eSTEeM Project Report: SDK100 – what aspects of this online only module are the students engaging with?

Carol Midgley, Vikki Haley-Mirnar and Graham Healing.

Key words: engagement, interactive, video, self-assessment questions, investigative activities, skills development, student workload.

Report submission date: 1 March 2021

Contact: carol.midgley@open.ac.uk

1. Executive summary

SDK100 *Introduction to health sciences, an evidence-based approach* (first presented in October 2015) is the Level 1 entry module for the Q71 BSc Health Sciences pathway. It was the first core module in Science to be delivered entirely online. To build engagement and motivation, the module incorporated a range of interactive resources including videos, animations, self-assessment quizzes, skills -related activities and virtual or home investigations. Student output from many of the skills activities and investigations is linked to the formative-thresholded TMAs.

The purpose of this eSTEeM project (in June/July 2018) was to evaluate how students view and use the interactive components. Students completed a questionnaire on how they are studying online materials, how much they value different types of interactive resources and virtual/home investigations, and some of the barriers which may be preventing them from fully engaging with these interactive aspects of the module.

The survey responses indicate that in the view of most students SDK100 has succeeded in achieving a good balance between written text and interactive components. The module study workload also appears to be appropriate. Students seem quite traditional in the sense that they most value and use interactive activities embedded in the module texts, such as videos, animations and self-assessment questions, as well as resources like end of topic quizzes and the glossary that help them understand, reinforce or retain new knowledge and understanding about a topic they are interested in. Activities that develop basic maths, writing and IT skills are less well used and felt to be less helpful. Some students see these skills activities as too basic, but comments suggest there is an awareness of the range of SDK100 student abilities and an acceptance that it is necessary to go at a pace appropriate for the least experienced. The skills activities can be quite time consuming and are most likely to be the components that are skipped if students are pressed for time. This may not be too much of a problem for more experienced students, but there were also some more worrying comments suggesting that there are students who do need the skills development but don't engage in these activities because they don't enjoy them. This emphasises the importance of continuing to embed key development skills in topic-relevant and 'authentic' activities and assessment to ensure as much engagement as possible.

2. Aim and scope

This evaluation of the effectiveness of interactive aspects of online study will support and inform the development of SDK100, as well as other online modules. By asking the students themselves what they find most useful and engage with most fully in their learning, we can ensure that we focus on including these resource types in subsequent modules, with a potential impact on student workload and retention.

Phase 1 of the project employed a student questionnaire to collect both quantitative and qualitative data. A second phase of the project which was not completed would have invited smaller cohorts of 18B students to complete a diary during 3 separate one week periods at defined points in the module, and to visit the Usability Lab to observe their interaction with online resources.

There were also plans to try and extract data from the main OU Learning Analytics systems on student engagement with individual interactive resources. However, this proved unfeasible because the automatically collected data is captured using pre-specified tags at a module 'page' level. Individual items are not tagged in any way that allows tracking and extraction of data about

individual elements such as videos and in text questions. Despite extended enquiries with KMS and LDS we were unable to obtain advice on how to access 'raw' data at the level required for an analysis of time and duration of student access to interactive components.

3. Activities

1020 students registered on either the SDK100 17J (October start) and 18B (February start) presentations were invited by email (Appendix 1) on 13th June 2018 to complete the online survey (Appendix 2) about student perceptions and engagement with the SDK100 interactive components and home/virtual investigations. At that point, SDK100 17J students had completed their studies while 18B students were part way through (in the process of studying Topics 5 and 6). 927 students were sent a reminder email on 2nd July 2018 and the survey closed on 11th July 2018. A final quantitative and qualitative (open comments) data report has was produced by the OU Survey office using the Qualtrics system.

4. Summary of findings

- **Student study hours** - there is wide variation in study hours. More than 40% of students reported studying 12 hours or less a week, and a significant number of these reported studying 6 hours or less (11% in a non-TMA study week and 16% in a TMA preparation week). Some students studied more than the recommended hours, but the range suggests the module workloads should be well within an achievable range. SDK100 student workload planning aimed to guide students through at a consistent weekly work rate with six 'catch up' TMA preparation weeks with no other study.
- **Factors that most affect study time** - are family (caring responsibilities) and work. Most students report more than one factor, emphasising that consistent time pressure is experience throughout most student's studies (not just at defined times in the year). A worrying percentage of students (44%) also mention their own physical or mental health as factor.
- **Use of online, offline or printed materials** – the majority of students (83.6%) report that they always study online connected to the internet. Although 10.9% report always studying with printed books, it seems the majority of these students also use online materials in parallel and it is likely that very few students exclusively study with printed materials. This may have implications for reconsidering the ever increasing demands for unwieldly printed packs.
- **Use of different types of interactive components** – the majority (88 -90%) reported using all or most of the types of interactive components embedded in the main texts i.e. videos, interactive diagrams and ITQs, reflecting the high level of online study. There was more variation in the use of components that are studied more 'in parallel' with the texts. Activities exploring external data were studied by most, probably because many of these activities were linked to TMA questions. The glossary and self-assessment topic quizzes were also quite well used, but fewer students used (or regarded as helpful) activities designed to generally develop maths skills, writing skills and IT skills. From open comments, this often relates to (a) a students' personal judgment that activities were too basic and they already had those skills or (b) whether they feel the activity is relevant to the topic and worth spending their limited time on. Many students appear to feel that developing topic knowledge is their primary aim and that skills development activities detracts from their effective use of time. There were some comments about technical issues, for example very few of the interactive activities work on portable devices such as iPAds.

Some students commented that they avoided activities because they felt the instructions /technical skills required were too difficult or complicated.

SDK100 has taken advantage of the 'Science model' of thresholded-formative assessment to encourage engagement by directly incorporate the output many of the skills activities and investigations into formative TMAs (students must achieve an overall threshold to pass the module). The TMAs also make clear that students are awarded significant marks for demonstration of skills, particularly writing skills. A concern is that the pressure to move the module to SCA by either removing the formative assessment threshold (so formative TMAs scores would not count at all) or by changing the assessment to SCA so we would have to redesign TMAs to accommodate constantly renewable questions, could make it harder to incentivise students to complete skills development activities.

- **Helpfulness of different types of interactive components** – reinforcement and the ability to test their own understanding was the factor that students most often identified as helpful, as well as interactives that explained some topics better or in more detail. So again, videos, interactive diagrams and self-assessment questions as well as the glossary were identified by most as helpful. A number also felt that mixed media/interactivity helped break up the text and made the module more enjoyable. Open comments suggest that 11% of students have a preconception of themselves as visual or auditory learners. Recent research suggests there is little evidence for the concept of different learning styles and that students often simply prefer study methods they perceive as easier, but presenting students with several different representations of information is probably most effective way of improving understanding and recall (An and Carr, 2019). Anecdotal experience on SDK100 is that students are poor at later drawing on knowledge that the module has delivered primarily by video. Nevertheless, this group may well include students who are less fluent in written language and many students will find that videos are beneficial in reinforcing a text explanation. Fewer student comments mentioned development of skills or applying their learning in a practical situation as factor in helpfulness.
- **The balance between text and interactive components** – seems about right as most students (76%) felt the balance between text and interactive activities was good. More students would like increased interactivity (19%) than would like increased text (5%).
- **The virtual/home investigations** – all of the students did at least some of the investigations and found them all fairly equally enjoyable and helpful. The two early virtual activities using online tools on the OpenScienceLab (digital microscope and virtual ling spirometer) were perhaps slightly more popular than the others. 55% of students reported doing the activities at the time they were working worked through the topic, 25% started the investigations during study and completed them in the TMA week but 19% reported only doing the activities in the TMA week. Students are encouraged to complete activities during study to spread out the assessment workload, but many still save all the TMA related ones until the deadline. The majority of students would like more rather than fewer investigations (although we failed to include the option of no change in the survey questionaire).

5 Results

5.1 Respondent's demographic profile

162 students responded in total (121 complete responses and 41 partial responses) which is an overall response rate of 11.9% based on complete responses only. The demographic profile of 157 respondents (Table 1) was broadly similar to the overall profile for SDK100 17J in terms of ethnicity, occupation status, disability, study motivation etc, although a slightly higher proportion of respondents are new students, older age groups and A level or equivalent previous educational qualifications. It should be noted that gender was not recorded in this study, but SDK100 cohorts are consistently > 80% female.

Table 1 Demographic profile of 157 of the survey respondents

		Number	%
SDK100 Presentation	2017J	86	55%
	2018B	71	45%
New/continuing	New	110	70%
	Continuing	47	30%
Qualification intention	Yes	150	95%
	No	7	5%
	BSc (Hons) Health Sciences	63	40%
	BSc (Hons) Psychology with counselling	37	24%
	BSc (Hons) Open	10	6%
	CertHE Health Sciences	9	6%
	BSc (Hons) Healthcare and Health sciences	7	4%
	BSc (Hons) Combined STEM	6	4%
	Certificate in Health sciences	6	4%
	DipHE Health Sciences	4	3%
	Other qualifications	8	5%
	No intention on file	7	4%
Age range	<25	32	20%
	26-35	44	28%
	36-45	33	21%
	46-55	34	22%
	56 and over	14	9%
ethnicity	white	139	89%
	mixed	5	3%
	black	5	3%
	asian	4	3%
	refused	3	1%
	other	1	<1%
PEQs	PG qualification	3	1%
	HE qualification	44	28%
	A levels or equivalent	36	23%
	Less than two A levels	43	27%
	No formal qualifications	1	<1%
	Not known	30	19%

Disability declared	No	119	76%
	Yes	38	24%
Study motivation	Mainly employment/career	22	14%
	Mainly personal development	20	13%
	Employment/career and personal development equally	57	36%
	Neither stated	58	37%
Occupation status	In full time work/self-employed	62	39%
	In part-time work/self-employed	37	24%
	Looking after the home/family	19	12%
	Unable to work: long-term sickness/disability	14	9%
	Unemployed and looking for a job	7	4%
	Not in paid work for some other reason	6	4%
	Information Refused	5	3%
	Retired from paid work	5	3%
	Not Known	2	1%

5.2 Study time and accessing module materials (Part 1 of the survey)

Q1 'On average, how many hours do you study during a week when you are [writing a TMA/not writing a TMA]:'

The expectation is that students following the study planner will study, on average, 16 -18 hours a week on SDK100. The average reported here is slightly lower but hides a wide range (Table 2). More than 40% reported 12 hours study or less. In a non-TMA week 11% reported studying 6 hours or less and in a TMA week 16% reported studying 6 hours or less. At the other end of the spectrum in a non-TMA week 10% studied 19-24 hours and 8% studied 25 or more hours, and in a TMA week 21% studied 19-24 hours and 12% studied 25 or more hours, with a few reporting excessive study of 40 hours or more. There was no obvious relationship between excessively short or long reported study times and characteristics like occupation or declared disability but confirming this would require more detailed analysis.

Table 2 Length of study time during a week (number of students)

(N = 130)	6 hrs or less	7-12 hrs	13-18 hrs	19-24 hrs	25 or more hrs	Mean study time
Week not writing a TMA	14	38	55	13	10 (3 reported 40 hrs or more)	14.7 hours
Week writing a TMA	21	34	33	27	15 (5 reported 40 hrs or more)	15.3 hours

Q2 'What are the factors that influence how much time you study?'

The majority of students reported that more than one factor influenced their study time, most frequently family and work, followed by own health (Figure 1 and Table 3). It should be noted that SDK100 cohorts are consistently greater than 80% female so we might expect a higher burden of family caring responsibilities than modules with a more balanced gender ratio.

Figure 1 Factors influencing study time (number of responses)

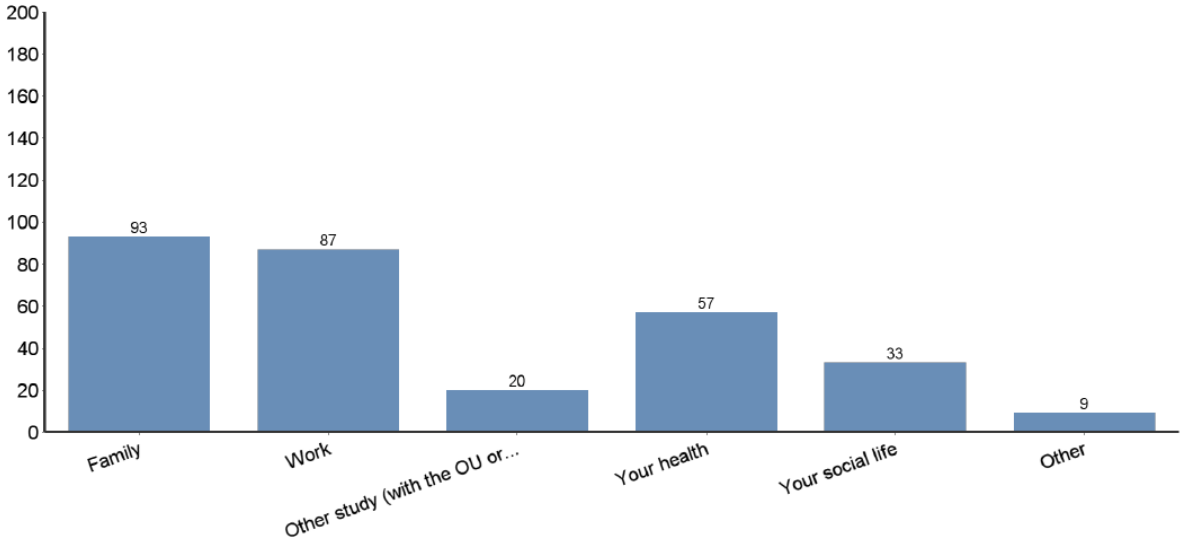


Table 3 Factors influencing study time.

Response (n=129 students)	No of responses mentioning factor	% of students mentioning factor
Family	93	72.1
Work	87	67.4
Your health	57	44.2
Your social life	33	25.6
Other study (with the OU or another institution)	20	15.5
Other	9	7.0

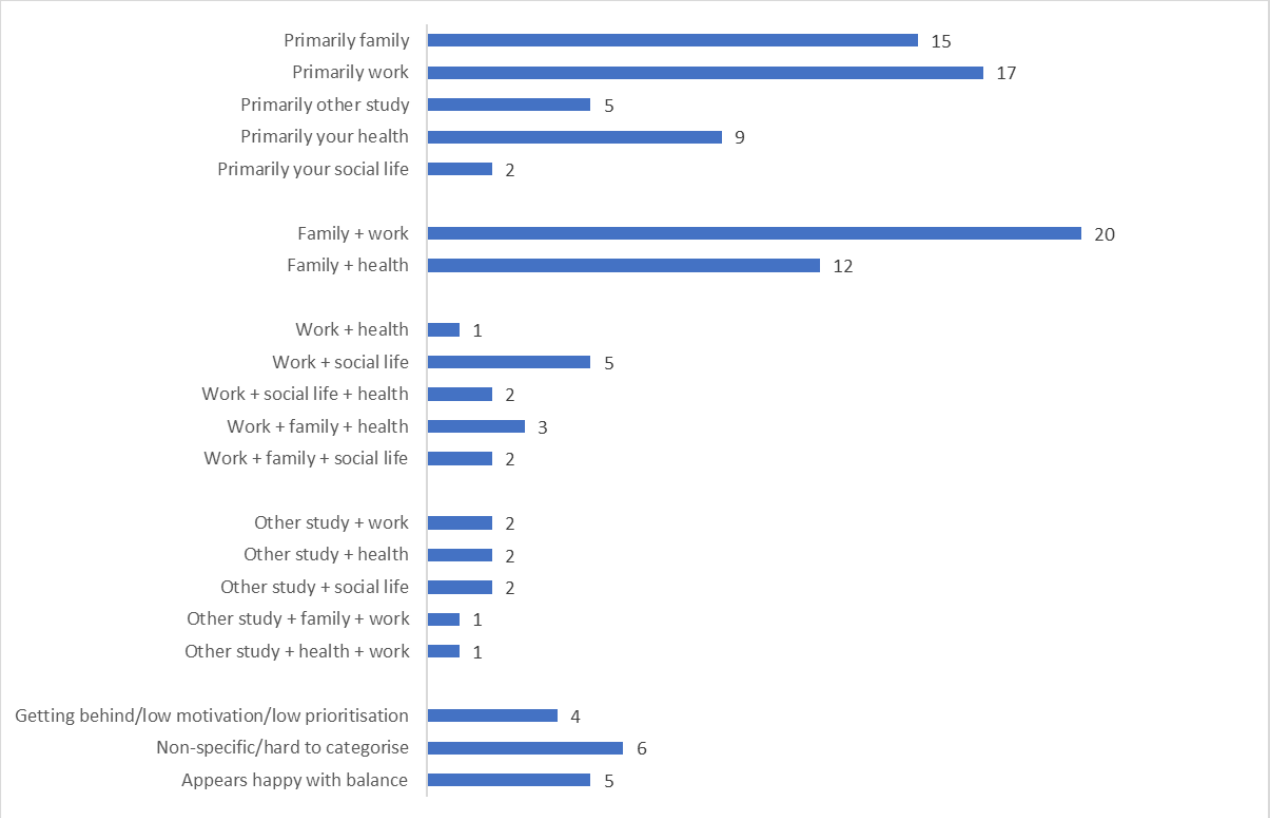
Q2a 'Please explain how these factors affect your study?'

117 open comments were sorted thematically (Figure 2). The factors mentioned most often in comments were family (in the sense of duty such as caring, 45%) and work (46%) followed by own health (26%). 45% of respondents identified more than one factor, most often family plus work, or family plus own health. This emphasises that time constraints are probably fairly consistent during most student's studies, for example:

'Hard to fit study time in around full time work (40 hours a week), looking after my child (under 1 year old) and being pregnant'

'I have no real time to study during the day so most of its done at night or weekend. However, I work 3 nights a week and the weekend mornings so I have to fit in family time, study time and relax time into 2 nights and 2 afternoons. Sometimes studying has to be put on the back burner or I just burn out'

Figure 2 Thematic analysis of 117 open comments on factors affecting study time (number of comments).



Q3 'How often do you use these three ways of studying when you study SDK100?'

The majority (83.6%) report that they always study online connected to the internet, while only 4.7% always study offline with downloaded materials and 10.9% always study with printed books (Table 4). 22.6% used printed material always or frequently. But interestingly, of the 30 students who 'always' (14) or 'frequently' (16) studied printed material, 26 reported they also 'always' (19) or 'frequently' (7) study online, so it appears that students usually use these two media in parallel and very few students exclusively study in print. There does not seem to be any clear relationship between age or disability and how often students use these three methods, but more detailed analysis would be required to confirm this.

Table 4 Different ways of studying (percentage of students)

Response (N = 128)	Always	Frequent	Occasional	Hardly ever	Never
Connected to the Internet	83.6	12.5	3.9	0	0
Offline with downloaded electronic material	4.7	16.4	26.6	20.3	32.0
Printed materials	10.9	11.7	18.0	24.2	35.2

5.3 Engagement with interactive components (Part 2 of the survey)

Q4 'What proportion of the following types of interactive components did you use?'

An issue with this question is whether students can recognise the categories of activity we are referring to, particularly skills activities, so examples were given in the questionnaire (see Appendix 2) which will necessarily have led some of the answers. With that caveat in mind, the majority (88-90%) reported that they viewed all or most of the videos, interactive diagrams and interactive questions directly embedded in the text (Table 5), reflecting the high level of online study reported in Question 3.

When it came to components that are studied more in parallel with the topic texts however, reported engagement was more variable. Activities exploring external data were quite well studied (80.3% all or most) probably because many were linked to TMA questions. But fewer used the activities designed to generally develop maths skills (66.9% used all or most), writing skills (62.2% used all or most), and IT skills (57.5% used all or most).

Table 5 Use of different types of interactive components (percentage of students)

Response (N=127)	All	Most	Sum of All and Most	Some	None
Videos	73.2	16.5	89.7	9.4	0.8
Interactive diagrams	74.0	16.5	90.5	7.9	1.6
Interactive module glossary	44.1	27.6	71.7	23.6	4.7
Exploring and using data from external websites	59.8	20.5	80.3	19.7	0
Activities that helped you learn about maths	36.2	30.7	66.9	27.6	5.5
Activities that helped you develop your writing skills	31.5	30.7	62.2	31.5	6.3
Activities that helped you develop your IT skills	33.1	24.4	57.5	27.6	15.0
Interactive questions that you can answer as you work through the text	59.8	28.3	88.1	9.4	2.4
End of topic quizzes	52.0	22.0	74	21.3	4.7

Q5 'How helpful are the following types of interactive components to understanding the topic?'

The majority of students rated all types of components either 'very helpful' or 'quite helpful', although 'very helpful' followed a similar pattern to use in Question 5, so components students were least likely to perceive as very helpful were the maths, writing and IT skills development activitiesm which were also those they were most likely to skip.

Table 6 Helpfulness of different types of interactive components (percentage of students)

Response (N=127)	Very helpful	Quite helpful	Sum of Very and Quite helpful	Not very helpful	Not at all helpful	Did not use
Videos	72.4	26.0	98.4	0.8	0	0.8
Interactive diagrams	71.7	27.6	99.3	0.8	0	-
Interactive module glossary	67.7	29.1	96.8	1.6	0	1.6
Exploring and using data from external websites	50.4	44.1	94.5	5.5	0	0
Activities that helped you learn about maths	41.7	44.9	86.6	4.7	0.8	7.9
Activities that helped you develop your writing skills	34.6	46.5	81.1	11.0	1.6	6.3
Activities that helped you develop your IT skills	35.4	39.4	74.8	8.7	4.7	11.8
Interactive questions that you can answer as you work through the text	56.7	37.0	93.7	5.5	0	0.8
End of topic quizzes	52.0	37.0	89	3.9	0.8	6.3

Q5a. 'Please explain why you find some types of interactive component particularly helpful'

92 comments were sorted into one of six main thematic categories (Figure 3) although it should be noted that some comments mentioned more than one aspect. 31 students (34%) described reinforcement and the ability to test their understanding as an important aspect of interactive activity (often naming quizzes), for example:

> *The end of topic quizzes were very helpful, because I could see where perhaps I needed more study.*

> *Much as I dislike watching video content, I admit that they are often valuable to get a good understanding of a topic and place it in context in a way that cannot be conveyed by written word. Interactive questions and end of topic quizzes are invaluable! They give me chance to check my understanding and retention of what I read.*

21 students (23%) thought that interactive components (particularly videos and animations) explained some subjects better, or in more detail. 10 students (11%) of students described their preference for interactivity, most often videos, because they have a preconception that they were 'visual learners' or that it was easier to listen than read, for example:

> *For me, the videos are the most helpful because i learn better through speech.*

12 students (13%) felt that mixed media/interactivity helped break up the text and made the module more enjoyable. Fewer students mentioned development of skills or applying their learning in a practical situation as a consideration in helpfulness.

Figure 3 Thematic analysis of 92 open comments why students find some types of interactive component particularly helpful (number of comments)

Q5b 'Please explain why you didn't use some types of interactive component or didn't find them very helpful'

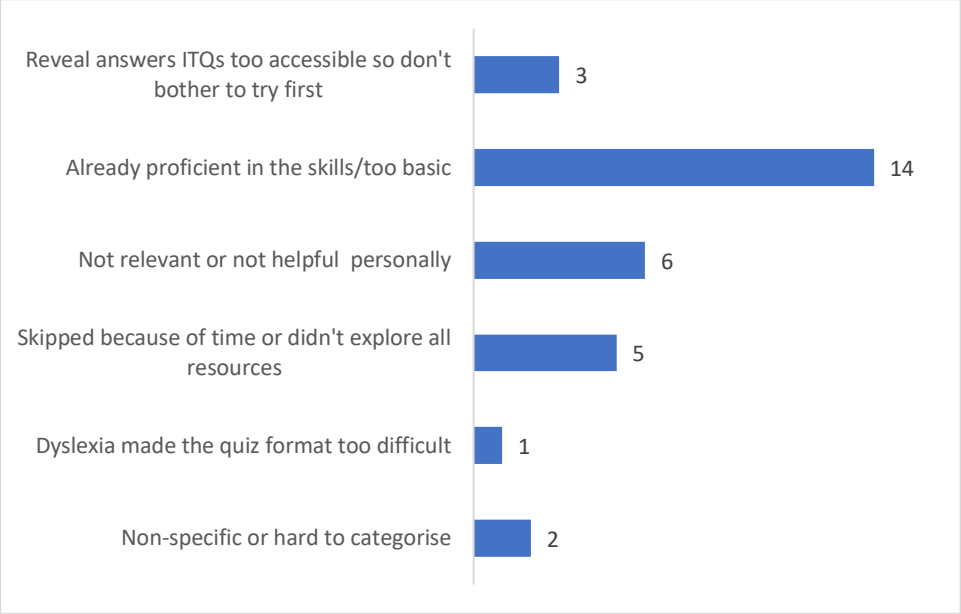
31 comments were sorted into one of five main thematic categories (Figure 4). The largest number of comments (45%) were about skills development (maths/writing activities/IT) being too basic, or the student felt proficient in already. Students also commented on lack of relevance to the topic and time pressures. 3 students commented that they didn't bother to try and answer ITQs before revealing the answer.

- *I haven't found the Maths or IT requirements difficult (due to my background) so did not need to access these materials.*
- *The maths and writing skills are very basic, repetitive, and break the flower of the topic. Also covered in day schools and tutorials, it's never-ending! I find it annoying to have to interrupt study to do those. Even more that they are included in tma.*
- *I have relatively strong maths and IT skills, though I appreciate others would find these very helpful.*
- *I used most interactive components. I didnt always do the writing skill ones because they required some time to complete and I was on a tight schedule and wanted to get the main study done.*

Occasionally comments indicated a lack of willingness to engage with skills activities even though they are probably needed:

- *There is so much to do in SDK100 that you don't have time to look at other websites, all I need is someone to help me write an essay I can't write an essay on scientific things. How can you write essays of 400 to 1000 words? It's hard enough trying to write 250 words! I don't really need help with writing skills as I've studied all my life!*

Figure 4 Thematic analysis of 31 open comments from individual students on why they didn't use some types of interactive component or didn't find them very helpful (number of comments)



Q6. 'What factors influence which interactive components you use?'

The factor that most students cite as influencing which interactive components they use is relevance to assessment (84%) (Figure 5 and Table 7). Time available (78%), personal preference for resources (such as videos) (68%) and interest in the subject area (61%) also had a significant influence. While accessibility, (9%), the IT skills required (14%) and technical issues (12%) had less influence but still affected a number of students.

Figure 5 Factors that influence use of different types of interactive components (numbers)

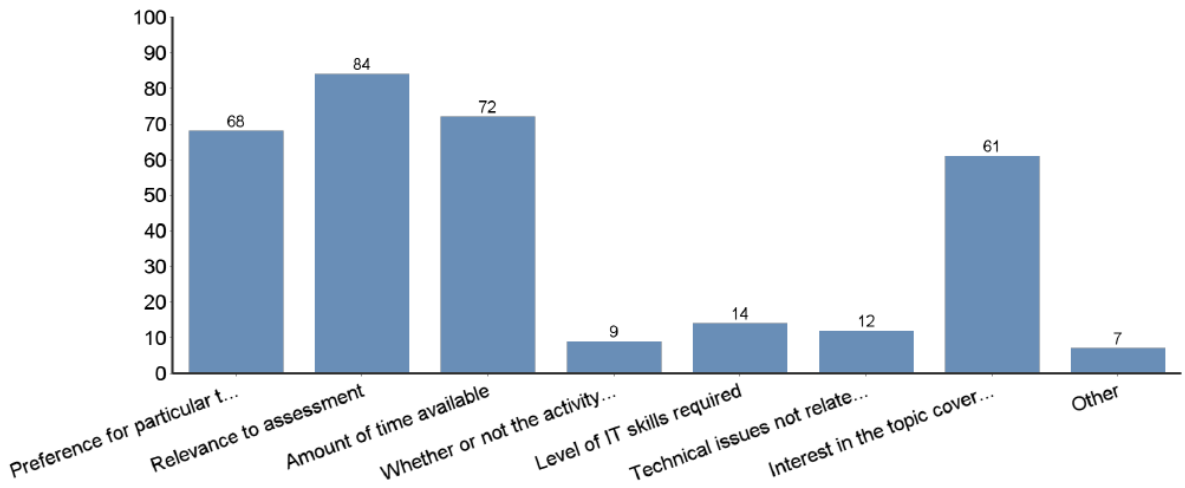


Table 7 Factors that influence use of different types of interactive components.

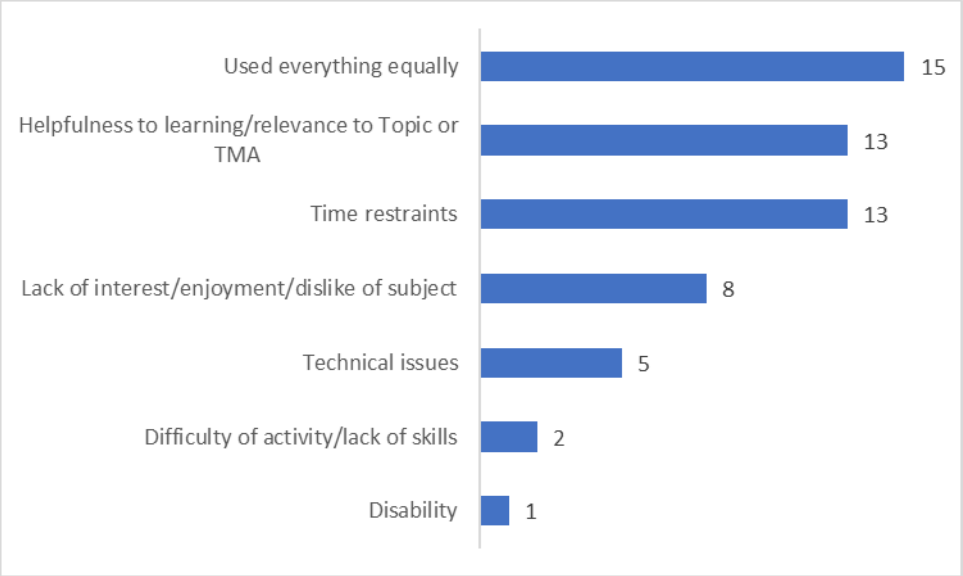
Response N = 128	**No. of responses**	**%**
Preference for particular types of activities	68	54.4
Relevance to assessment	84	67.2
Amount of time available	72	57.6
Whether or not the activity is accessible to me due to a disability or medical condition	9	7.2
Level of IT skills required	14	11.2
Technical issues not related to accessibility	12	9.6
Interest in the topic covered by the activity	61	48.8
Other	7	5.6

Q6a. 'Please explain how these factors affect your use of interactive components?'

59 comments were sorted into one of 7 main thematic categories (Figure 6). About 25% of students studied all the components, relatively equally. About 22% described helpfulness/relevance as the main factor, about 22% described time constraints and 14% lack of enjoyment or dislike of a topic.

- *I only used the interactive components that were relevant to the topic I was needed.*
- *There are times when i only have a little time to study, so i choose to study the course material rather then do an interactive activity*
- *My personal dislike of a given subject such as mathematics limits my access to learning activities that may overdo or exceed my needs. I therefore keep it to a minimum so as it is just what I require for that topic and tma*

Figure 6 Thematic analysis of 59 open comments from individual students (number of comments)



Q7 'What do you think of the balance between written text and these interactive components?'

76% felt the balance was about right (Table 8) while 24% would like more interactive components, and only 6% would like more text.

Table 8 Percentage of students' opinion on balance between written text and interactive components

Response (N=125)	No. of responses	%
I would like more text and fewer interactive components	6	4.8
Good balance	95	76.0
I would like less text and more interactive components	24	19.2

Q8 'Which interactive components would you like to see more or fewer of?'

The components most students would like to see increased were the videos, interactive diagrams and interactive questions embedded in the text (Table 9). Surprisingly, more activities for learning about maths was also identified by 32.8%. Activities about writing and particularly IT skills were least requested.

Table 9 Interactive components students would like to see more or fewer of (percentage of students)

Response (N=125)	More	No change	Fewer
Videos	36.0	56.0	8.0

Interactive diagrams	33.6	65.6	0.8
Interactive module glossary	19.2	79.2	1.6
Exploring and using data from external websites	20.8	70.4	8.8
Activities that helped you learn about maths	32.8	57.6	9.6
Activities that helped you develop your writing skills	25.6	59.2	15.2
Activities that helped you develop your IT skills	14.4	72.8	12.8
Interactive questions that you can answer as you work through the text	36.0	55.2	8.8
End of topic quizzes	16.0	73.6	3.6

5.4 Engagement with the virtual/home investigations (Part 3 of the survey)

Q9a 'Did you do any of the virtual/home investigations?'

Only 2 students (1.6%) of 125 respondents reported they hadn't done any of the investigations, but their response to Q9e. 'If you didn't do one or more of these investigations, please tell us why?' indicated that but both appear to refer to using the video version of the yeast respiration experiment, rather than the home practical version, so its not clear if these students understood this question.

Q9b 'How enjoyable were the virtual/home investigations you have done so far?'

The majority of students found all the investigations very or quite enjoyable (Table 10). The first two of the 'virtual' investigations using online tools (the digital microscope and the lung spirometry) seemed the most popular.

Table 10 How enjoyable did students find the investigations (percentage of students)

Response (N=123)	Very enjoyable	Quite enjoyable	Sum of Very and Quite enjoyable	Not very enjoyable	Didn't enjoy at all	I didn't do them
Topic 1: Digital microscope leukocyte counting investigation	50.4	41.5	91.9	7.3	0.8	-
Topic 2: Yeast temperature investigation	44.7	40.7	85.4	11.4	-	3.3
Topic 4: Lung volume spirometry investigation	50.4	36.6	87	10.6	0.8	1.6

Topic 6: Alcohol effect on reaction time investigation	44.8	32.8	77.6	13.4	4.5	4.5
Topic 7: Digital microscope ER positive cancer cell investigation	40.3	40.3	80.6	10.4	4.5	4.5

Q9c 'How helpful did you find the virtual/home investigations in understanding more about how scientific research is undertaken and presented?'

Most students found all the virtual experiments very or quite helpful in understanding more about how scientific research is undertaken and presented (Table 11). The yeast temperature investigation was regarded as the least helpful.

Table 11 How helpful did students find the investigations in understanding more about how scientific research is undertaken and presented (percentage of students).

Response (N = 123 for topics 1/2/4. N = 67 for topics 6/7)	**Very helpful**	**Quite helpful**	**Sum of Very and Quite helpful**	**Not very helpful**	**No help**	**I didn't do them**
Topic 1: Digital microscope leukocyte counting investigation	74.8	22.8	97.6	1.6	0.8	-
Topic 2: Yeast temperature investigation	56.1	31.7	87.8	10.6	-	1.6
Topic 4: Lung volume spirometry investigation	70.7	22.8	93.5	4.9	-	1.6
Topic 6: Alcohol effect on reaction time investigation	65.7	23.9	89.6	7.5	-	3.0
Topic 7: Digital microscope ER positive cancer cell investigation	61.2	31.3	92.5	3.0	-	4.5

Q9d 'When did you do the virtual/home investigation activities?'

Only about half of students (55.3%) did the investigations as they studied the topic (Table 12). 19.5% only did them when they got to the TMA and a further 25.2% completed them in the TMA period.

Table 12 When did students do the investigations.

Response (N= 123)	**Number of responses**	**%**
As I was studying that part of the topic	68	55.3

During the TMA preparation period	24	19.5
Both selected (students were not restricted to one answer)	31	25.2

Q10 'Would you like to see more or fewer virtual/home investigations?'

The majority of students (84.4%) would like to see more investigations (Table 13) although they were not given an option of no change in number.

Table 13 More or fewer investigations (percentage of students)

Response (N = 122)	Number of responses	%
More investigations	103	84.4
Fewer investigations	19	15.6

Q11. 'Is there anything else you'd like to share about your study experience on SDK100?'

60 comments were sorted into 9 main thematic categories (Figure 7). About half of the comments (30) expressed general satisfaction and in many cases enthusiastic enjoyment of the module. About an equal number (28) expressed some area of dissatisfaction. However as is common with other student feedback, the comments reveal a wide variation in students' abilities, expectations and personal preferences so it is difficult to identify any widely perceived deficiencies. Dissatisfaction relates to factors we frequently see across all modules, including too high workload, a desire for more/face to face tutorials and books, and a dislike of any collaborative activities.

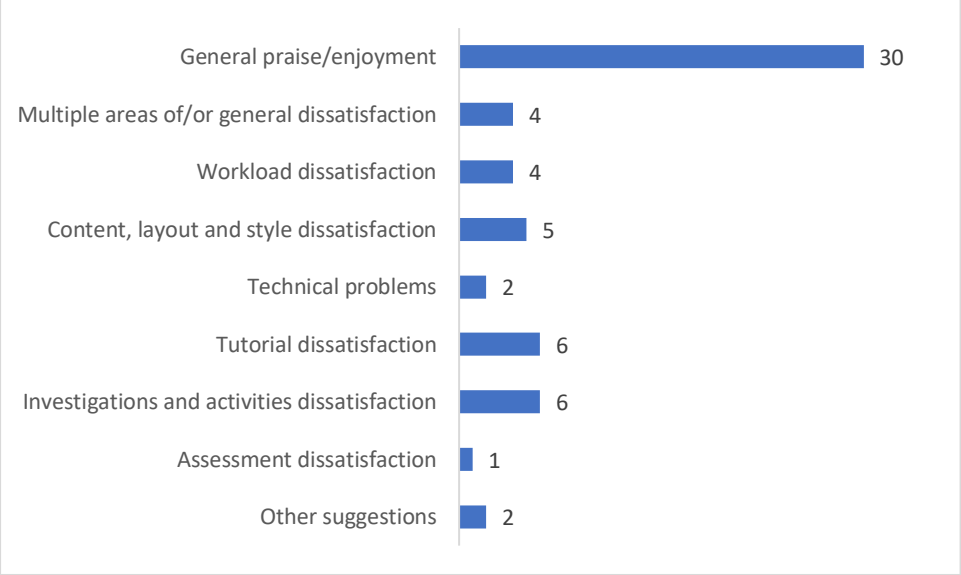
Comments specifically relating to investigations and interactive activities, showed a similar mix of satisfaction, with some students wanted more activities and some wanted to emphasise that they found them tedious or pointless.

- *More interactive activities or investigations would be more interesting than just text and questions*
- *'Where there is purpose in the investigations - so learning to use and analyse data - this is useful. But for instance the spirometry test took a lot of waiting time for results and once done a couple of times it wasn't obvious what was being gained.'*
- *I thoroughly enjoyed this module - very imformative and enjoyable. Some of the virtual investiagtions were tedious but I guess that comes with the trade of studying and working in science. Patience is necessary*

There were also some technical problems with for example video streaming and the fact that most interactive resources other than videos are not supported on popular devices like iPADs.

- *Some of the interactive diagrams (drag and drop) didn't work, even in end of topic quizzes, this was frustrating. Due to my job and lack of internet when I downloaded the study material, a lot of the interactive stuff doesn't work and I don't always have time to go back and revisit that, so maybe something could be done to improve that aspect*

Figure 7 Thematic analysis of other general comments about the study experience (number of comments)



6. Impact

The lessons learnt about student engagement with different types of interactive components will feed into upcoming Level 1 Health Sciences modules production and assessment design to optimise student workload and retention by focussing on the most useful activity types. It is difficult to significantly alter a module during presentation lifespan, but the module team has produced extra supportive video resources, including a set of 'getting started' introductory videos introducing aspects of the module and also some basic English skills and maths skills mini-tutorial videos. The maths skills videos were associated with a separate EsTEem project assessing a series of live online maths workshops (Nicola McIntire and Linda Thompson REF) but have been retained as a permanent resource and were recently made more widely available on the S-Science Qualification website.

7. Deliverables

There are no publications resulting from the project.

8. List of figures and tables

Table 1 Demographic profile of 157 of the survey respondents
Table 2 Length of study time during a week (number of students)
Figure 1 Factors influencing study time (number of responses)
Table 3 Factors influencing study time.
Figure 2 Thematic analysis of 117 open comments on factors affecting study time (number of comments).
Table 4 Different ways of studying (percentage of students)

Table 5 Use of different types of interactive components (percentage of students)
Table 6 Helpfulness of different types of interactive components (percentage of students)
Figure 3 Thematic analysis of 92 open comments why students find some types of interactive component particularly helpful (number of comments)
Figure 4 Thematic analysis of 31 open comments from individual students on why they didn't use some types of interactive component or didn't find them very helpful (number of comments)
Figure 5 Factors that influence use of different types of interactive components (number of responses)
Table 7 Factors that influence use of different types of interactive components.
Figure 6 Thematic analysis of 59 open comments from individual students (number of comments)
Table 8 Percentage of students' opinion on balance between written text and interactive components
Table 9 Interactive components students would like to see more or fewer of (percentage of student
Table 10 How enjoyable did students find the investigations (percentage of students)
Table 11 How helpful did students find the investigations in understanding more about how scientific research is undertaken and presented (percentage of students).
Table 12 When did students do the investigations.
Table 13 More or fewer investigations (percentage of students)

Figure 7 Thematic analysis of other general comments about the study experience (numbers of comments)

9. University approval processes

Approval from the Student Research Project Panel/Staff Survey Project Panel (SRPP) was obtained according to the Open University's code of practice and procedures before embarking on this project. Application number 2018/047.

References

An, D., & Carr, M. (2017). Learning styles theory fails to explain learning and achievement: Recommendations for alternative approaches. Personality and Individual Differences, 116, 410–416.

Linda Thomson and Nicola McIntyre (2019) eSTEeM project: Online tutorial design: can we do better. Available at: http://www.open.ac.uk/about/teaching-and-learning/esteem/projects/themes/supporting-students/online-tutorial-design-can-we-do-better

Acknowledgements

The authors thank Sandra Miller of the Learning and Teaching Innovation, Quality Enhancement and Learning Analytics Team for constructing the online survey and providing the data report.

Appendix 1 Invitation letter by email

Dear SDK100 Student

Thank you for taking the time to read this invitation to take part in an educational research project run by Carol and Vikki, the Module Team Chairs on SDK100.

We are currently investigating which aspects of SDK100 you find the most beneficial for your learning, which bits you don't find very helpful, and which parts you are not using and why. We're particularly interested in how much you value the various different interactive components of SDK100 for example, video assets, interactive activities, end of topic quizzes, and the home/virtual investigations. This will not only help us to improve the design of SDK100, but will enable us to inform the teams who are writing modules later in your degree pathways about the things you find particularly helpful for your learning. This questionnaire should only take about 10-15 minutes to complete, and we'd really appreciate it if you could answer as many of the questions as you can. It can be found using the link below.

Your answers will be confidential and anonymised, and any data will be stored in compliance in the General Data Protection Regulation. Your responses will in no way affect your studies or module result, so please answer as honestly as possible!

Additional information for 18B students only: We will be asking for volunteers to participate in a follow-up activity to this questionnaire and will ask volunteers to tell us their name and email address. These contact details will be separated from the responses to the questionnaire before the results are analysed so the analysis can take place without us, the researchers, being able to identify anybody from their responses.

General Data Protection Regulations: Any information you provide us with will be treated in the strictest confidence in accordance with General Data Protection regulations and used only by Open University staff as part of this research. This project is administered under the Open University's general GDPR guidelines.

Please don't hesitate to contact us if you've got any questions about this questionnaire by email (vikki.haley-mirnar@open.ac.uk or carol.midgley@open.ac.uk).

Many thanks in advance, Vikki and Carol.

Appendix 2 Questionnaire

There were two versions of this questionnaire, one for SDK100 17J and one for SDK100 18B students that were virtually identical but the 18B students completed the questionnaire earlier in the module so hadn't yet encountered all of the different types of interactive components (part 2 of this questionnaire) or all of the virtual and home investigations (part 3).

Student questionnaire – SDK100

Thanks for taking the time to complete this questionnaire. We want to know which parts of SDK100 you find the most beneficial for your learning, and which bits you don't find very helpful, or are not using, and why. We're particularly interested in how much you value the various different interactive components of SDK100 for example, video assets, interactive activities, end of topic quizzes, and the

home/virtual investigations. This will not only help us to improve the design of SDK100, but will enable us to inform the teams who are writing modules later in your degree pathways about the things you find particularly helpful for your learning. This questionnaire should only take about 10-15 minutes to complete, and we'd really appreciate it if you could answer as many of the questions as you can. Your answers will be confidential and anonymised, and any data will be stored in compliance in the General Data Protection Regulation. Your responses will in no way affect your studies or module result, so please answer as honestly as possible!

Many thanks in advance, Vikki and Carol.

Part 1 General questions

Q1. On average, how many hours do you study during a week when you are:

- Writing a TMA?
- Not writing a TMA?

Q2. What are the factors that influence how much time you study? (Please select all that apply)

- Family
- Work
- Other study (with the OU or another institution)
- Your health
- Social life
- Other

Q2a. Please explain how these factors affect your study? (free text box)

Q3. How often do you use these three ways of studying when you study SDK100? (Matrix of Always/Frequently/Occasionally/Hardly ever/Never)

- Connected to the Internet
- Offline with downloaded electronic material
- Printed materials

Part 2 Interactive components of the module

This section asks about the interactive components we have incorporated into this online interactive module.

Q4. What proportion of the following types of interactive components did you use? (Matrix of All/Most/Some/None)

- Videos (e.g. the digestive system, and balancing chemical equations in Topic 2; the action potential and people discussing experiences of pain in Topic 3)
- Interactive diagrams (e.g. labelling the action potential in Topic 2, making a DNA strand drag and drop in Topic 7)

- Interactive module glossary (pop-up definitions and audio pronunciations)
- Exploring and using data from external websites (e.g. the IHME database activity in Topic 1)
- Activities that helped you learn about maths (e.g. reading information from graphs, scientific notation for large and small numbers in Topic 1)
- Activities that helped you develop your writing skills (e.g. essay writing, note-taking)
- Activities that helped you develop your IT skills (e.g. locating scientific articles online, using a spreadsheet to draw a graph)
- Interactive questions that you can answer as you work through the text (e.g. 'Reveal answer' questions)
- End of topic quizzes

If you answered none please proceed to Question 8.

Q5. How helpful are the following types of interactive components to understanding the topic? (Matrix of Very helpful/Quite helpful/Not very helpful/Not all at helpful/Did not use')

- Videos
- Interactive diagrams
- Interactive module glossary
- Exploring and using data from external websites
- Activities that helped you learn about maths
- Activities that helped you develop your writing skills (e.g. essay writing, note-taking)
- Activities that helped you develop your IT skills (e.g. locating scientific articles online, using a spreadsheet to draw a graph)
- Interactive questions that you can answer as you work through the text (e.g. 'Reveal answer' questions)
- End of topic quizzes

Q5a. Please explain why you find some types of interactive component particularly helpful. (Free text box)

Q5b. Please explain why you didn't use some types of interactive component or didn't find them very helpful. (Free text box)

Q6. What factors influence which interactive components you use? (Please select all that apply)

- Preference for particular types of activities
- Relevance to assessment
- Amount of time available
- Whether or not the activity is accessible to me due to a disability or medical condition

- Level of IT skills required
- Technical issues not related to accessibility
- Interest in the topic covered by the activity
- Other

Q6a. Please explain how these factors affect your use of interactive components? (free text box)

Q7. What do you think of the balance between written text and these interactive components?

- I would like more text and fewer interactive components
- Good balance
- I would like less text and more interactive components

Q8. Which interactive components would you like to see more or fewer of? (Matrix of More/No change/Fewer)

- Videos
- Interactive diagrams
- Interactive module glossary
- Exploring and using data from external websites
- Activities that helped you learn about maths
- Activities that helped you develop your writing skills (e.g. essay writing, note-taking)
- Activities that helped you develop your IT skills (e.g. locating scientific articles online, using a spreadsheet to draw a graph)
- Interactive questions that you can answer as you work through the text (e.g. 'Reveal answer' questions)
- End of topic quizzes

Part 3: Virtual and home investigations

In SDK100 there are several virtual/home investigations.

Q9a. Did you do any of the virtual/home investigations? (If no, students are only shown Q9e).

Q9b How enjoyable were the virtual/home investigations you have done so far? (Matrix of Very enjoyable/Quite enjoyable/Not very enjoyable/Didn't enjoy at all/I didn't do them)

- Topic 1: Digital microscope leukocyte counting investigation
- Topic 2: Yeast temperature investigation
- Topic 4: Lung volume spirometry investigation
- Topic 6: Alcohol effect on reaction time investigation
- Topic 7: Digital microscope ER positive cancer cell investigation

Q9c. How helpful did you find the virtual/home investigations in understanding more about how scientific research is undertaken and presented? (Matrix of Very helpful/Quite helpful/Not very helpful/No help/Did not use)

- Topic 1: Digital microscope leukocyte counting investigation
- Topic 2: Yeast temperature investigation
- Topic 4: Lung volume spirometry investigation
- Topic 6: Alcohol effect on reaction time investigation
- Topic 7: Digital microscope ER positive cancer cell investigation

Q9d. When did you do the virtual/home investigative activities?

- As you were studying that part of the topic
- During the TMA preparation period
- Not applicable

Q9e. (Shown to students who answered 'I didn't do them' to question above) If you didn't do one or more of these investigations, please tell us why? (Free text box)

Q10. Would you like to see more or fewer virtual/home investigations?

- More investigations
- Fewer investigations

Q11. Is there anything else you'd like to share about your study experience on SDK100? (Free text box)

Thank you for completing this questionnaire!

Appendix 3 – Metrics for your project

Project staff	
Number of academic, academic-related staff who contributed to the project	3
Number of days spent working on the project for all staff involved, including the project lead(s)	Approximately 10 days
Number of ALs and number of days contribution to the project	0
Number of students involved as co-researchers/co-collaborators on the project and any student incentives provided	0
Student survey data (if applicable)	
Number of students surveyed	1020 invited
Number of student respondents	162 (121 complete responses and 41 partial responses)
Student interview data (if applicable)	

Number of students interviewed	0
Student focus group data (if applicable)	
Number of students involved either as interviewers or interviewees	0
AL survey data (if applicable)	
Number of ALs surveyed	NA
Number of AL respondents	NA
AL interview data (if applicable)	
Number of ALs interviewed	NA
AL focus group data	
Number of ALs involved either as interviewers or interviewees	NA