

## Title Page

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29 **Abstract**  
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## 32 **Background**

33 Sport and Exercise Medicine (SEM) Masters curricula vary. This Delphi study aimed to create a  
34 consensus curriculum for doctors undertaking SEM Masters courses.

## 35 **Methods**

36 A modified Delphi survey was utilised. An expert panel was established of individuals deemed to  
37 have adequate knowledge of the field. The research group developed the initial draft of the  
38 curriculum by collating and reviewing previously published United Kingdom-based postgraduate  
39 SEM-related curricula. There were 2 phases. In phase 1 the expert group either accepted,  
40 rejected or modified each learning objective (LO). During phase 2 the expert group were asked  
41 to accept or reject each LO that did not get accepted outright previously. The research group  
42 analysed the levels of agreements and the comments given by the expert panel after each phase.

## 43 **Results**

44 The expert panel consisted of 45 individuals, with 35 completing phase 2 (78% retention rate). Of  
45 the 136 LOs initially collated: 71 (52%) were accepted outright, 60 (44%) were altered in some  
46 way and re-included in phase 2, and 5 (4%) were removed after phase 1. The research group  
47 added 2 (1%) new LOs upon reflection over comments made by the expert panel. The final  
48 curriculum contained 133 LOs, divided into 11 sub-themes.

## 49 **Conclusion**

50 The findings will better inform educators when developing SEM Masters curricula and inform  
51 students what they should look for when considering an SEM Masters. This consensus curriculum  
52 is an important step in standardizing postgraduate SEM education.

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# **Creating a Sport and Exercise Medicine Masters syllabus for doctors: a Delphi Study**

## **Introduction**

Sports and Exercise Medicine (SEM) became established as a speciality in 2005 in the United Kingdom (UK) and this has driven increasing demand for education on its core components.<sup>1</sup> SEM postgraduate education varies throughout the world. Some countries offer postgraduate courses in SEM, such as Masters of Science or Postgraduate Diplomas.<sup>2</sup> Within the UK, there is currently no consensus on what learning objectives (LOs) should be included within both SEM Masters and diploma courses. Consequently, students undertaking postgraduate SEM qualifications at different universities will develop different skills, leading to less standardisation of clinicians employed in SEM posts.

Increased integration of SEM into the National Health Service (NHS) could provide significant benefits.<sup>3</sup> An important aspect for the evolution of SEM in the UK is ensuring the development of SEM curriculum for every level of training. Many SEM jobs in the UK require having an SEM Masters in their eligibility criteria. However, there is limited previous research looking into what a Masters course in SEM should include. A study in 2005 in the UK developed LOs for an ideal SEM Masters course, although how the findings influenced or were implemented into curricula is unknown.<sup>2</sup> This Delphi study aims to develop an up-to-date consensus on what skills and knowledge are expected of an individual with a Masters in SEM in the UK. This will aid in creating a unified and standardised SEM Masters education by universities throughout the UK. It will also ensure students can appreciate whether their SEM Masters education has provided the necessary skills and objectives to work as a competent SEM clinician.

This study has focused specifically on what LOs doctors undertaking an SEM Masters should hope to achieve. It should be noted that other health care professionals also undertake Masters degrees in SEM, and the LOs for these groups are likely to be different due to their role within the Multidisciplinary team.

## **Methods**

### Ethics

Ethics approval was granted by Hull York Medical School.

### Study Design

A modified Delphi survey was utilised to seek consensus on a postgraduate SEM Masters curriculum for doctors. Expert contributions to the study remained anonymous to the research group, in keeping with the principles of Delphi methodology.<sup>4</sup>

107 Establishing the research group

108 The research group included the authors DV, KM, PB, CN, AP and GF. The research group were  
109 selected due to their experience in medical education. DV, CN and AP have experience in the  
110 exercise medicine sector. DV and CN have experience in delivering SEM education. DV and KM  
111 have undertaken a Masters in SEM. GF and PB have experience in Delphi methodology. DV and  
112 KM have experience in the education of early career SEM professionals through BASEM and  
113 roles within UK Universities. Content decisions were finalised by the research group.

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115 Expert Delphi Panel

116 Experts are defined as individuals with knowledge and experience. For this study, they must have  
117 adequate knowledge in postgraduate SEM education.<sup>5,6</sup> Invitations to express interest in being on  
118 the expert panel were emailed to all members of the British Association of Sport and Exercise  
119 Medicine (BASEM) and the Faculty of Sport and Exercise Medicine (FSEM) via their mailing lists.  
120 In addition, members of the research group shared invitations to submit interest in being on the  
121 expert panel via social media.

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123 In their expressions of interest individuals were asked demographic information and questions  
124 selected by the research panel to determine eligibility. The following eligibility criteria were used:

- 125 ● Doctors that have completed their Foundation Training
- 126 ● Hold a higher qualification in SEM: specifically either an SEM Masters degree or diploma.  
127 Alternatively, they could have membership or fellowship of the FSEM (MFSEM/FFSEM)
- 128 ● Have been a doctor for more than 5 years
- 129 ● Working in the UK at the time of the study

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131 The research group reviewed the responses and removed those that did not match the eligibility  
132 criteria. Regarding the size of the expert panel, a panel size of more than 30 is not considered to  
133 improve the quality of the study.<sup>4,7</sup>

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136 Development of the initial curriculum

137 The research group developed the initial curriculum draft by collating and combining previously  
138 published LOs from United Kingdom-based SEM specialty training curriculums and a previous  
139 paper exploring the LOs required for an ideal SEM Masters curriculum published in 2006.<sup>2,8,9</sup> This  
140 approach was utilised to ensure no potential relevant LOs were omitted. The LOs taken from the  
141 pre-existing curricula were grouped into suitable themes by the research group utilising themes  
142 previously published. All LOs were reviewed by the research group and edited, if needed, using  
143 Bloom's taxonomy wheel (Figure 1) to make them suitable for postgraduate level.<sup>10</sup>

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145 Procedure

146 The initial survey to express interest in joining the expert panel was made using Google Forms  
147 (Google Inc. USA). Demographic information was obtained through this form. For the Delphi itself,  
148 electronic surveys were created using Qualtrics software and a link to it was emailed to all eligible  
149 members of the expert panel.<sup>11</sup> The participant information sheet was attached to the email, along  
150 with contact details of the research group. Consent was gained via a mandatory question given

151 before starting the Delphi. The instructions clearly stated that experts should consider the  
152 curriculum to be relevant for doctors undertaking a Masters in SEM, not considering other  
153 professions that may also undertake a Masters in SEM.

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155 Engagement from the expert panel is crucial for any Delphi study and the aim was for the  
156 response rate to not fall below 70%.<sup>12</sup> Experts were given 12 days to complete each phase of the  
157 Delphi. Non-responders after 8 and 10 days received a system-generated reminder. Text  
158 reminders were also sent to the expert panel if no response had been received on day 11. Only  
159 experts that completed phase 1 of the Delphi were invited to participate in phase 2. The data were  
160 collected between October and November 2020.

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162 *Phase 1: Review of the draft curriculum*

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164 During phase 1, panel members reviewed the curriculum and were asked to accept, reject or  
165 modify each item. Participants were given the option of providing an anonymous comment after  
166 each decision. The percentages of agreement for each LO were calculated and, along with all  
167 comments, were read through and discussed by the research group. The response to each LO  
168 was discussed regardless of the level of agreement from the expert panel. After the collected data  
169 were reviewed, the research group agreed to either accept, reject or alter each LO to create a  
170 second version of the proposed curriculum. LOs with levels of agreement above 75% with no  
171 comments were accepted. The research group reviewed all comments on LOs that had been  
172 accepted and the Los were amended accordingly and included in phase 2. LOs with levels of  
173 agreement below 75% without comments were rejected. For those with comments, these were  
174 reviewed by the research group, and where it was felt appropriate a modified LO was added for  
175 further review in phase 2.

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178 *Phase 2: Second Review of proposed curriculum (Accept or Reject)*

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180 A link to the second version of the curriculum was sent to all expert panel members that completed  
181 phase 1. For this phase, they were only provided with the option to accept or reject each LO. As  
182 reported by Keeney et al., a consensus was defined by 75% agreement.<sup>13</sup> Previous literature  
183 reports varied levels appropriate for consensus, ranging from 70% to 100%.<sup>6</sup> There was an  
184 optional open comments box at the end of each theme for further comments. The LOs accepted  
185 outright after phase 1 and did not require further input were included for reference. Again, the  
186 percentage of agreement was calculated, the research group reviewed all comments, and a  
187 consensus was reached to either accept or reject each LO. Phase 2 would be repeated until a  
188 final consensus on the syllabus was reached.

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191 **Results**

192 The initial proposed curriculum

193 There were 136 LOs collated from prior SEM syllabi. The research group divided these across 11  
194 distinct themes.

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### The Expert Panel

Of the 94 people interested in being on the expert panel, 48% (45/94) met the eligibility criteria. The reasons for non-eligibility included having worked as a doctor for less than 5 years (n=19), not holding an SEM Masters/Diploma/FFSEM/MFSEM (n=17) and not being based in the UK (n=13). The expert panel consisted of 20 SEM consultants, 4 orthopaedic consultants, 1 rheumatology consultant, 17 GPs, 11 SEM registrars and 14 doctors that did not specify their training/job role but did confirm that they had been a doctor for more than 5 years. All the 14 doctors that did not specify their training/job role had completed a SEM MSc or Diploma and fifty-seven percent had been a doctor for 13 years or more. Twenty-one individuals on the expert panel (47%) had experience teaching SEM Masters and diploma courses.

### Phase 1

In phase 1 of the study there was a 100% (45/45) response rate from the expert panel. Fifty-two percent (71/136) of LOs were accepted without the need for alteration, and 44% (60/136) were altered. The reasons for alterations are given in Table 1. Thirty LOs were altered for more than one reason. Regarding the alterations made to the Bloom taxonomy level, 44% (n=15) were moved to a higher taxonomy level, 41% (n=14) were moved to a lower taxonomy level, and for the final 15% (n=5) the wording was altered but the LO was kept within the same taxonomy level.

<b>Reasons for alteration</b>	<b>Number of learning objectives (LOs) altered</b>
Spelling and grammar (including re-wording)	44 (32%)
Alteration to Bloom taxonomy level	34 (25%)
Objective made more specific	10 (7%)
Objective made more broad	2 (1%)

*Table 1. The reasons for alterations to LOs after phase 1. The percentage of LOs altered for each reason is also provided.*

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Five LOs (4%) were rejected and all were removed due to being deemed too high level for postgraduate SEM Masters. The objectives removed for being too high level are given in Table 2, alongside comments given by the expert panel that contributed to the research group deciding upon their removal. The first two LOs listed in Table 2 regarding developing, leading and delivering exercise medicine services and MSK services received an agreement of 78% and 80% respectively. Despite being above the approval threshold, the research group discussed these objectives at length, taking on board comments given by the expert panel, and determined these LOs were too high a level for a Masters level.

<b>Learning objective (LO) removed</b>	<b>Expert panel quotes supporting the removal</b>
1. Develop, lead and deliver both paediatric and adult exercise medicine services	<i>Be able to contribute to the delivery of - Reduce the taxonomy order (Participant 41)</i>
2. Develop, lead and deliver both paediatric and adult MSK services	<i>Demonstrate awareness of - Not all MSc courses offer the chance for delivery (Participant 39)</i>
3. Perform a targeted ultrasound examination of a peripheral musculoskeletal problem	<i>Does not need to be part of SEM MSc - needs to be a separate course (participant 21)</i> <i>Reject as this is an additional skill that isn't going to be taught as part of MSc (participant 30)</i>
4. Inject a variety of joints and soft tissues with radiological guidance	<i>Does not need to be part of SEM MSc - needs to be a separate course (participant 21)</i> <i>I don't feel this is mandatory for Msc level (participant 42)</i>
5. Perform compartment pressure testing	<i>Not sure this is an essential component- would be done in Secondary Care (participant 33)</i> <i>Reject as advanced skill? beyond this level - know how it is done (participant 28)</i>

Table 2. The LOs removed after phase 1 and comments given by the expert panel which contributed to justifying the removal of the LO.

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Upon reviewing the comments given by the expert panel, the research team added the following 2 LOs to the proposed curriculum:

1. Discuss a range of common ethical issues in a team sport environment (added to 'sports team and event management' sub-theme)
2. Recognise the key medico-legal requirements and considerations in team medicine (added to 'sports team and event management' sub-theme).

These were both added due to comments made by members of the expert panel at the end of the survey when asked if they had any final thoughts. The first was added due to a participant stating: 'I would also add a section on Ethics and how this may impact the SEM physician' (participant 31). The second was added due to a member of the expert panel stating: 'Medico-legal issues in sports' (participant 18). Upon discussing these within the

246 research group the value of both comments were noted, and it was therefore deemed  
247 important to add related LOs.

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250 Phase 2

251 Of the 45 that completed phase 1, 78% (35/45) of these individuals also completed phase 2. All  
252 LOs (100%) were accepted in phase 2 of the study, with all objectives achieving over 85%  
253 agreement. No alterations were made to any LOs. Therefore, no further phases were required.  
254 The final curriculum consisted of 11 sub-themes (outlined in Table 3) and 133 LOs. The full  
255 version of the final curriculum can be found in the supplementary information.

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<b>Sub-Theme</b>	<b>Number of objectives in sub-theme</b>
1. Physical Activity and Human Health	13
2. Medical Issues Related to Exercise	16
3. Injuries Related to SEM	22
4. Basic Science in SEM	18
5. Clinical Pharmacology	6
6. Antidoping	4
7. Sports Team and Event Management	28
8. Physical Activity in Challenging Environments	1
9. Specific Groups in SEM	11
10. Intrinsic Skills of an SEM Clinician	3
11. Extrinsic Skills of an SEM Clinician	11
<b>Total</b>	<b>133</b>

258 *Table 3. The finalised sub-themes and number of LOs within each sub-theme.*

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267 **Discussion**

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269 Summary of findings

270 An expert panel of 45 (100% of those eligible) completed phase 1 of this modified Delphi study,  
271 with 35 also completing phase 2 (78% retention rate). One hundred and thirty-six LOs were  
272 reviewed, with 5 removed during phase 1 after being deemed too high level for an SEM Masters  
273 degree. Two additional LOs were added, resulting in a final curriculum of 133 LOs, all of which  
274 were accepted by the expert panel during phase 2.

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276 The importance of a standardised SEM Masters curriculum for doctors

277 Obtaining a high-quality and relevant education in SEM should be a critical goal for all physicians  
278 working in SEM.<sup>14</sup> Although there is no specific data on this, anecdotally, the research group is  
279 aware that a large proportion of doctors working in the field of Sport and Exercise Medicine are  
280 not SEM consultants or on SEM specialty training programmes. For this group, their SEM  
281 knowledge and experience will be heavily influenced through the completion of an SEM Masters.  
282 It is reasonable to assume physicians will want their SEM Masters to be as relevant as possible  
283 to being an SEM physician, particularly given the cost and time-commitment of undertaking a  
284 Masters degree.

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286 As a relatively new specialty SEM is continuing to find its place within the UK healthcare system;  
287 many fellow healthcare professionals have limited knowledge of the specialty and the skills SEM  
288 physicians possess.<sup>15,16</sup> As a specialty we need to demonstrate we can stand alongside  
289 conventional specialties by being prepared to methodically examine our practice, ensure  
290 physicians practising within SEM are sufficiently capable, and ensure they are working at a high  
291 level consistent throughout the UK.<sup>17</sup> It is becoming increasingly common for SEM posts to include  
292 having an SEM Masters in their desirable or essential job criteria. The need to standardise SEM  
293 Masters curricula is therefore becoming increasingly important. It will be beneficial to the  
294 professionalism of the specialty to ensure individuals working in SEM posts that require an SEM  
295 Masters possess similar, consistent skills and knowledge.

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297 Aspects too specialist for SEM Masters level

298 The expert panel rejected the practical LOs around performing ultrasound, joint and soft tissue  
299 injections, and compartment pressure testing, with comments implying that they are too high level  
300 for SEM Masters courses. Ultrasound imaging is increasingly used in SEM to diagnose and  
301 monitor injuries; diagnostic ultrasound has previously been described as the 'sports physicians  
302 stethoscope'.<sup>18</sup> A 2017 International Consensus statement outlining a generic syllabus for SEM  
303 speciality training includes an 'advanced skill' of 'targeted ultrasound examination of a peripheral  
304 musculoskeletal problem'.<sup>9</sup> How best to provide ultrasound training to SEM clinicians, or a  
305 consensus decision as to whether it is needed, remains a controversial issue.<sup>18</sup> The research  
306 group anecdotally acknowledges that many SEM clinicians choose to self-fund ultrasound training  
307 courses and equipment. The findings of this study indicate that ultrasound training should not be  
308 included in SEM Masters' teaching.

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310 LOs focused on developing and delivering exercise medicine services and musculoskeletal  
311 services were also not deemed appropriate to include in this curriculum, with several expert panel  
312 members commenting on issues with SEM Masters including these LOs. The research group  
313 discussed these objectives at length and deemed that these objectives would be more suitable  
314 for SEM consultant level or specialist SEM trainees. FSEM have created resources to aid SEM  
315 doctors in setting up SEM clinics and services, such as 'Sport and Exercise Medicine: A Fresh  
316 Approach in Practice' published in 2014.<sup>19</sup> Interestingly, the 2017 International Consensus  
317 syllabus for SEM specialist training does not include learning how to set up an SEM service, nor  
318 does the most recent UK SEM specialist training programme curriculum.<sup>8,9</sup> With increasing  
319 interest in how SEM can best be integrated into the NHS given the benefits SEM services can  
320 provide, it would be of great interest for further research be done to determine how the SEM  
321 specialty can most effectively increase the number of SEM services offered in the UK.<sup>3</sup>

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### 323 Catering to all SEM Masters students

324 Doctors at any stage in training can undertake a Masters in SEM, and doctors at different stages  
325 in training may require different outcomes from a Masters course. It is also important to  
326 acknowledge that other health care professionals undertake an SEM Masters degree, such as  
327 physiotherapists, osteopaths and sports therapists. While there will be overlap, the outcomes  
328 these professionals wish to achieve from an SEM Masters are likely to be different to the LOs for  
329 doctors. Future research may consider exploring an appropriate SEM Masters curriculum for other  
330 healthcare professionals; it would be interesting to compare and contrast these with this  
331 curriculum.

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### 334 Strengths

335 A modified Delphi was conducted thoroughly, following the appropriate methodology.<sup>4</sup> The expert  
336 panel consisted of highly qualified individuals from relevant professional backgrounds. A high  
337 level of engagement and response rate was achieved. Many, often detailed, comments were  
338 received from expert panel members to justify responses. The research group contains individuals  
339 with a wide range in level of training. A high level of acceptance was achieved for each of the LOs  
340 included in the final curriculum. As no repeats to phase 1 or phase 2 were required, there were  
341 only 2 rounds of the Delphi before the finalised curriculum being created. Less than 3 rounds are  
342 recommended to reduce participation fatigue.<sup>13, 20, 21</sup>

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### 345 Limitations

346 Although demographic data was removed, due to the nature of the questions asked to deem  
347 eligibility criteria, the research group may have been able to deduce who expert panel members  
348 were, resulting in bias. In addition, despite Masters degrees being primarily academic degrees,  
349 the only mention of research in the final proposed curriculum is in one LO listing research as a  
350 skill commonly used in practice by SEM physicians that the learner should be able to demonstrate.  
351 This is likely due to vocational-based curriculums being used to create the initial proposed list of  
352 LOs developed by the research group. It may be appropriate for educators creating curricula for  
353 SEM Masters to consider including additional research-related LOs. Given the nature of a Delphi

354 study, the study is limited by the research group members and expert panel. The study  
355 methodology is by design opinion-based and open to researcher and participant bias. In addition,  
356 it would have been beneficial to know the specific training/job role of the 14 doctors on the expert  
357 panel that did not provide this information. However, all of these doctors had an MSc or Diploma  
358 in SEM and had all been a doctor for 5 years or more, with the majority having been a doctor for  
359 over 10 years.

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### 361 Conclusion

362 The findings of this study will better inform educators involved in developing SEM Masters  
363 curricula, and inform students as to what they should look for when considering undertaking a  
364 Masters in SEM. This consensus curriculum is an important step in the standardisation of  
365 postgraduate SEM education. The next step will be to ascertain views of the finalised consensus  
366 curriculum from individuals involved in delivering, teaching and examining SEM masters content  
367 in the UK.

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#### **What are the new findings?**

- This Delphi study has produced an up-to-date consensus on what skills and knowledge are expected of an individual with a Masters in SEM in the UK.
- Practical skills such as ultrasound, joint and soft tissue injections, and compartment pressure testing were deemed too specialised to be included in SEM Masters curricula.
- How to develop and deliver exercise medicine services and musculoskeletal services were also deemed inappropriate to include on SEM Masters curricula.

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#### **How might it impact clinical practice in the future?**

- An important aspect in the ongoing evolution of SEM is ensuring adequate SEM skills and knowledge in individuals working as SEM clinicians.
- The consensus will help standardise the quality of SEM Masters graduates in the UK.

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439

#### 440 **CONTRIBUTION**

441 DV conceived the idea of creating a piece of work on this topic. DV, AI and KM were involved in  
442 data collection. DV KM PB CN AP GF sat on the research group and analysed the data. All  
443 authors contributed to the critical revision and approval of the final editorial.

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445 None declared

446 **FUNDING AND ROLE OF FUNDING AGENCIES**

447 There was no funding associated with this work.

448 **COMPETING INTERESTS**

449 KM and DV are on the BASEM Executive Board. KM is an associate editor of the BJSM.

450 **DATA SHARING**

451 Data available upon request to the corresponding author.

452

453 Figure Headings

454 Figure 1. Bloom's taxonomy wheel. Level 1 is application, level 6 is comprehension. Image used  
455 within rules of license (creative commons attribution- sharealike license). Taken from:  
456 <https://www.wylio.com/credits/flickr/4100721032#>

457

458 Table 1. The reasons for alterations to LOs after phase 1. The percentage of LOs altered for  
459 each reason is also provided.

460

461 Table 2. The LOs removed after phase 1 and the comments given by the expert panel that were  
462 reviewed by the research group and justify the removal.

463

464 Table 3. The finalised sub-themes and number of LOs within each sub-theme.

465