of HOTS, but about the ways in which they should be integrated into the teacher and student education process. Yet there seems to be a challenge to educators in achieving a well-balanced use of different learning theories (Thompson, 2011; Jordan et al., 2008).

A large number of researchers (Krogh, 2008; Paul & Elder, 2006; Hofreiter, 2005; Dam & Volman, 2004; Paul, 1995) hold that there are many complex moral, political, and social issues that citizens

must face and, therefore, teaching HOTS is necessary for gaining the moral integrity and responsible citizenship of students. There is an argument that HOT should be included in teaching social sciences within the undergraduate curriculum (Willingham, 2007; Hofstede & Hofstede, 2005; Mumm & Kersting, 1997). This study emphasises the problem that significantly less research has been done to investigate the acquisition of HOTS in social disciplines. Another problem identified in the present study is that the use of social disciplines for developing the HOTS of Israeli students escapes the attention of Israeli scholars. For decades, the Israeli authors concerned with developing HOTS (Abed & Dori, 2013; Barzilai & Zohar, 2012; Caesar & Lazarowitz, 2010; Kaberman & Dori, 2009; Lunetta et al., 2007) have carried out their studies in the fields of mathematics and in natural and computational sciences. The lack of scholarly attention to the use of social disciplines for developing the HOTS of Israeli students is seemingly at odds with the goal to educate them as engaged citizens in a plural and democratic society (Pedagogical horizons, 2007).

A review of the literature on the situation in the Arab education system, including several HOTS-related studies, helped establish the links between the features of the Arab school culture in Israel and implementation problems identified in this study. It can be suggested that Israeli Arab teachers face more challenges with regard to creating the HOTS-promoting environment than their counterparts in Jewish schools. These challenges can be explained by cultural/traditional differences between Arab and Jewish sectors and by traditional, teacher-centered pedagogy that still predominates in Arab schools and is focused on mastering and memorizing content knowledge (Abed & Dori, 2013; Abu-Asbah, 2012; Dkeidek et al., 2010; Abu-Asbah & Avishai, 2007). It has been also argued by several authors (Abu-Asbah, 2012; Arar & Ab-Rabia-Queder, 2011; Kraft, 2010) that the Arab educational system in Israel operates under inequitable conditions, both in terms of funding, teacher education, and involvement by Arab public in all policymaking issues.

6.2.2 The HOTS intervention programme and factors that affect its implementation

An analysis of the HOTS programme shows that it is built on concept of HOTS that encompasses a broad range of cognitive and metacognitive skills and thinking dispositions. Such a combination considered most effective for students to be productive and competitive in the modern society (Yoad & Levin, 2007; Paul & Elder, 2006; Kuhn, 2005; ten Dam & Volman, 2004; Anderson &

Krathwohl, 2001; Goleman, 1995; Resnik, 1987). The key point set out in the programme is that cultivating students' cognitive skills and thinking dispositions is a complex process in which the methods employed are often multipurpose and interrelated (Paul & Elder, 2006; Facione, 2000). The programme adopts an 'infusion' approach whereby learning subject matters and developing HOTS are inseparable.

The programme emphasises the constructivist principles of learning and teaching and promotes an active involvement of students in learning process and construction of knowledge (Yoad & Levin, 2007; Hofer & Pintrich, 2002; Thayer-Bacon, 2000). Based on the ideas of social constructivism the programme supports the ideas of an active teacher and student involvement in creating the learning community and developing the citizenship competence of students (Dam & Volman, 2004; Mantero, 2002; Rogoff, 1990; 2003). At the same time, the programme recognizes the significance of some behaviourist (Krathwohl, Bloom & Masia 1965; Bloom et al., 1956) and cognitivist learning theories (Pavio, 1986; Ausubel, 1978) for learning and instructional practices. An example is scaffolding techniques which were widely used in the behaviourist and cognitivist teaching practices and were enhanced and updated by constructivist educational researchers (Mayer, 2008; Hogan & Pressley, 1997).

The HOTS intervention programme provides an enhanced explanation of thinking strategies and their role in developing the HOTS of students, including their metacognitive knowledge (Yoad & Levin, 2007; Schraw et al., 2006; Anderson, 2004). It is also recommended that a cross-curricular approach is used whereby skills and knowledge obtained in one subject may be used to support and reinforce learning in other subjects. The programme emphasizes the importance formative assessment in the form of teacher feedbacks which are expected to provide a more effective evaluation of students' learning performance and their abilities. Teachers are encouraged to exert more effort in their work with low academic achievers while implementing thinking strategies and creative pedagogic techniques.

The results of this study suggest the factors that may impede the implementation of the HOTS programme, being are at odds with the principles of the constructivist learning environment for developing HOTS. The Ministry of Education of Israel emphasises the necessity of the classroom

learning environment that fosters inquiry learning and the move to the student-centered collaborative pedagogies (Pedagogical horizons, 2007). However, in 2009, a new government was elected and new directives were put forth, resulting in frequent alterations in the educational policies and reduction of the priority given to 'Pedagogical horizons' (Galagher et al., 2012). The new government attached high importance to raising test scores on national and international exams and the implementation of a high level accountability system for teachers and schools (Wolf, 2014; Gallagher et al., 2012).

It has been argued (Gallagher et al., 2012) that the new government policies that require intensive test preparation are in conflict with developing HOTS. So are the practices of schools which, in order to present good results to educational authorities, teachers focus their efforts on teaching for tests instead on teaching to learn. In Israeli schools, there is also an ill practice of promoting students from grade to grade regardless of their academic proficiency (Wolf, 2014). As teachers reported in the current study, there was not sufficient time to involve students in unguided inquiry, classroom discussions and deep thinking, as they experienced tremendous pressure to cover the curriculum and prepare students for tests. These challenges were aggravated by the necessity to work in oversized classes and addressing the needs of low-achieving students. It has been claimed (Pinar, 2013; Gallagher et al., 2012) that the intensive pressures generated by the new policies have been experienced by teachers throughout the Israeli school system.

Shortcomings in the programme implementation may concern the development of the social and citizenship competence of Arab students by using social disciplines. An examination of the HOTS programme materials lead to the conclusion that the programme places an accent on fostering HOTS in mathematics and sciences classes. The picture is different regarding the infusion of HOTS in social disciplines curricula. With regard to the latter, the programme goes in line with the policies set out by the Ministry of Education of Israel. The main problem, which has been identified by a number of authors (Pinar, 2013; Barak, 2013; Arar, 2012; Levy & Massalha, 2012; Ganz, 2008; Aden et al., 2001) and by the teachers interviewed in this study, is that the content of history and civics curricula emphasises the national-Jewish aspect of the State of Israel, downplaying the importance of learning about Israel's minorities.

The lack of the sound theoretical basis for developing the HOTS of Israeli students through social disciplines and the Education Ministry's standpoint on this issue has likely affected the implementation of the skill transfer concept promoted by the HOTS intervention. Although it has been suggested that the employment of cognitive and metacognitive strategies through cross-curricular learning contribute to the transfer of HOTS across different tasks and knowledge domains (Zohar & David, 2009; Barak et al., 2007; Kuhn & Dean, 2004; Pintrich, 2002; Halpern, 2001), the current study shows that this approach has not been followed in the instruction of social disciplines and might impede cross-curricular learning.

6.2.3 Results of instructional practices

Prior to implementing the HOTS programme at school, teachers studied the materials of the intervention HOTS programme during the in-service training course initiated by the Israeli Ministry of Education. All the teachers reported that the HOTS-related in-service training helped them better comprehend how thinking strategies can be used in facilitating thinking processes and in increasing the metacognitive skills of students. Teachers reported about the progress made in adjusting themselves to the student-centered learning environment and most of them advocated a greater teacher autonomy in building the HOTS-based curriculum. It was acknowledged that participation in the training programme and implementing the intervention made teachers better understand the concept of the problem-based lifelong learning.

The themes developed in the qualitative study reflect the positive results obtained in the most of the intervention areas. Quantitative findings show that there is a significant difference between the pre- and post-intervention parameters for the intervention group teachers' perceptions of the methods for developing the cognitive domain of students' HOTS and creativity in their thinking as well as in the dispositional domain of students' HOTS. It can be concluded that there have been improvements in instructional practices and teacher professional and personal development.

Along with the achievements of teachers in establishing the HOTS-promoting, constructivist learning environment, problems still exist in meeting the new educational goals. Qualitative findings revealed that the tasks that required HOT were not sufficiently performed by teachers due to a number of factors. Although all the intervention group teachers voiced support for the new

educational policies (Higher-order thinking strategies, 2009; Pedagogical horizons, 2007), many of them were not actually prepared for creating the constructivist learning environment, preferring traditional teacher-centered understanding of the learning process. The qualitative findings allow for the suggestion that many of the teachers have been more in favour of the behaviourist and cognitivist approaches to instructional design and some of them support the highly regulated 'top-down' approach in building the HOT curriculum. Those teachers admitted that they followed the programme guidelines rather out of the necessity to do so, but not because of the belief in the effectiveness of the new educational policies in the existing conditions. On the grounds of the above factors and other challenges faced by teachers in the implementation of the programme, the conclusion arises that they did not fully implement the HOTS programme's recommendations regarding a desirable balance between traditional approaches and constructivist, student-centered classroom.

6.2.4 Results of students' performance

Post-intervention qualitative data suggest that as a result of implementing the HOTS programme, the intervention group students improved their understanding of the construction and acquisition of knowledge and there has been an increase in the number of students prepared for independent, self-directed learning. The post-intervention students' responses to open-ended questions revealed that many of the intervention group students improved their understanding of team-working and communicating with team members. As a result of the intervention, some of the students expressed the belief that the knowledge gained in school includes the skills to think critically about a variety of issues. These data are supported by the opinions of the intervention group teachers: they argue that there has been an improvement in the cognitive and metacognitive performance of the intervention group students and in their thinking creativity. A comparison of the post-intervention quantitative results for the intervention and control groups also suggests that the former outperforms the latter with regard to cognitive, metacognitive skills and thinking dispositions.

At the same time, teachers reported that the results of the intervention were mostly seen in the performance of strong and some of the average students while the improvement was insignificant among weaker learners. There was a number of average and low ability students who were unmotivated toward the tasks for developing HOTS and have not changed their beliefs during the

period of intervention. In addition, very few students expressed the wish to use their knowledge and skills to increase the wellbeing of the local community. It can be also suggested that due to the problems faced by teachers in implementing the new educational policies, students could not fully benefit from the methods recommended by the HOTS intervention programme.

6.2.5 Reflections on the impact of the HOTS intervention programme on the Arab school culture

The factors which may have an impact on the Israeli Arab school culture refer to teachers' and students' attitudes to the HOTS intervention, their beliefs about the acquisition of knowledge and relation thereof to socio-cultural environment. There is growing body of research (Feucht & Bendixen, 2010; Weinstock, 2010; Fives & Buehl, 2010; Hofer, 2008) that claims that personal beliefs about teaching and learning are sensitive to the socio-cultural context. To date, however, there is only one author (Amer, 2011) who brought up the issue of the relationship between the beliefs of Israeli Arab teachers and their educational practices. This section also addresses the issue of developing the HOTS of Arab students by means of social disciplines. This is considered an important aspect in moving students towards an understanding of democracy and their contribution to society in a critical and aware manner (Krogh, 2008; Dam & Volman, 2004).

The content of students' records reflect their experiences in the tasks required by the school, work around the home, interactions with family members and friends, involvement in the local community projects, and other activities. Similarly, the qualitative data obtained from teachers suggest that many beliefs that teachers hold about instruction originate from their personal and professional development, studying scholarly literature, social encounters and socio-cultural environment. Quantitative results show that the control group teachers have higher scores in their perceptions of some of the intervention areas than their counterparts from the intervention group. Qualitative data indicate the occurrence of professional contacts between all teachers in the school and this may be one of the reasons for the professional growth of the control group teachers. It is also possible that some of these teachers were more inclined towards the HOTS-based constructivist approaches because of their beliefs. Qualitative findings also point to a positive change in participants' attitudes to the HOTS-based educational environment. To sum up, an improvement in participants' understanding of the necessity to create the HOTS-based educational

environment may lead to positive changes in the Israeli Arab school culture, bringing it up to the demands of the 21st century.

In the precious sections, a number of problems were highlighted that hinder the move of Arab school culture towards the focus on HOTS. It was also stated in section 6.2.2 that the HOTS programme goes in line with the policies of the Ministry of Education of Israel, downplaying the importance of developing the HOTS of students by means of social disciplines. This study is the first one that suggest the negative impact of these Educational Ministry's policies on the Arab school culture in Israel. Teachers of social disciplines have argued that, on the one hand, the Ministry of Education encourages HOTS in history and civics, but on the other hand, requires to learn about many important to Arab society issues only by using the content approved by it. Teachers reported that in order to avoid conflicts with the regulatory bodies, they preferred to comply with the Ministry's policies and instructed students to learn what was written in textbooks. As a result, such issues as Israeli-Arab history, culture and identity and the nature of Israeli-Palestinian conflict were not the topics for critical discourse and thinking in the classroom.

The lack of Israeli research on developing HOTS within social sciences leads to the idea that both Israeli educational authorities and scholars working in the field of HOTS are unwilling to involve high school students in the reflection on the complex, socio-cultural and political realities in Israel. Mathematics and natural sciences represent thus somewhat of a "neutral" zone in which HOTS can be enhanced without having to engage students in dealing with sensitive socio-political issues. This is not consistent with the concepts of socio-cultural constructivism whereby learning to think critically pertains not only to the acquisition of knowledge and thinking skills, but is a constructive and socially and culturally situated process of educating active society members (Powell & Kalina, 2009; Rogoff, 2003; Vygotsky, 1978; 1986). Such a position allows for no room for independent and critical thinking regarding the issues of Israeli-Arab history, culture and national identity of Israeli Arabs. The present WBP is the first study that calls for a change in the Educational Ministry's policies in this regard.

6.3 Recommendations for creating a culture of higher order thinking in Israeli Arab schools

Recommendations below address several areas: governmental policies, aspects on which teachers and students should focus to take the Israeli Arab school system to a higher level of achievement, and issues on which Israeli education research should be focused in order to improve the Arab school culture in Israel.

Both the Education Ministry and local authorities need to move a whole educational system towards the focus on HOTS with the help of carefully planned strategies. These have to be implemented simultaneously, addressing several aspects: curriculum, learning materials, assessment, and teacher professional development. The consistency of implementing HOTS-based educational strategies implies that raising test scores on national and international tests and accountability system for teachers and school do not interfere with creating the environment promoted by 'Pedagogical horizons' (2007) and requiring critical thinking and skills to learn. The instruction of social disciplines should be based only on liberal and democratic values and encourage students to think critically about the complex socio-political realities. The regulatory bodies and scholars have to understand that Arab students will not be able to make their own contribution to society in a critical and aware manner if they are not encouraged to critically reflect on their history and culture and on the complex social-political realities. In addition, infusing the school curriculum with the HOTS-promoting activities should not result in increasing the amount of teacher work beyond the classroom hours. If this is unavoidable for some reason (particularly in the conditions existing in Israeli Arab schools), teachers should be fairly paid for the extra work done.

Since the majority of Israeli Arab schools are still highly oriented at conventional instruction because of various historical and socio-cultural reasons (Abed & Dori, 2013; Abu-Asbah, 2012; Dkeidek et al., 2010), it would be reasonable to suggest that Arab schools system needs more measures for creating the conditions for the HOTS-promoting learning environment. There should more investments in the education of Arab teachers so that they could acquire sufficient knowledge to foster HOTS of students. More time and financial resources have to be allocated to various forms of in-service training like continuing education programmes, workshops and teacher seminars, and online training as well. On-line training sponsored by some Israeli Arab institutions

has become ever growing trend and a practical way of educating teachers, particularly those living in remote Arab villages. Ever growing online education opportunities expend the possibilities for teachers to implement long-life learning.

Teachers would benefit from learning how to be more creative in methods of delivering lessons in order to create the constructivist collaborative learning classroom that fosters HOTS. Through the use of reflective strategies, teachers can find a proper balance between teacher-centered instruction and students-centered learning and reach a better understanding of how the advantages of behaviourist and cognitivist approaches can be used in the constructivist learning environment. The adoption of a reflective approach to instruction may improve teacher performance, both in terms of initiatives in creating the HOTS-based curriculum and participation in the whole-school decision making processes. More creativity is needed in structuring the lesson so that students will have the opportunity to connect the knowledge acquired in school to real life situations. This will contribute to the transfer of thinking skills across different knowledge areas and make the HOTS of students pervasive. Another issues concerns the instruction of social disciplines like history of Israel and civics. If teachers of history and civics believe that governmental policies do not promote the development of students' HOTS in social disciplines, they are recommended to critically reflect on their instruction of the above subjects. This is certainly not an easy task for teachers to implement. They need to make students understand the historical and cultural complexities existing Israeli society and explain to them that conflicts should be resolved only through peaceful, democratic means.

As to the recommendations for students, there are a number of aspects students should consider when working on developing their HOTS. On the basis of the data obtained from teachers and students responses from the questionnaire, students are recommended to be more persistent in solving complex problems and be more reflective with regard to the transfer of their thinking skills across different areas of the curriculum and activities beyond the school. With regard to successes and failures in learning, students have to work more on channeling their emotions in positive and constructive ways, in order to achieve better learning results. Another important aspect is using students' HOTS in contributing to the local community and to Israeli Arab society in general. Israeli Arab youth should realize that only this can bring Arab society to a new level in a

democratic way, despite all challenges ahead. According to this study's findings, students have been already involved in community projects. This can be a good and practical way to use students' thinking skills for the good of the local community and increase their social responsibility.

The need was previously emphasised for sound research that informs the development of HOTS of Israeli Arab students through studying history and civics, involving the issues of culture and national identity of Israeli Arabs. Another area of Israeli research that needs exploring is Arab teachers' and students' beliefs about knowledge and learning. As the majority of studies have investigated these issues in Western contexts, the validity of researchers' conclusions extend mostly to Western democracies. The comprehensive study of the beliefs of Israeli Arab teachers and students may provide a better understanding of the beliefs structure of this population groups and how their perspectives are linked to educational practices. This will hopefully make the developments in curriculum, training and assessment more suitable to specific teachers/students' needs.

There is an expectation that the researchers who engage in the development of HOTS can use the findings of this study to understand the beliefs, behaviours and feelings related to the practices of infusing HOTS across the curriculum. The findings of this study may make them better understand the process of developing the HOTS-promoting learning environment in Arab schools. It should be noted that the work on this thesis has contributed greatly to the professional and personal development of the author as a researcher and a lecturer. The practical performance of the present study provided a broader view on various aspects of the teaching and learning practices in an Arab public high school. Since the present research is the first step on the way of studying the implementation of the HOTS-based educational policies in Israeli Arab schools, a considerable amount of additional work is necessary in order to have deep insights in the ways of cultivating good thinking in our teachers and students and changing the culture of learning and instruction in Israeli Arab schools.

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APPENDICES

Appendix 1. Informed consent forms

A. Informed consent form (for all the participants, including children aged 14 and older)

The title of the study: 'Developing higher order thinking skills of Arab public high school students in Israel: a case study'.

Purpose of the study: Examining the processes of developing the higher order thinking (HOTS) of students in an Arab secondary school. The study is also aimed at determining the impact the implementation of the HOTS intervention programme may have on the Arab school culture in Israel. The study is to be conducted over two years. The results of the study will be translated into English and submitted to the University of Derby (England).

Researcher: Amgad Seif

Contact information: Email: Address: 30026 Arara, p.o.Box: 77, Israel

Tel No. 00972 524 206 811 E-mail: **amgad_seif@yahoo.com**

I hereby declare as follows:

1. The researcher explained to me the aim and procedures of the study at the debriefing meeting. I had an opportunity to ask questions and received satisfactory answers.

2. I have been informed me that the data will be collected through interviews (teachers and parents), questionnaires (teachers, pupils) and written narratives (teachers). The interviews will be audio-taped.

3. The information gathered from the interview transcripts, questionnaires and written narratives will be stored in a secure area, and access to it will be restricted to the researcher.
4. I understand that the data collected in this study will be solely used for the study purposes. I have been ensured that all copies of the raw data will be permanently destroyed five years after completion of the study.

5. I understand that the data collected is confidential and will not be disclosed to third parties without my consent, except to meet legal or other regulatory authority requirements. I agree to the use of anonymised quotes in publications.

6. I have understood that no stresses or risks are foreseen. I have been ensured that this participation is entirely voluntary. I can withdraw consent at any time without penalty.

7. I have been given a signed copy of this informed consent form, which is mine to keep.

Signature:
Date:

B. Parental consent for participation in research

The title of the study: 'Developing higher order thinking skills of Arab public high school students in Israel: a case study'.

Purpose of the study: Examining the processes of developing the higher order thinking (HOTS) of students in an Arab secondary school. The study is also aimed at determining the impact the implementation of the HOTS intervention programme may have on the Arab school culture in Israel. The study is to be conducted over 2 years. The results of the study will be translated into English and submitted to the University of Derby (England).

Researcher: Amgad Seif
Contact information: Email: Address: 30026 Arara, p.o.Box: 77, Israel
Tel No. 00972 524 206 811 E-mail: **amgad_seif@yahoo.com**

I give my consent for my son/daughter …….. to participate in the aforesaid study. I hereby declare as follows:

1. The researcher explained to me the aim and procedures of the study. I had an opportunity to ask questions and received satisfactory answers.

2. The researcher informed me that the data about my son/daughter will be collected through administering a questionnaire.

3. The information gathered from the questionnaires will be stored in a secure area, and access to it will be restricted to the researcher.
4. I understand that the data collected in this study will be solely used for the study purposes. I have been ensured that all copies of the raw data will be permanently destroyed five years after completion of this study.

5. I understand that that the data collected is confidential and will not be disclosed to third parties without my consent, except to meet legal or other regulatory authority requirements. I agree to the use of anonymized quotes in publications.

6. I have understood that no stresses or risks are foreseen. I have been ensured that this participation is entirely voluntary. I or my child can withdraw consent at any time without penalty.

7. I have been given a signed copy of this informed consent form which is mine to keep.

Parent …….. ……. Signature ……..
Address:
Date:

Appendix 2. Interview guides

A. Questions for teachers

1. How would you characterise the contribution of the HOTS programme to your personal thinking patterns and work habits?

2. How would you outline the pedagogical strategies you have used during the programme implementation?

3. How do you use the problem-based approach in the subject you instruct?

4. How do you teach your students to monitor and control their thinking process?

5. What is your attitude to the team-thinking processes in developing HOTS?

6. How do you act in case your students unexpectedly initiate the discussion of the things explained to them during the process of instruction?

7. Do you connect the subject you instruct with the real-life situations? Please provide explanations for both positive and negative answers.

8. Do you see any changes in your students' learning performance? If so, please detail.

9. How would you summarize the problems you have encountered in implementing the programme?

10. What is your opinion on instilling HOTS in low-achievement students?

11. What are your pedagogical methods with regard to the success of your students in meeting their learning goals?

12. How do you deal with the student's failure in accomplishing his/her task?

13. Do you think your students enjoy their schooling as a result of participation in the programme?

14. What do you think about the role of HOTS in developing the student's responsibility towards school and community?

15. How would you describe the role of the HOTS programme in shaping the character of the school culture?

16. How do you understand the concept of school as "thinking culture"?

B. Focus group guide

- Welcome words
- An overview of topic
- Ground rules
- Questions:

1. How would you characterise the impact of the programme on your pedagogical strategies?

2. What do you think are the most important methods in developing HOT in students?

3. Can you identify any changes in your students' learning performance? I so, please detail.

4. What challenges have you experienced when implementing the new pedagogical strategies?

5. How do you see the impact of the HOTS programme on the educational environment of an Arab school?

- Brief summary.
- Thanks and dismissal.

Appendix 3. Questionnaires for students and teachers

A. The questionnaire for students

Dear student,

These questionnaires were composed in order to examine your thinking skills used for accomplishing learning tasks and in everyday life, you learning motivation, teacher's attitude toward your learning methods, and satisfaction with your schooling. Please respond to the statements in the questionnaire to the best of your ability. In addition, you are required to provide short written examples for some of the statements listed in the tables below.

The information collected through this enquiry will be used for the purposes of this study aimed at improving learning environment and tailoring it to your needs. The privacy of each participant will be respected. All questionnaires will be coded to ensure the anonymity of each participant. Completed questionnaires will be kept in a locked place accessible only to the researcher.

Thank you in advance for your cooperation.

Part 1: Please indicate your opinion on the statements listed in the tables by ticking a number according to the scale provided:

1 – Strongly disagree. 2 – Disagree. 3 – Somewhat disagree. 4 – Somewhat agree. 5 – Agree.

6 – Strongly agree.

The questionnaire for students

No	To which extent you agree or disagree with the following statements?	1	2	3	4	5	6
1	Generally, the task implementation is preceded by reflection on action.						
2	Before task implementation, I outline a programme of action and test it during the implementation.						
3	At the successful/unsuccessful completion of the task, I seek to analyse the process I have passed, in order to succeed in future tasks						
4	When working on a task, I rarely stop to test whether I do it right or wrong.						
5	I try to analyse the forces that led to my decision (whether I was guided by logic or emotional forces or both).						
6	When encountered by a problem, I analyse it and formulate possible solutions in order to find the best one						
7	My solutions to problems are supported by rigorous arguments and strong evidence.						
8	When encountered by a problem that requires multiple solutions, I feel confused. I prefer the single, well-established answer to a problem.						
9	While preparing to accomplish a task, I analyse my past experiences, both failures and achievements, and seek to use the knowledge gained through the accomplishment of previous tasks.						

10	The thinking skills obtained in the classroom help me to understand connection between prior knowledge and the new information.						
11	The thinking skills obtained in the classroom help me in daily life.						
12	Every learning experiment helps me to be a more independent learner.						
13	The knowledge, which I accumulated through my studies, increased confidence in my abilities						
14	I am usually challenged by decision making process because I am afraid of making mistakes.						
15	When seeking solutions, I always consider the opinions of others even if they differ from mine.						
16	When accomplishing a task, I am completely focused on achieving my goal and do not consider the opinions of others. I rely only on myself.						
17	By working on a problem in a team I become a more independent thinker.						
18	Working in a team facilitates problem solution						
19	If team-member offers an alternative problem solution, it confuses me. I need a single solution to a problem.						
20	I do not make assumptions and draw conclusions until I understand things deeply.						
21	I value more the results than the thinking process leading to them.						
22	I always look for the facts that confirm my arguments and disregard the facts that refute them.						
23	I have to work more in order to perfect my thinking skills regardless the challenges encountered						
24	I have to learn more by myself, rather than relying on teachers and text-books						
25	The feelings of satisfaction and joy, which result from successful task accomplishments, stimulate my motivation for further actions.						
26	My thinking skills should help me become a responsible member of my school and community.						

Part 2

Please provide written responses to statements 2, 6, 11, 15.

B. The questionnaire for teachers

This questionnaire is designed to investigate the effects of using HOTS in your pedagogical practices. Please respond to the statements in the questionnaire to the best of your ability. The information collected through this enquiry will be used for the purposes of this study. The privacy of each participant will be respected. All questionnaires will be coded so as to ensure the anonymity of each participant. Completed questionnaires will be kept in a locked place accessible only to the researcher.

Please indicate your opinion on the statements listed in the tables by ticking a number according to the scale provided below.

1 – Strongly disagree. 2 – Disagree. 3 – Somewhat disagree. 4 – Somewhat agree. 5 – Agree.

6 – Strongly agree.

The questionnaire for teachers

No	**To which extent you agree or disagree with the following statements?**	1	2	3	4	5	6
1	Each task implementation should be preceded by reflection on action.						
2	Before task implementation, I recommend to outline a programme of action and test it during the implementation.						
3	At the end of a task, I recommend to students to reflect on the thinking methods and strategies employed.						
4	I help my students to analyse the forces that led them in their thinking process (whether they were guided by logic or emotional forces or both)..						
5	When we have a problem at hand, I teach students to solve it systematically (formulating goals, generating and evaluating solutions).						
6	I teach my students to solve problems by using rigorous arguments and strong evidence.						
7	We should work on problems which provide the opportunity for students to build their own ideas into the solution.						
8	The best way to solve problems is to demonstrate specific methods for solving each type of problem. Students may be confused when encountered by the problems that require alternative approaches.						
9	I am prepared to stop the preplanned sequence of instruction in order to coach students' thinking.						
10	I see curriculum and subject matter are at the center of instruction. Engaging students into probing subject matter creates ambiguity which interferes with instruction.						
11	We should develop methods for instilling critical thinking in students with high academic achievements and in those with learning difficulties.						
12	Teaching HOT is appropriate for students with high academic achievements; it is inappropriate for week students.						
13	Developing HOT is important not only in teaching math and science, but in the humanities as well.						
14	New concepts should be taught in real-life context by using examples from everyday life.						
15	I recommend my students to understand things deeply before they make assumptions and draw conclusions.						
16	Reflecting on the thinking process that led to the idea may confuse students and interfere with the accomplishment of a learning task.						
17	I encourage team-thinking activities focused on the students' personal thoughts rather than definitive knowledge.						
18	I believe that students learn better when they are engaged in participation. Team brainstorming makes them more independent thinkers.						
19	Engagement of students in a team-thinking process interferes with the normal sequence of instruction.						
20	Teachers should guide and facilitate learning rather than to control it.						
21	The main role of teachers is to transmit knowledge to students and prepare them for matriculation exams.						
22	By developing students' thinking skills, we make them more independent learners.						
23	The feelings of satisfaction and joy, which result from successful task accomplishments, stimulate the student motivation for further actions.						
24	Instilling critical thinking skills in students should be aimed at developing their respect for the ideas of others and encouraging cooperative behaviour.						
25	By developing HOTS in students, we should educate them as socially and ethically responsible members of the community.						

Appendix 4. The research sources used for developing the questionnaires

A. The research sources used for developing the questionnaire for students

Students' perceptions of their HOTS based learning activities	
1 Generally, the task implementation is preceded by reflection on action.	The process of planning, assessing and monitoring of thinking (Icuenobe, 2001; Csapo, 1999; Alvino, 1990) Reasons to justify beliefs and actions (Paul, 1990).
2 Before task implementation, I outline a programme of action and test it during the implementation.	
3 At the successful/unsuccessful completion of the task, I seek to analyse the process I have passed, in order to succeed in future tasks	Self-regulation in thinking; monitoring one's cognitive activities (Facione et al., 2000 ; Paul & Elder, 2006; Dean & Kuhn, 2003)
4 When working on a task, I rarely stop to test whether I do it right or wrong.	
5 I try to analyse the forces that led to my decision (whether I was guided by logic or emotional forces or both).	
6 When encountered by a problem, I analyse it and then formulate and evaluate possible solutions.	Problem solving techniques (Snyder & Snyder, 2008; Zohar & Dori, 2003; Facione et al., 2000; Jonassen, 2000). Divergent thinking and the idea-generation strategies (Fisher & Williams, 2004; Plucker & Runco, 1999) Developing evaluative thinking (Cropley, 2001; Plucker & Runco, 1999). Creativity in thinking (Eckhoff & Urbach, 2008; Runco, 2007)
7When encountered by a problem that requires multiple solutions, I feel confused. I prefer the single, well-established answer to a problem.	
8 My solutions to problems are supported by rigorous arguments and strong evidence.	
9 While preparing to accomplish a task, I analyse my past experiences, both failures and achievements, and seek to use the knowledge gained through the accomplishment of previous tasks.	Reflective thinking focused on deciding what to believe or do (Paul & Elder, 2006; Ennis, 1990) Comprehension of relationships between the old and new knowledge and between the different areas of the existing knowledge. Transferability of thinking skills (Willingham, 2007; Pithers & Soden, 2000; Thayer-Bacon, 2000; Csapo, 1999).
10 The thinking skills obtained in the classroom help me to understand connection between prior knowledge and the new information.	
11 The thinking skills obtained in the classroom help me in daily life.	
Students' thinking dispositions	
12 Every learning experiment helps me to be a more independent learner.	Self-confidence in one's own abilities to reason (Facione et al., 2000; Thayer-Bacon, 2000; Facione, 1990) Hostility towards using critical thinking (Paul & Elder, 2006; Facione et al., 2000)
13 The knowledge, which I accumulated through my studies, increased confidence in my abilities	
14 I am usually challenged by decision making process because I am afraid of making mistakes.	
15 When seeking solutions, I always consider the opinions of others even if they differ from mine.	

16 When accomplishing a task, I am completely focused on achieving my goal and do not consider the opinions of others. I rely only on myself.	Flexibility in considering alternatives and opinions, open-mindedness. Egocentric tendencies in thinking (Perkins & Ritchhart, 2008; Facione et al., 2000; Thayer-Bacon, 2000).
17 By working on a problem in a team I become a more independent thinker.	Flexibility in considering alternatives and opinions, open-mindedness. Egocentric tendencies in thinking (Perkins & Ritchhart, 2008; Paul & Elder, 2006; Facione et al., 2000; Thayer-Bacon, 2000).
18 Working in a team facilitates problem solution	
19 If team-member offers an alternative problem solution, it confuses me. I need a single solution to a problem.	
20 I do not make assumptions and draw conclusions until I understand things deeply.	Pervasiveness of critical thinking; prudence in suspending, making or altering judgments (Paul & Elder, 2006; Facione et al., 2000; Siegel, 1989; Langer, 1989). Hostility towards using critical thinking (Paul & Elder, 2006; Facione et al., 2000)
21 I value more the results than the thinking process leading to them.	
22 I always look for the facts that confirm my arguments and disregard the facts that refute them.	
23 I have to work more in order to perfect my thinking skills regardless the challenges encountered	Effort and persistence in thinking (Paul & Elder, 2006; Halpern, 1998)
24 I have to learn more by myself, rather than rely on teachers and text-books.	
25The feelings of satisfaction and joy, which result from successful task accomplishments, stimulate my motivation for further actions.	HOTS and emotional intelligence (Elder, 1996; Goleman, 1995)
26 My thinking skills should help me to become a responsible member of my school and community.	Critical thinking as a citizenship competence. Making contribution to society in a critical and aware manner (Hofreiter, 2005; Hofstede & Hofstede, 2005; Dam & Volman, 2004; Battistich et al., 1997; Cantor, 1990; Glaser, 1985).

B. The research sources used for developing the questionnaire for teachers

Teachers' pedagogical strategies for instilling cognitive and metacognitive skills in students	
1 Each task implementation should be preceded by reflection on action.	The process of planning, assessing and monitoring of thinking (Icuenobe, 2001; Csapo, 1999; Alvino, 1990) Reasons to justify beliefs and actions (Paul, 1990).
2 Before task implementation, I recommend to outline a programme of action and test it during the implementation.	
3 At the end of a task, I recommend the students to reflect on the thinking methods and strategies employed.	Teaching meta-cognition (Davis, 2004; Dean & Kuhn, 2003). Reflective thinking focused on deciding what to believe or do (Ennis, 1990).
4 I help my students to analyse the forces that led them in their thinking process (whether they were guided by logic or emotional forces or both).	

5 When we have a problem at hand, I teach students to solve it systematically (formulating goals, generating and evaluating solutions).	Problem solving techniques. Divergent thinking and the idea-generation strategies. (Snyder & Snyder, 2008; Zohar & Dori, 2003; Facione et al., 2000; Jonassen, 2000) Developing evaluative thinking (Cropley, 2001; Plucker & Runco, 1999). Algorithmic vs. non-algorithmic problem solving ability (Zohar, 2004; 2008; Jonassen, 2000; Resnick & Klopfer, 1989; Resnik, 1987). Creativity in thinking (Eckhoff & Urbach, 2008; Runco, 2007). Cognitive conflict as a means to stimulate children to think actively (Limon, 2001; Adey & Shayer,1994)
6 I teach my students to solve problems by using rigorous arguments and strong evidence.	
7 We should work on problems which provide the opportunity for students to build their own ideas into the solution.	
8 The best way to solve problems is to demonstrate specific methods for solving each type of problem. Students may be confused when encountered by the problems that require alternative approaches.	
9 I am prepared to stop the preplanned sequence of instruction in order to coach students' thinking.	Conventional instruction vs. teaching students to process information creatively (Zohar, 2004; 2008)
10 I see curriculum and subject matter are at the center of instruction. Engaging students into probing subject matter creates ambiguity which interferes with instruction.	
11 We should develop methods for instilling critical thinking in students with high academic achievements and in those with learning difficulties.	Instilling HOTS in low-achieving students (Zohar & Dori, 2003; Ferretti et al., 2001; Zohar et al., 2001; Neisbett, 1997)
12 Teaching HOT is appropriate for students with high academic achievements; it is inappropriate for week students.	
13 Developing HOT is important not only in teaching math and science, but in the humanities as well.	Developing HOTS in social sciences (Edmonds et al., 2005; Clark & Biddle, 1993). Transferability of thinking skills (Willingham, 2007; Zohar, 2004; Dean & Kuhn, 2003; Pithers & Soden, 2000; Csapo, 1999).
14 New concepts should be taught in real-life context by using examples from everyday life.	
Teachers' pedagogical strategies for developing thinking dispositions in students	
15 I recommend my students to understand things deeply before they make assumptions and draw conclusions.	Pervasiveness of critical thinking; prudence in suspending, making or altering judgments (Paul & Elder, 2006; Facione et al., 2000; Siegel, 1989). Hostility towards using critical thinking (Paul & Elder, 2006; Facione et al., 2000)
16 Reflecting on the thinking process that led to the idea may confuse students and interfere with the accomplishment of a learning task.	
17 I encourage team-thinking activities focused on the students' personal thoughts rather than definitive knowledge.	Development of thinking as a social endeavor (Ritchhart & Perkins, 2008; Ritchhart et al., 2006) Divergent thinking and the idea-generation strategies. (Cook, 2008; Cropley, 2001; Zohar, 2004; Plucker & Runco, 1999).
18 I believe that students learn better when they are engaged in participation. Team brainstorming makes them more independent thinkers.	

19 Engagement of students in a team-thinking process interferes with the normal sequence of instruction.	Encouraging and scaffolding students' participation in team-thinking process (Perkins & Ritchhart, 2008; Ritchhart et al., 2006; Zohar & Schwartzer, 2005). Self-directed learning. Conventional instruction vs. teaching students to process information creatively (Zohar, 2004; 2008; Royer, 2005; Stenberg, 2003)
20 Teachers should guide and facilitate learning rather than to control it.	
21 The main role of teachers is to transmit knowledge to students and prepare them for matriculation exams.	
22 By developing students' thinking skills, we make them more independent learners.	Effort and persistence in thinking. Self-directed learning (Paul & Elder, 2006; Brown, 2004; Halpern, 1998).
23 The feelings of satisfaction and joy, which result from successful task accomplishments, stimulate the student motivation for further actions.	HOTS and emotional intelligence (Elder, 1996; Goleman, 1995). Developing the learning motivation of students (Lepper et al., 2005; Deci et al., 2001; Pintrich, 2003; Facione et al., 2000).
24 Instilling critical thinking skills in students should be aimed at developing their respect for the ideas of others and encouraging cooperative behaviour	Developing Dispositions, Promoting Democratic Practice (Huber-Warring & Douglas F. Warring, 2005; Cantor, 1990). Reflective thinking focused on deciding what to believe or do (Paul & Elder, 2006; Ennis, 1990).
25 By developing critical thinking in students, we should educate them as socially and ethically responsible members of the community.	Critical thinking as a citizenship competence. Making contribution to society in a critical and aware manner (Willingham, 2007 Hofreiter, 2005; Hofstede & Hofstede, 2005; Dam & Volman, 2004; Battistich et al., 1997; Cantor, 1990; Glaser, 1985).

Appendix 5. Thematic framework: the results of triangulating the data collected through the qualitative data collection methods

The sign '+' refers to the theme occurrence in the data developed by a given data collection tool. In the 'N' column, the number of the main theme indicates its number in the Findings chapter.

Themes and sub-themes	Interviews with teachers	Focus group interview	Teachers' reports	Students' comments	Teachers' instructional plans
Using thinking strategies for enhancing the students' cognitive and metacognitive abilities					
Using thinking strategies for developing critical analysis and reasoning skills.	+	+	+	+	+
Teaching students to use metacognitive skills for self-directed learning.	+	+	+		+
Increasing the transfer of thinking skills through cross-curricular connections.	+	+	+		+
Developing students' cognitive and metacognitive skills through problem solving activities.	+	+	+	+	+
Increasing students' cognitive abilities through student-centered, collaborative learning.					
Implementing inductive instruction.	+	+	+		+
Enhancing students' cognitive abilities through collaborative learning.	+	+	+	+	+
Developing inquiry skills by involving students in collaborative learning projects.	+	+	+	+	+
Promoting students' cognitive and metacognitive skills by the peer and cross-age tutoring.	+	+			+
Developing students' thinking creativity by employing problem-based and collaborative learning methods.	+	+	+		+

Using scaffolding as a teaching strategy.	+	+	+		+
Combining summative and formative assessment of students' learning outcomes.	+	+	+		+
Using the HOT-based instruction for developing students' thinking dispositions					
Enhancing students' self-confidence and the ability of self-directed learning.	+	+	+		+
Achieving the pervasiveness of students' HOTS through problem-based learning.	+	+	+		
Developing the tolerance and open-mindedness of students.	+	+	+		+
Developing students' communication and interpersonal skills through collaborative activities.	+	+	+	+	+
Enhancing students' self-confidence and motivation in learning.	+	+	+		+
Teaching students to understand and productively use their emotions.	+	+			
Developing responsibility for the wellbeing of the local community.	+	+	+	+	
An impact of the HOTS programme implementation on teachers' attitudes and performance.					
Understanding the necessity of a systematic use of thinking strategies for developing students' HOTS.	+	+	+		+
A better comprehension of the interrelation of the HOT affective and cognitive dimensions.	+	+	+		+
Understanding the necessity of adjusting to the student-centered classroom environment.	+	+	+		+

Teachers' disagreements over the students' collaborative work in the classroom.	+	+			
Perceiving the school as a learning community.	+	+	+		
The problems experienced by teachers when implementing the programme.					
Considering time constraints a serious obstacle in the programme implementation.	+	+	+		
Expressing the belief that the curriculum reform is slow and inconsistent.	+	+			
Having disagreements over the role of teachers in creating the HOT-based curriculum.	+	+			
Increasing the amount of extra-classroom activities to provide additional help.	+	+	+		+
Having a challenge in developing HOTS in students with diverse educational attainment.	+	+	+		
The effectiveness of the intervention with regards to the student learning performance.					
An improvement in students' cognitive and metacognitive skills.					
An increase in students' ability to use thinking strategies in critical analysis and reasoning.	+	+	+	+	
An improvement in students' problem solving skills.	+	+	+	+	
An increase in students' metacognitive abilities	+	+	+	+	
An indication of the transfer of knowledge and thinking skills.	+			+	
Demonstrating creativity in thinking.	+		+	+	

An impact of the intervention on students' thinking dispositions.					
A positive change in students' performance in collaborative learning activities.	+	+	+	+	
Adopting a positive attitude to the involvement in the HOT-based learning.	+	+	+	+	
Demonstrating a negative attitude or indifference toward the HOTS-based learning.	+	+	+	+	
An increase in students' self-confidence and the ability of self-directed learning.	+	+	+	+	
Differences in students' reactions to success and failure.	+	+	+		
Students' low aspirations to use their knowledge and skills to improve their community life.	+	+		+	

Appendix 6. The scientific reasoning guide

In what follows, the text is displayed from the PowerPoint slides developed by the intervention group science teachers and used during the presentation about science and scientific inquiry.

1. The connection between prior and new knowledge

The new knowledge is built on the basis of past knowledge and experience.

While building on previous knowledge, scientists seek to improve our understanding of the world.

2. Scientific knowledge must be based on evidence

Researcher's statements must be confirmed with a large body of evidence.

Scientists derive evidence through the process of scientific inquiry.

3. What is scientific inquiry?

Scientific inquiry involves making observations, raising questions and proposing answers, planning investigations, using tools to gather, analysing and interpreting data; examining sources of information to see what is already known about the subject of investigation, and communicating the results.

Doing inquiry requires the use of critical and creative thinking and consideration of alternative points of view and interpretations.

4 Main types of scientific reasoning

Reasoning is the process of arriving at conclusions from a given body of information.

Scientific reasoning is the ability to solve problems through the application of scientific methods

Scientists use both inductive and deductive reasoning to address scientific problems.

5 Deductive reasoning in science

Deductive reasoning starts from a general principle or theory and proceeds from there to specific conclusions.

In deductive arguments, conclusions follow from the stated premises (reasons given in support of conclusions). If the premises are true, then it is impossible for the conclusion to be false.

A researcher begins with a theory about the topic of investigation and narrows it down into more specific hypotheses. Data is then collected and analysed to see if hypotheses can be confirmed.

6 Inductive reasoning in science

Inductive reasoning starts from specific observations and moves to broader generalizations and theories.

In inductive arguments, the conclusion follows probably from premises. Even if premises are true, it is still possible for the conclusion to be false.

A researcher observes the object of investigation, forms hyposesise, performs experiments to verify the hypothesis, and then creates a theory.

7 Hypothetico-deductive method in science

The hypothetico-deductive method is a form of deductive reasoning and one of the more basic methods common to all scientific disciplines.

It proceeds by formulating hypotheses and theories from which particular occurrences can be deduced, predicted and explained.

8 Stages of the hypothetico-deductive inquiry

Formulate the research question(s)

Generate a testable (analysable with scientific methods) hypothesis or several hypotheses

From the hypothesis, generate initial predictions which can be proved or disproved by the experimental process.

Perform experiments, obtaining statistically testable results.

If the predictions are correct, then the hypothesis is proved. If not, the hypothesis is disproved.

If the data do not support the hypothesis, scientists may restart the process to refine their hypothesis.

9 Communicating the findings

It is important to accurately represent your findings in a way that is clearly understood by others.

Findings can be communicated through written reports, press releases or oral presentations.

Communication of your findings allows for scientists to reproduce the experiments and verify the results.

Appendix 7. The guide for analysing a scientific article (primary research article)

1. Find out the author's credentials. Is the article written by an expert in the field?

2. Read the abstract. The abstract will inform you about the major findings of the article and their significance. In the abstract, you will get the initial information whether the article is relevant for your quest.

3. Focus on the Introduction section of the article. In this section, the author should make it clear what his/her objectives for the research are.

4. Figure out the key question the author wants to address.

5. Examine the techniques described in the Methodology section. It might provide you with more information whether this paper is truly helpful for you inquiry. Does the problem match the methods?

6. Examine whether the Results (Findings) section of the article accurately describe the data presented in the paper. Tables, figures, graphs and the corresponding legends should clearly present the results of the experiment. Check to see whether there is something in the experiment results of that does not substantiate authors' claims.

7. Read the Discussion section in which the results are interpreted and compared to the results of other experiments. In this section, the author provides an answer to the question posed in the Introduction and explains how the results support that conclusion. Sometimes, the Results and Discussion sections are combined. In this case, the data are divided into logical groups and explanations are provided for each group of results.

8. In the final section of the article, the author draws conclusions about the results, focusing the reader on what is important about his/her inquiry. The author might give the ideas about what issues are still unaddressed in the field.

9. Throughout the article, the author refers to the information from other papers. Citations are all listed in the references (bibliography) section. If you want more information on the content, you can try to find the articles cited in that paragraph.

Remember when reading an article:

- Reading and understanding a scientific article is an iterative process. You may re-read it several times to find out whether the logic clear and whether claims are properly supported with convincing data.
- Highlight important data and make notes when reading an article. This will help you to find out what is important about it and keep you focused on the task.
- Note any terms or part of the article you do not understand. Consult various sources of information to learn about the terms you do not understand.

Appendix 8. Cause and effect reading organizer

Figure 8.1. A cause and effect chart created by the intervention group student who analysed the story by Yigal Lev ('The dream village far from the moon').

Cause		Effect
Three juvenile adolescents disliked the correctional facility where they were kept. They wanted to be free and independent.	→	They escaped the facility, looking for a remote village where nobody would ask who they were. They dreamed to live in an abandoned house and do small robberies for their living.
On the second day of their escape, they walked on the side of the Haifa speedway, looking for a ride. They witnessed an accident: a luxury car hit a man and fled. Nobody was around, except for the boys.	→	A badly injured men lay on the road. The boys were caught in a dilemma over the decisions on what to do.
Decision 1: they help the wounded by trying to bring him to the hospital.	→	They will be eventually caught by the police and returned to the correctional facility.
Decision 2: they leave the wounded on the road, hoping that someone would help him.	→	The badly injured man might die without being helped.
Two boys felt so happy to be out of the facility that they could not accept the idea to be caught and returned to the place they hated.	→	Their decision was to leave the man on the road and move on.
Their peer, a fourteen year boy, felt much compassion to the injured man and wanted to help him. But he did not want to jeopardize his friends' dream to be free and live in a remote village.	→	He tried to persuade his friends to help the man, but they did not want to. The boy was physically strong and dragged the unconscious man to the side of the road.

He felt sad and frustrated by the thought that he would lose his dream of freedom, but he did not feel like leaving the helpless man.	→	He offered his friends to move on without him. He sat next to the unconscious man, waiting for some car to come. His friends hid behind the cliff nearby, being uncertain about what to do.
Suddenly, a car came across the way and stopped. The driver was an Arab who went with his friends to some place. They got out of the car and approached the boy and the injured man. The other boys came out of the bushes. The boys explained to the Arabs what had happened. Nobody wanted the injured to die.	→	Three boys and the Arab driver picked up the injured man and brought him to the nearest hospital.
In the hospital, the boys were told to stay and to testify to the police about what they had witnessed. The boys were afraid of being caught.	→	They escaped the hospital. The Arab driver told the police what had happened and described the boys. The police sergeant guessed that those might be the three boys who escaped the facility
The police sergeant had to make a decision: to chase the boys or to give them a chance and not catch them now, since they did a good deed.	→	The boys were given a chance. The officer decided not to pursue them immediately, pretending further that he could not find them.
The boys kept on wandering. They felt hungry, but had no money to buy food.	→	They tried to break into a grocery store and were eventually arrested and returned to the facility. Their dreams about a remote village collapsed.

Conclusion

When returned to the correctional facility, the boys pretend to be cynical about their deed: “How stupid we were! We spent a full day of freedom for a lousy ride to the hospital!” In fact, they were good hearted people and were able of doing good deeds. They were capable to understand that saving someone’s life was more important than pursuing their dream.

Appendix 9. The formative assessment guidelines developed by teachers on the ground of the HOTS programme

General

- Observing, documenting and evaluating student learning and development (behaviours, development, skills, knowledge, strengths, needs and interests)
- Providing communication and collaboration with other teachers and students' families.
- Ensuring that students have a clear understanding of the requirements they have to meet to accomplish a task. The requirements vary, depending on the assignment (written analysis of an article/piece of fiction, inquiry write-up, part of a project to be completed, and so on)
- Giving students a practice session in order to teach them: a) how to apply assessment criteria to their own performance; b) how to perform peer assessment.
- Giving students feedback on their self-evaluations and discussing peer assessment results.

Student self-evaluation sheet

Upon competing an assignment or part thereof, students are required to complete a structured evaluation sheet in which they should respond to the following questions:

- What outcomes were achieved?
- What kind of knowledge was obtained?
- What thinking strategies were used?
- What problems were encounter and how were they solved?
- What was the most challenging part of this assignment?
- What should be done differently next time?
- Do I find this interesting? Why or why not?
- How could I make this material personally relevant?
- What is most challenging for me about this task? Most confusing?

Peer feedback template

Does the content relate to the title and/or purpose of the work?

Is the argument consistent? Do the author's statements follow from each other?

Is sufficient evidence given to support arguments? Are conclusions drawn appropriately?

Assessment descriptors recommended to be used in assessment

Excellent; outstanding; bright; deep; at a high level; satisfactory; unsatisfactory; poor; very poor; correct; very clear; very precise; well-argued; understandable; quite understandable; giving an idea; giving a little idea; unclear; uncertain; incomplete; blur; incorrect; sweeping claim; little evidence; misleading.

Appendix 10. The plan of self-directed learning

1. Articulating the goal, predicting outcomes, choosing strategies, checking resources to be used and time needed (What I have to accomplish? What do I already know about this topic? What strategies am I using? What resources I need to complete this task? How much time do I need to complete the task?)

2. Monitoring activities and adjusting strategies during task performance (Am I making my points clear and understandable? What strategies are working well/ not well? What can I do if I do not understand something? What other resources should I use to complete this task? What confusions/uncertainties remain? How am I going to get them clarified?)

3. Evaluating the outcomes (To what extent have I successfully accomplished the task? "Does the solution make sense? Have I convinced my opponent/reader? To what extent the available resources were used? What strategies worked well for me that I should use next time?)

Appendix 11. Description of a brainstorming session

During the course of psychology, I had to address the issue of violence in human behaviour. I decided to conduct a brainstorming session on violence and how to eliminate or reduce it in society. I offered students to present their ideas in the form statements that determine the cause of violent behaviour and offer a remedy solution. It was important to teach students to use thinking strategies when evaluating their ideas. The group, for which the brainstorming was planned, consisted of the sixteen ten-graders – two boys and fourteen girls. Two girls were absent from the classroom for some health reasons, so that the number of brainstorming participants was 14. We already did some brainstorming in the classroom and students were acquainted with the rules of brainstorming activity. Since the issue was taken broadly, the whole lesson was dedicated to brainstorming (45min.). We agreed that the students' statements would be recorded on the blackboard (I volunteered to do this) and in the students' notebooks. The ideas would then be organized and evaluated by students. They should identify the most workable ones, mapping also the main points of the decision making process. Three criteria were established for evaluating the ideas for preventing violence: 'it should be practically achievable', 'it should be legal' and 'it should be done with respect to an individual'.

Students voiced their opinions in the following order:

1 If parents frequently use physical punishment to discipline their children, these children may grow up to be violent. We should educate parents not to use physical punishment and create a caring environment for their children.

2 If children grow up in violent homes, they may grow up to be violent. Children should be removed from such homes.

3 People often respond violently to social injustice. Only when we eliminate social injustice, we can reduce violence.

4 Some researchers believe that violent people are just born that way. May be we should alter the DNA people are born with.

5 Those who use alcohol and drugs often behave violently. Alcohol and drugs should be prohibited and this will reduce violence among people.

6 When people are forced to do anything against their will, they may respond violently. Particularly, when they are forced unfairly. To reduce violence, we have to preserve justice.
7 Some people behave violently toward those who are weaker or less powerful. If they would be punished severely for such behaviour.
8 An individual may have many reasons to act violently, not only one. People who work with such individual should find out what these reasons are and then deal with the problems.
9 Some children or teenagers behave violently and aggressively because they want to keep power and control over their peers in school or in neighbourhood. Offenders should be punished and educated not to behave violently.
10 Children see too much violence in the media, movies and video games. It is worse now because the see may bad things on the internet. We should educate our children by teaching them true values and protect them from evil things.
11 Often children have to behave aggressively or violently because they have to protect themselves from abusive peers. Children have to feel safe and protected, otherwise they would grow up violent.
12 People may behave violently because they are ill. The illness should be treated.
13 Media producers use much violence to attract an audience. They should be prohibited from doing so.
14 Many people behave violently because they do not know how to communicate with one another. People should be taught to communicate.

We proceeded further with the analysis of the statements. Students were required to sort their statements out into categories by identifying common characteristics for each category. Students grouped the statements as follows: domestic violence and harsh discipline practices (1, 2); unsafe environment (7, 9, 11); injustice (3, 6); biological causes (4, 12), effects of alcohol and drugs (5); violence in media sources (10, 13); lack of communication skills (14); a combination of causes (8).

I told students that before they reached workable measures for preventing violence, they should identify the common idea that underlies all the solutions they offered. Students seemed to be puzzled. I posed a prompting question: “Have some of you said that violent behaviour can be

tolerated or justified?" The answer they gave was: "Violence should not be tolerated in no way". I went on, noting that the statements 2, 5, 7, 13 refer to harsh legal measures. I asked those who voiced these statements to present their arguments for such measures. They put them as follows:

- Educating people requires time. Harsh measures are necessary because otherwise people would not be afraid to act violently.
- Children should be removed from violent families because it is unlikely that their parents would change their behaviour.
- Without restrictions people would attempt to use more alcohol and drugs.
- If we do not forbid the production of movies or violent games with much violence, the media producers will be more seduced to releasing such things in the market.

Other students presented their opinions on what had been said. Below, I displayed some of them, since some participants voiced similar views:
- Removal of children from the family may cause serious trauma for those children. It should be done if there are no any other solutions.
- Islam forbids using alcohol and drugs because they are believed to weaken our thinking capability. Drugs are prohibited by law in our country, but alcohol is not. No one can forbid people of other religions from using it.
- It is a question what constitutes "violence" in media and for what reasons it appears. By making restrictions on media productions, we can endanger the freedom of word and freedom of creativity. Children may not understand that actors play characters created by writers.
- So what does it help to restrict on the production of alcohol? Some statistics says that there are Muslim countries where the use of alcohol is on the rise. People will always find ways to buy alcohol.
- It is true that education takes time, but using harsh measures will not help without educating people on how to behave. Prisons are full of violent people. They were, probably, not educated properly when they were young.

I then drew the students' attention to the statement 8 which included the argument that causes of violence should be found out and then treated appropriately. I asked students how these causes can

be identified. There were many opinions about involving various professionals in addressing the problem, but further I told students that something was missing in their responses. Students, however, did not know what to answer. I had given them a clue by saying that they were future social workers and when they would meet the person to find out about his/her problems and needs, they first of all should (I made a pause, waiting)… They answered almost unanimously: we should try to listen to this person as attentively and objectively as possible.

In the course of further discussion, students had evaluated the statements in each category. Eventually, students chose the statements 1, 3, 8, 9, 10, 11, 12 and 14, after they had decided that these statements met the established criteria and included the workable measures for eliminating or reducing violent behaviour in people. Students were uncertain about using genetic changes to eliminate violence in human behaviour. I have noted that Israel does not have any laws or guidelines regulating gene therapy as it is considered to be still in the experimental stages. Statement 8 was discarded, but I told students that this issue would be addressed in our further lessons. Students made a decision to reject statement 6 in favour of statement 3, arguing that 'social injustice' is a more concrete and socially sound definition than simply 'injustice'. On the basis of discussion, students reached several conclusions which were articulated as follows:

- Violence should not be tolerated. It is against the law and can lead to charges being laid.
- Violent behaviour may have many different causes. Some causes are biological, the other related to negative experiences and unsafe environment, and a combination of different causes is also possible.
- Causes of violence in children should be identified by parents, concerned community members or/and various professionals (school staff members, health professionals, social workers, and so on)
- Keeping our minds open to those who have exhibited violent behaviour and listening objectively to their opinions and feelings.
- Punishment after an act of violence has been done is not a sufficient measure for dealing with violent behaviour.
- Education is a powerful tool which should be used for preventing violence in many areas: creating a safe environment for children and youth by fighting violence in family and in peer situations;

informing children and youth about crimes related to violence and drugs; controlling the exposure of children to violent media and discussing with them the content they view; teaching people communication skills and peaceful conflict resolution.

- Devoting resources to finding solutions that contribute to social justice.

It can be stated, therefore, that eliminating or reducing violence in society is a complex problem which requires a comprehensive, complex solution and the input of many professionals working together.

Appendix 12. Corroboration of qualitative and quantitative results

Figure 12.1. The intervention group students' perceptions of their performance in the HOTS-based learning

Qualitative study				**Quantitative study**
Qualitative data				**Categories of dependent variables developed in the quantitative study**
Factors for the interpretation of qualitative and quantitative findings			**Areas of comparison**	
			Students' perceptions of their cognitive and metacognitive skills. Transferability of thinking.	
			An increase in students' ability to use thinking strategies in critical analysis and reasoning. An increase in students' metacognitive abilities.	The learner's capacity of organizing the work on the learning tasks. +
				Controlling and modifying cognitive learning processes. +
			An improvement in students' problem solving skills. Demonstrating creativity in thinking.	Formulating and solving problems. +
			An indication of the transfer of knowledge and thinking skills.	Transferability of knowledge and skills. +
			Students' thinking dispositions	
Problems imposed by the time constraints in the curriculum delivery and regulatory policies in implementing the HOT-related reform	**Students' epistemological beliefs and attitudes to learning in general. Skills developed beyond the classroom. Pre-existing students' thinking skills.**	**Students' responsibilities at home and in school. Hierarchical interpersonal relationships with family members. Interactions with close friends and in the group of peers.**	Themes related to the increase in students' cognitive and metacognitive abilities. Students' attitudes to the involvement in the HOT-based learning. Transfer of knowledge and skills.	The level of the learner's self-confidence. +
				Self-directed learning as indicator of learning motivation. +
				Pervasiveness of HOTS. -
			A positive change in student performance in collaborative learning activities.	Attitude to a team work. +
				Flexibility and tolerance with regard to other's beliefs. +
			Differences in students' reactions to the success and failure.	The influence of positive emotions on learning motivation. +
			Students' low aspirations to dedicate their knowledge and skills for the future of local community.	Responsibility towards school and community. -

Figure 12.2. The intervention group teachers' perceptions of the HOTS-based instruction and factors that are supposed to influence instructional practices

Qualitative study					**Quantitative study**
Qualitative data					**Categories of dependent variables developed in the quantitative study**
Factors for the interpretation of qualitative and quantitative findings			**Aspects of comparison**		
			Methods for developing the cognitive domain of students' HOTS		
Problems caused by the time constraints in the curriculum delivery and regulatory policies in implementing the HOT-related reform.	**Teachers 'epistemological beliefs and attitudes to the HOTS-related instruction.**	**Teacher professional level and training, teacher self-education, professional contacts among teachers**	Combining summative and formative assessment of students' learning outcomes.	Using metacognitive skills for self-directed learning. Using thinking strategies for analysis and reasoning abilities. Developing students' cognitive and metacognitive skills through problem solving activities. Enhancing students' cognitive abilities through collaborative learning projects, discussion, brainstorming and peer tutoring. Using task modeling as a scaffolding technique.	Teaching to organize learning. +
					Fostering meta-cognition skills. +
					Developing reasoning and argumentation skills. +
				Developing students' thinking creativity by employing problem-based and collaborative learning methods. Implementing inductive instruction.	Developing thinking creativity. +
				Increasing the transfer of thinking skills through problem-solving and cross-curricular connections	Increasing transferability of thinking skills. +
				Modifying scaffolding according to students' needs.	Instilling HOTS in low achievement students. +
			Methods for developing the thinking dispositions of students		
			Combining summative and formative assessment of students' learning outcomes.	Achieving the pervasiveness of students' HOTS through problem-based learning.	Encouraging pervasive thinking in students. +
				Developing students' communication and interpersonal skills through collaborative activities.	Involving students in a team-thinking process guided by the teacher. +
				Enhancing students' self-confidence and motivation in learning. Combining summative and formative assessment of students' learning outcomes.	Educating independent and motivated learners. +
				Teaching students to understand and productively use their emotions.	The use of student's positive emotions for increasing learning motivation. +
				Conducting discussion and brainstorming sessions for teaching tolerance and open-mindedness	Promoting tolerance and cooperative behaviour. +
				Developing responsibility for the wellbeing of the local community	Educating socially and ethically responsible community members. +

Appendix 13. The results of thematic analysis of the students' written responses to the questionnaire's open-ended questions

Themes (the figures in parentheses indicate the number of the questionnaire statement)	**The theme frequency** (the results are given in percentages of responses)			
	Intervention group		**Control group**	
	Pre-test results	**Post-test results**	**Pre-test results**	**Post-test results**
An increase in the student cognitive and metacognitive skills (2, 6)				
a) an ability to plan and evaluate the process of work (2)	25	40	27	33
b) demonstrating the awareness of the problem solving process (6)	16	28	14	20
c) the awareness of the ways to solve complex, open-ended math problems (6)	3	10	2	6
An indication of the knowledge transfer (11)				
a) being uncertain about the applicability of the knowledge obtained in school	26	3	23	13
b) having the belief that the knowledge of some subjects is useful beyond the school	74	84	77	83
c) having the belief that the knowledge gained in school includes the skills to think critically	-	13	-	3
A positive change in the attitudes and behaviours towards the collaborative learning (15)				
a)) valuing the opinions of the family members or a friend in seeking solutions	22	18	24	25
b) demonstrating patronizing behaviour patterns towards the family members or a friend	15	10	17	14
c) understanding the principles of cooperation among the group members.	25	43	23	30
d) a low level of cooperation among the group members	38	29	36	31
Showing low aspirations for using the acquired knowledge and skills for the local community wellbeing (11)				
a) an involvement in the community projects	16	28	18	26
b) committing life plans to the good of the local community	2	5	1	4

An analysis of students' responses revealed that, before the intervention, there was only the 4 % difference between the intervention and control group students writing about the work on the learning tasks (48 % of intervention group students against the 52 % of those from the control group). The proximity of these results can be explained by the uniformity of both respondent groups which were formed by using randomized sampling method and began at the same starting point. In the post-intervention questionnaire, the percentage of the records related to learning assignments is higher among the intervention group students (63% against 37 %), including the records reflecting the work in the collaborative and individual learning projects, solving open-ended math problems, and using thinking guides. A comparison of the pre-intervention results of both student groups indicates that their characteristics are close in terms of the ability to plan and evaluate the work on a task, approaches to problem solving, attitudes to collaborative activities, views on the usefulness of the knowledge obtained in school, and the involvement in the community life. Post-intervention results point to the higher differences between the two groups of respondents.

Appendix 14. An example of text encoding

(Excerpt from the interview with the history teacher)

	Meaning units	Codes
1	**How would you characterise the contribution of the HOTS programme to your personal thinking patterns and work habits?**	
	1 First, it was certainly a good thing to participate in the training course for teaching HOTS.	Appreciation of an in-service course.
	2 I can't say that this issue has been something completely new to me and, I believe, to my teacher colleagues.	Pre-knowledge of HOT.
	3 Over recent years, there have been talks about higher order thinking at some of the teacher meetings and in-service training courses.	Pre-knowledge of HOT.
	4 But it was this time when we had the chance to take a closer look at it.	Deep study of HOT in the course.
	5 This time, we learned about higher order thinking in a systematic and organized way.	Systematic study of HOT.
	6 There were not only lectures, but practical workshops as well, so we could get to the heart of the matter of higher order thinking.	Systematic study of HOT.
	7 The greatest thing about that was getting awareness of what is going on in your mind and regulating your own thinking.	Getting awareness of metacognitive skills.
2	**How would you outline the pedagogical strategies you have used during the programme implementation?** 8 We had to teach our students what we were taught about, I mean good and effective thinking skills, and do this within the subject area.	Applying an infusion approach.
	9 We were taught about thinking strategies of all kinds.	Learning about thinking strategies in the training course.
	10 Our task was how to empower our students with the ability to use these strategies, wherever they need them.	Work on the pervasiveness of students' HOTS.
	11 Certainly, our students had to do such things as making comparison, formulating questions or engaging in argumentation before the intervention.	Pre-existing students' thinking skills.
	12 But the new policies require from us to educate more effective thinkers.	New educational policies for teaching on HOTS
	13 Therefore, our goal has been to go in this direction and involve students in more tasks that require thinking and also in the reflection on thinking.	An increase in student involvement in cognitive and metacognitive activities.
2a	***So, was your main task to increase their cognitive skills?*** 14 I would say that it was an important task, but not less important was to encourage students to be reflective and to motivate them to engage in higher order thinking.	a) Importance of developing cognitive skills; b) Importance of motivating students to engage in HOTS.
	15 Students were explained the purpose of the intervention and that it would help them to perform better both in learning and in their future lives.	Developing students' awareness of the HOTS intervention.
	16 But, as a teacher, you know that students differ in their attitudes to learning.	Having students with different attitudes to learning.

	17 There are not a few of those who have little interest in school, let alone being engaged in higher order thinking.	Having disaffected students.
	18 So, as I told, our task was to develop a positive attitude to thinking activities.	Developing thinking dispositions.
	19 And also there is another important thing I should point out (*he raises his finger*). 20 We have to teach our students to be open-minded and independent thinkers and teach them to engage in a constructive discussion with teachers.	a) Fostering open-mindedness in students; b) Educating independent thinkers; c) Teaching on proper discussion skills.
	21 You know that this is quite a change in comparison to what has taken place in Arab schools.	A change in the Arab school education
	22 I was brought up with the idea that one should not tend to challenge the superior or authority, and the teacher's domination in the classroom was undisputed.	a) Blind submission to superior and authority; b) Teacher's undisputed authority in the classroom.
	23 But times are changing. 24 The parental authority is getting eroded.	Decrease in parental authority.
	25 The ability to think independently is required at many workplaces.	A requirement to think independently at workplaces.
	26 Sometimes (*he smiles*), I felt that when I encouraged students to pose more questions and to openly voice their views, my authority was crumbling.	The feeling of losing the teacher authority.
	27 But I have learned to overcome this feeling and today I enjoy having discussions with my students and listening to their opinions.	a)Overcoming negative emotions; b)Constructive interaction with students
3	**How do you teach your students to monitor and control their thinking process?** 28 We were instructed that metacognitive skills should be taught.	Programme guidelines that metacognitive skills should be taught.
	29 Our purpose was to make students understand that the more they would regulate their thinking, the better it would serve them.	Teaching on the importance of metacognition.
	30 We developed a general plan that would help them to stay focused on the task and evaluate their performance when doing the task.	Developing the plan of self-directed learning.
	31 I have also established for myself the rule which I have followed in almost each lesson: to link what is being taught to the facts students already know.	a) Teaching on metacognition in a systematic way; b) Establishing links between the previous and new knowledge.
	32 By doing their tasks, students learned how and when to use thinking strategies.	Students acquiring metacognitive skills.
	33 To say the truth, all this has been a tough task both for us and for the majority of students.	Challenges experienced in teaching metacognition.
	34 We had to restructure annual and many of the lesson plans to involve students in the self-regulation of their learning.	Adjusting instruction plans.
	35 As to students, I would not exaggerate to say that, in the beginning of the intervention, about two thirds of them considered the issue of thinking strategies a headache and a burden.	Negative student attitude to new thinking tasks.
	36 Consequently (*he smiles*), they learned to get along with it.	A change in student attitude to the intervention.

3a	***Could you please give the examples of how you have taught about thinking strategies in your subject?*** 37 It was important to explain to students what and how these strategies serve.	Importance of the explanation of thinking strategies.
	38 In the beginning, I have used the examples of activities from everyday life to make this more understandable to average and weaker students.	a) Examples from everyday life b) Adjusting to the abilities of average and weak students.
	39 I taught them how to work properly on the texts from their history textbooks so that they would better understand and remember the content.	Teaching to work properly on the history text.
	40 I asked them to work with a pencil to highlight key facts within the body of text and establish relationships between them.	a) Using visual methods; b) Identifying key components; c) Establishing relationships between the components.
	41 I picked up short articles on the same topic from different newspapers and students used thinking strategies to analyse how the same event was interpreted by different authors.	a) An analysis of newspaper articles; b) Analysis of different interpretations of the same event; c) Using thinking strategies
	42 They were required to formulate questions and compare and evaluate different points of view regarding the issue.	a) Formulating questions; b) Comparison; c) Evaluation of the points of view.
	43 They also had to present their own arguments to support the interpretation they found to be most convincing.	Using argumentation.
	44 In the beginning, I showed them how to do this and we worked together, but once they got the hang of it, they did it more independently.	Scaffolding through modeling.
	45 When learning about thinking strategies, they also learned about the language of thinking.	Learning about the language of thinking.
	46 We used the topics students learned in the classroom to compare the characteristics and purposes of different events like wars or political and industrial revolutions.	Using comparison.
	47 I developed a plan for reading and analysing a primary research article.	Using the guide for analysing a scientific article.
	48 Regretfully, we had very little time to use it in the classroom and did the analysis during the evening history classes I organized for students.	a) Time constraints; b) Working during extra-classroom hours.

The table above includes 3 questions from the interview guide and 2 follow-up questions. The sentences from teacher's answer are enumerated. The third column presents the names of codes that are placed next to the sentences, from which they have been developed. The sentences highlighted in blue represent the examples of inclusive text encoding, according to which the development of codes is based on the two or more related simple closes included in the compound

one. Adjacent sentences 19-20 and 23-24 (highlighted in green) create the context in the following way: the first simple close serves to emphasise the meaning of the second one. A number of sentences are coded with more than one code. As a result, the same sentence can provide the source for different themes.

The codes developed from teacher's responses were merged into themes. For instance, codes 4-13 merged into the theme" understanding the necessity of a systematic use of thinking strategies for developing the students' HOTS"; 14-20 – into "a better comprehension of the interrelation of the HOT affective and cognitive dimensions"; 19-27 – into "understanding the necessity of adjusting to the student-centered classroom environment"; codes 10, 13, 14a, 28-32, 37, 39-42, 43, 45-47 - into "using thinking strategies for enhancing students' cognitive and metacognitive abilities".

Appendix 15. Dissemination of the WBP and plan for future research

In what follows, measures for disseminating this research project activities are presented and the plan for future research is outlined.

At the initial stage of this study, a plan was elaborated with the purpose to create clear messages about the research objectives, concepts and results; pinpoint the target audiences for the messages; and develop ways to deliver the messages to the audiences being targeted. The dissemination of the research objective and outcomes was considered a long-term relationship with targeted groups which were expected to provide ongoing feedback to help researcher adapt and clarify the information delivered to the audience (Hinton, Gannaway, Berry & Moore, 2011; Wilson, Petticrew, Calnan & Nazareth, 2010; Harmsworth & Turpin, 2000; Foray & Hargreaves, 2003; Glik, Berkanovic, MacPherson, Ratner & Jones, 2000).

The dissemination of this research goals and objectives started at the last quarter of 2009, when the search for research participants took place. At the school, which served as the research setting, the management, teacher and student population as well as students' parents were explained about the goals, procedures and the expected benefits of this research project. The targeted groups included the management and teachers of Israeli Arab high public schools in order to inform them about the theoretical and practical implications of the present study. It has been also necessary to make this study's results accessible to the regulatory bodies that are responsible for the education policies and allocation of funding for schools in Arab sector. In addition, the targeted groups included the members of the university and research institutions' staff, in order to inspire the discourse on the development of HOTS and receive their feedback on researcher's work.

Over the recent years, dissemination activities have been carried out within the frameworks of the MOFET Institute and the Al-Qasemi Academic College of Education where the researcher works as a lecturer of computer sciences. In 2009, the research proposal was presented to the MOFET institute which had accumulated a wide-ranging pool of research resources, including research proposals submitted by applicants across the country. Dissemination activity included participation in a number of seminars, public presentations and professional conferences organized by the above institutions over the period of 2010 to 2014 years. At the seminars organized for

teacher educators and teachers working in the Arab educational sector, the following issues were addressed: the intellectual foundations and an overview of the research of HOTS; an impact of behaviourist, cognitivist and constructivist theories on the HOTS-related instruction; and developing the HOTS of students in social disciplines.

In 2012, the researcher participated in the national conference organized by the Al-Qasemi Academic College and dedicated to the problems and new ideas in the field of teacher education. A report was presented under the title 'The use of the HOTS strategies in delivery of curriculum in an Arab public high school'. In cooperation with Dr. Oleg Techlin, a PowerPoint presentation was created ('Development of HOTS through problem-based collaborative learning') and delivered at the Sixth International Conference titled 'Changing Reality through Education' (held in 2013 in Jerusalem). In addition, the poster outlining the research project was developed and presented at several in-service training workshops organized for teachers at the Al-Qasemi Academic College. At the conferences, there was an opportunity to discuss the study-related issues with the officials from the Education Ministry, particularly with those representing the Arab educational sector.

In order to expand dissemination activity, several scientific journals were reviewed as potential publication sources. Scholarly journals serve a variety of purposes, providing a forum for communicating research findings, disseminating new knowledge to a wide audience and informing public policy (Pollard, 2005; Byrnes, 2001; Benson, 2000; Bronmo, 1996). A joint article (Seif & Mohsen, 2011) was published in 'Al Jamia' – the journal issued in Arabic by the Al-Qasemi Academic College. The tile of the article is "Using online tools in promoting HOTS". Two other Israeli journals were chosen for the dissemination of the research results: 'Dapim' - a refereed academic journal published by the MOFET in Hebrew, and 'Megamot' – the Israeli periodical that reports on new trends in contemporary social research and features articles by Israeli researchers. Another journal selected for the dissemination of this WBP results is "Thinking Skills and Creativity" – an international journal in English that represents a peer-reviewed forum for the researchers dealing with HOTS and thinking creativity.

The dissemination of this WBP includes informing educational professionals and the Education Ministry officers about the study results through researcher's personal website (which is currently in state of development) as well as through the websites of the Al-Qasemi Academic College and the Israeli Teacher Association. The information about this research has been posted and is constantly updated on the website of the school where the researcher works. In addition, the researcher has recently started to use web conferencing (through Blackboard Collaborate™) as the method of disseminating the findings of this study. In the video conference organized in March 2015, the problems related to the student-centered inquiry learning were discussed with a number of Arab high school teachers from the north of Israel. The author hopes that the dissemination of this study findings will contribute to the HOTS-based educational practices and encourage a scholarly dialogue about instilling the culture of good thinking, both within the Israeli and international research communities.

Below, there is a plan of actions which the researcher intends to follow in his further research activities.

- Keeping abreast of the most contemporary research on fostering the HOTS of school students and the Education Ministry's policies for promoting the HOTS-based learning in high schools.
- Examining the measures developed by the Education Ministry for teacher professional development, including conferences, workshops and seminars in the field of HOTS.
- Developing a range of the HOTS assessment measures based on the existing tests for measuring the HOTS of teachers/students. The results of these tests will be used for the validation of data obtained by other research tools. Student interviews and classroom observation sessions, which have been not used in the present study, are planned to be employed in the examination of the results of the HOTS-based learning, both in the school under study and other school settings.
- Establishing contacts with Israeli scholars who are concerned with the promotion of HOT in Arab schools and engaging them in conducting the investigations that would involve several Arab high schools throughout the country. The author believes that such a collective effort of researchers will produce the accurate and comprehensive picture of the ways of implementing the HOTS-based educational policies in the Arab educational sector.