

Title	How much do preclinical medical students utilize the internet to study physiology?
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Publication date	2019-07-30
Original Citation	O'Malley, D., Barry, D. S. and Rae, M. G. (2019) 'How much do preclinical medical students utilize the internet to study physiology?', <i>Advances in Physiology Education</i> , 43(3), pp. 383-391. doi: 10.1152/advan.00070.2019
Type of publication	Article (peer-reviewed)
Link to publisher's version	https://www.physiology.org/doi/abs/10.1152/advan.00070.2019 - 10.1152/advan.00070.2019
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Download date	2024-04-16 14:56:12
Item downloaded from	https://hdl.handle.net/10468/8422

1 **How much do pre-clinical medical students utilise the internet to study physiology?**

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7 Abbreviated title: **Pre-clinical medical students' use of online videos**

8
9 Medical students increasingly utilise social media platforms to supplement their preclinical
10 learning; however, the prevalence of social media use for physiology learning in medical
11 education remains unclear.

12 The aim of the current study was to determine how first year medical students from both
13 direct entry medicine and graduate entry medicine interacted with social media as a learning
14 tool by assessing its prevalence, perceived benefits, favoured platforms and reason(s) for its
15 use.

16 Seventy-one percent of surveyed students (out of 139 participants) stated that they interacted
17 with social media in general more than 12 times per week. However, 98% had previously
18 used internet platforms to source physiology information, with 89.2% doing so at least once
19 per week during term. YouTube was the primary source of learning for 76% of students.

20 Significantly, 94% of students indicated that they would first search for answers online if
21 they did not understand something in physiology rather than contacting their instructor in
22 person or by e-mail. However, only 31% of students "fact-checked" physiology information
23 obtained from online sources, by using textbooks, papers and/or instructors.

24 Our study has revealed that most pre-clinical medical students utilise social media
25 extensively to study physiology. However, the absence of academic and ethical oversight,
26 paired with students' lack of critical appraisal of possibly inaccurate information, does raise
27 concerns about the overall utility of social media as part of physiology education.

28

29 Keywords: Pre-clinical medical students, physiology, social media, YouTube, fact-checking

30

31 Snapshot: This study revealed that the vast majority (89%) of surveyed first-year medical
32 students frequently utilised social media, particularly online videos, to supplement their study
33 of physiology. Notably, 94% of students preferred to first search for answers online if they
34 had a physiology-related question rather than asking their instructor(s) in person or by e-mail.
35 Of concern however, was the finding that only 31% “fact-checked” physiology-related
36 information obtained online, suggesting a deficiency in students’ critical appraisal skills.

37

38 **Introduction**

39 Physiology remains amongst the most essential of the basic sciences learned by medical
40 students for their subsequent clinical training (1, 4, 9, 19, 34, 49). Although traditional
41 didactic lectures and practical sessions remain at the core of most physiology syllabi (8, 33)
42 many institutions are moving towards a more technology-enhanced learning (TEL) approach
43 as one way of facilitating the change in approach of today's students to their education
44 compared to students of previous eras (6, 18, 25, 42, 43, 46). Indeed, acknowledging
45 students' love of social media, several higher education programmes, including those in the
46 medical and allied healthcare sectors, have investigated integrating the use of social media
47 platforms into their courses (3, 20, 21, 40).

48 Deployment of social media tools in this way enables students to study more efficiently (54),
49 permits rapid and effective communication between users, and facilitates feedback to students
50 from faculty (12, 36, 50). Furthermore, students who regularly use social media and other
51 learning technologies report higher levels of engagement within the university, an enhanced
52 sense of community (11, 31, 32, 48) and increased confidence/reduced anxiety (40). Social
53 media also provide platforms for collaborations (27) and allows students to feel that they are
54 in control of their own education rather than relying upon tutors to provide them with
55 information (2, 18).

56 Within medical education, the impact of social media has been reported as near exclusively
57 positive and desired by medical students (2, 3, 6, 10, 17, 20, 21, 30, 32, 40, 43, 48; for
58 reviews see refs 12 and 53). However, it is currently unclear to what extent students are
59 utilising and relying upon social media in physiology education. Therefore, we gauged how
60 first year pre-clinical medical students (both graduate entry medicine (GEM) and direct entry

61 medicine (DEM)), within the medical school at University College Cork (UCC) employed
62 social media and other Web 2.0 tools to supplement their physiological learning.

63

Methods

GEM versus DEM programmes

The GEM programme at University College Cork (UCC) is an accelerated professional degree that usually spans only four, rather than the five, years of the more traditional DEM degree programme. This is accomplished by compressing the pre-clinical teaching for GEM students into just over one rather than two years. As such, GEM students must learn the same amount of material as their DEM counterparts in approximately half the time. Social media is not incorporated into existing student medical curricula.

The taught physiology component of both first year DEM and GEM courses is delivered over a duration of seven and 8.5 months respectively (four modules for DEM students, three for GEM students) and comprises a mixture of both didactic lectures and laboratory practical classes. Academic material for each module is supported by Blackboard Academic Suite into which lecture presentations, practical laboratory guides and supplemental learning resources are posted.

Data Collection and Analysis

Ethical approval for the current study was granted by University College Cork Social Research Ethics Committee. Both DEM and GEM students could access an itemised survey through UCC's virtual learning environment, Blackboard Academic Suite (<http://www.blackboard.com>) from the start of April 2018 to the end of June 2018 before the data were downloaded for analysis.

The survey instrument consisted of 25 items which, in addition to collecting demographic data including age and gender, sought to interrogate students' use of social media websites generally, and specifically in relation to physiology, with one free comment option.

Seventeen of the survey items were Likert scale options. For topics related to social media use in physiology learning, the survey items were designed to determine 1) how comfortable, and how frequently, students were using social media to access information on physiology, 2) what online sources students used to access physiology information, 3) under what circumstances students used social media to access information about physiology, 4) how students viewed the reliability of social media-derived physiology information, 5) students preference for social media-derived physiology information over their lecture notes, and 6) their views on a faculty-led social media physiology page. The entire questionnaire is available in appendix.

For statistical comparisons, Likert scale responses and frequency of use data were each converted to a 0-5 numerical value. Specifically, strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, strongly disagree = 1; for frequency of use data, never = 0; 1-2 times = 1; 3-5 times = 2; 6-8 times = 3; 9-11 times = 4; 12 or more times = 5. All survey data from respondents was downloaded from Blackboard Academic Suite, collated and entered into GraphPad Prism for statistical analysis. For comparisons between GEM and DEM students overall, Student's unpaired t-test was utilised to analyse data. For comparisons across all DEM and GEM male and female subgroup data, one-way analysis of variance (ANOVA) with Tukey's multiple comparisons test was employed.

Results

Student Demographics

One hundred and thirty-nine respondents completed the survey, of which 78 were female (40 DEM, 38 GEM) and 61 were male (32 DEM, 29 GEM).

Most students (83/139; 59.7%) indicated that their region of origin was Europe, with the second largest grouping consisting of students from Canada/North America (25.2%; 35/139). 33/35 of the Canada/North American students were in the GEM cohort. Although most students were aged 18-20 (43.2%), the age of the GEM cohort greater was significantly greater ($p \approx 0.001$, unpaired t -test) than that of the DEM class. However, there was no significant difference between the ages of either the DEM male vs female students or the GEM males vs females.

Use of internet enabled devices and web-based resources

All students surveyed possessed at least one internet-enabled device (i-pad, laptop, tablet, smartphone, etc.) with 138/139 students possessing at least two (data not shown; no significant differences between GEM vs DEM, or male vs female, students). Although the majority of students (81.5%) reported that they were comfortable using social media ('strongly agree' and 'agree' combined; mean score = 4.07 (SD 0.99) (Fig. 1A), with 84% of respondents having used social media to discuss general GEM course-related issues with their colleagues (84% 'strongly agree' and 'agree' combined; mean score = 4.07 (SD 0.94) (no significant differences in the responses of GEM vs DEM, or male vs female, students; Fig. 1A), we found that a remarkable 98.5% of GEM and 97.3% of DEM students had used social media *specifically* to find information about physiology ('strongly agree' and 'agree')

combined; overall mean score = 4.63 (SD 0.58) (no significant difference between DEM vs GEM, or male vs female students; Fig. 1A).

The video sharing platform, YouTube, was by far the most popular source of physiology information for students (76.3%; Fig. 1B), with, for those who expressed a preference, “Khan Academy” being the most popular (41% of students) specialised content channel within YouTube itself (although it should be noted that 36% of students did not express a preference for any particular channel; Fig. 1C).

In terms of how frequently the students actually used social media, 98.6% accessed *general* social media sites at least once per week during the academic term, with 70.5% doing so at least 12 times per week (no significant differences between DEM vs GEM, or male vs female, students; Fig. 2A). Specifically with regard to their study of physiology however, where 89.2% of students accessed physiology-related “online video clips” at least once per week during term time, we did uncover some statistically significant differences between groups (Fig. 2B). For example, GEM students accessed social media to source physiology material significantly more frequently than DEM students ($p = 0.03$, unpaired t-test; *e.g.* 20.9% of GEM students vs 6.9% of DEM students viewed physiology videos at least 6 times per week), with GEM males also doing so more frequently than DEM females ($p = 0.047$, one-way ANOVA, Tukey’s multiple comparisons test; *e.g.* 27.6% of GEM males vs 2.5% of DEM females viewed physiology videos at least 6 times per week), but not more than DEM males or GEM females (Fig. 2C).

Students’ perceived usefulness of online physiology material as a tool for learning

We found that although near equally large percentages of DEM and GEM students found online video clips “generally useful for understanding physiological concepts” (‘strongly

agree' and 'agree' combined; 83.3% DEM, mean score = 4.28 (SD 0.79) vs 86.3% GEM, mean score = 4.32 (SD 0.77)), there was a difference in how useful each cohort of students perceived them to be (Fig. 3A). For example, we found that whereas 79.1% of GEM students strongly agreed or agreed that they found online video clips "generally more useful for [their] understanding of physiological concepts than taught lecture material/lecture slides" (mean score = 3.64 (SD 0.95)), only 47.2% of the DEM cohort expressed similar views (mean score = 3.46 (SD 0.85)), although this difference was not statistically significant (one-way ANOVA). Indeed, just under half (40.3%) of DEM students were equivocal about the benefit of YouTube videos to their studies over lecture material (Fig. 3B).

Interestingly, we also found that significantly more GEM females than either DEM males or females (but not GEM males) felt that online physiology videos were better study aids than taught lecture material/slides (GEM female, 68% SA or A, mean score = 3.82 (SD 0.8) vs DEM female 50% SA or A, mean score = 3.45 (SD 0.93), $p = 0.04$, vs DEM male, 44% SA or A, mean score = 3.47 (SD 0.76), $p = 0.04$) (Fig. 3B).

Circumstances underlying social media use for supplemental physiology study

We next wished to identify the motivation(s) for student's use of web-based resources in physiology learning. We found that 49.7% of students overall disagreed or strongly disagreed (mean score = 2.86 (SD 1.27)) that they would contact an instructor in person if they had a physiology-related question (Fig. 4A). This *apparent* reluctance of students to engage with faculty directly seemed to be supported by the finding that only 13.8% of students overall strongly agreed or agreed that they would contact their instructors by e-mail if they had a physiology query, with 69.8% indicating that they strongly disagreed or disagreed with the statement; mean score = 2.24 (SD 0.98) (no significant differences existed between DEM vs GEM or between groups (Fig. 4A). 92.8% of respondents strongly agreed or agreed (mean

score = 4.54 (SD 0.73)) with the statement, “If I don’t understand something when I study Physiology I first search for an answer online” (Fig. 4A).

We also gauged how students regarded the physiology information sourced from web-based resources. 41.7% of all students disagreed or strongly disagreed that they automatically trusted information from online sources such as YouTube, Wikipedia and Facebook (mean score = 2.88 (SD 1.12)), while a third (34.6%) trusted this information, and 23.7% neither agreed nor disagreed (Fig. 4B). Probing the same area, we sought to determine if students ever “fact-checked” information obtained from online sources by using textbooks, research papers and/or instructors. 31% did fact-check information although 43.9% did not (mean score = 2.83 (SD 1.1)). There were no significant differences in the responses of GEM *vs* DEM, or male *vs* female students (Fig. 4B).

Instructor-led social media page

Finally, we wished to determine if medical students “would enjoy interacting with course materials on a social media page”, such as Facebook. In both GEM and DEM cohorts, 45.3% strongly agreed or agreed; mean score = 3.18 (SD 1.04). Nearly a third (29.2%) of students did not express an opinion either way, and 25.6% indicated that they would not want to interact with a physiology-focussed social media page (Fig. 5). Moreover, DEM students overall were more in favour of a physiology-devoted social media page than the GEM students (DEM mean score = 3.44 (SD 1.0) *vs* GEM mean score = 2.91 (SD 1.02); $p=0.003$, unpaired t-test), with DEM females being particularly strongly in favour (66.7% DEM female *vs* 37.5% DEM male ($p=0.02$, one-way ANOVA, Tukey’s multiple comparisons test) *vs* 42.1% GEM female ($p=0.004$, one-way ANOVA, Tukey’s multiple comparisons test) *vs* 28.6% GEM male ($p=0.001$, one-way ANOVA, Tukey’s multiple comparisons test)) who agreed or strongly agreed with the setting up of a physiology-related social media page (Fig.

199 5). There was no significant difference between DEM males *vs* GEM males, or between
200 GEM males *vs* GEM females.

201

Discussion

We wished to gauge the relevance and roles of social media for physiology learning in medical education. First year GEM and DEM medical students were invited to complete a survey designed to assess frequency of use, perceptions and preferences of physiology-related social media, with response rates of 81.7% (n = 67) and 56.3% (n = 72) respectively, and almost proportionally equal numbers of male and female student respondents. GEM students originated mainly from North America or Europe, and were aged between 21 and 29, whilst DEM students were predominantly European and aged between 18 and 20.

Irrespective of sex, the majority of first-year medical students were comfortable using social media, with most using these tools 12 times or more per week to facilitate their physiology learning, as well as to discuss physiology content with classmates (Fig.2). YouTube was the students' favourite social media information source, with Khan Academy being the most popular video channel for both DEM and GEM students (Figs. 1A & B). Interestingly, GEM students used social media content to aid their learning more than DEM students (Fig. 1C). GEM females in particular found online videos more helpful than lectures to learn physiological concepts, as exemplified by the following comments from two female GEM students, *"I usually use online material to clear up a topic that seems convoluted in the lecture slides and/or textbooks. Videos with animations are particularly helpful for my understanding of phys[iology] because I can "see" certain processes happen rather than just looking at a picture."*, and *"I usually use online material to clear up a topic that seems convoluted in the lecture slides and/or textbooks."*

These data indicate that the extent of social media integration into medical education is greater than has been previously reported (6, 12, 22, 24, 26, 28, 50, 53, 54). The reason for such integration most likely lies in the immediacy of responses to questions and/or a lack of

226 instructor accessibility. Indeed, in alignment with previous anatomy-oriented reports (6, 39),
227 only 14% of students indicated that they would seek academic guidance if they encountered
228 an issue in their physiology learning, opting to first search for an answer online. For example,
229 one female DEM student commented, *“I just find it less time consuming to search for something*
230 *online rather than look for it in a physiology textbook”*, and, *“I find it easier to look [up] any*
231 *questions that I have up online because often I find there is not enough time to ask a lecturer a*
232 *question after a class because they are rushing to another class or I am rushing to another class*
233 *(mainly this reason)”*, with another, female DEM, student commenting, *“I tend to use online*
234 *resources mainly for videos of complicated concepts or simple factual questions with a definite*
235 *answer”*.

236 Significantly, 34.6% of GEM and DEM students indicated that they “automatically trust[ed]
237 information” from online sources without verification, with only 31.3% of students indicating
238 that they did fact-check information using textbooks (*e.g.* one GEM female wrote, *“If I am*
239 *looking for more detail on a conceptual question, I generally will use a textbook over an online*
240 *source”*), research papers or instructor input. Two other students addressed this topic directly
241 in the survey free-comment section, with one (DEM female) stating, *“Most times when I fact*
242 *check, it would be because the information given is different or stated in a different approach than*
243 *my lecturer or seems like it doesn't make sense or seems weird. other than that, the information I*
244 *have gathered online regarding academics have been quite sound”*, and another (GEM female)
245 writing, *“I do not fact check unless there is a major contradiction. Usually, it is very obvious what*
246 *online resources are most trustworthy i.e. based on the quality of the video, number of view [sic],*
247 *comments, correlation with previous knowledge from lectures and notes”*. This latter comment
248 reflects a common student misconception that the number of views, likes or comments about
249 educational videos on YouTube are reliable indicators of their reliability or usefulness, when
250 in fact no such correlation exists (50).

251 The rise of social media platforms in undergraduate medical education is likely due to
252 eroding student – instructor interactions, their increasing number and accessibility and their
253 emergence as primary inter-student communication tools (23). However, student
254 interdependence on physiology-based web resources raises several issues. For example, there
255 is an enormous variation in the quality and accuracy of online life science content (18, 53).
256 Inaccuracies in YouTube videos in particular have already been documented with, for
257 example, the majority of anatomy material falling far below a useful learning standard (5,
258 45). Moreover, in addition to the fact that many students are “conditioned to select the first or
259 most easily accessible information resource” available to them (18), they also generally lack
260 the media literacy and critical analytical skills to determine if information sourced from
261 online resources is correct or not (15, 16, 18, 35, 47, 52). It is however worth noting that in
262 the present survey, three students specifically commented that they would appreciate being
263 directed towards “reputable” physiology videos, *e.g.* “*In general, I find watching a video can be*
264 *useful in helping to retain information and would be very grateful if there were more signposts/ links*
265 *to reputable video channels for more of the concepts we cover in Physiology.*” (GEM female),
266 “*For every lecture, it might be useful to have some youtube links to videos explaining the contents of*
267 *the lecture.*” (GEM male)
268 “*Lecturers couldput recommended videos in lectures notes for better understanding*” (DEM
269 female)
270 However, these sentiments aside, in an era of increasing time-constraints for academics, their
271 continued peer monitoring of social media physiology content is unlikely and developing
272 students’ digital insights is not a generalised curricular component (14, 18).
273 The solution to this issue would seem to lie in the development of dedicated academic-led
274 physiology social media content where, for example, links to physiology-orientated videos

that had been checked for accuracy of content could be provided. However, there is often a generational and technological gap between students and faculty (41). So-called “digital immigrants”, who were born before the rapid rise in digital technology (36), may not only be sceptical about the benefits of utilising social media platforms to support their teaching (29, 37, 41), but may also be less than comfortable using them (7). As such, it is possible that some academics will be unaware of the full versatility of the social media platforms that they are instructed/requested to use in their teaching. This in turn means that such platforms are unlikely to be used optimally, to the overall detriment of student learning (53).

Nonetheless, social media does allow faster communication with, and feedback from, instructors (21, 30, 50) and may reduce overall academic workload (53). However, in our study only 45.3% of students stated that they would enjoy interacting with course materials on a social media page. Significantly, more DEM than GEM students were in favour of such an idea, with females almost as twice as enthusiastic as males. The reasons for these demographic differences are unclear, but in terms of the DEM vs GEM differences, the significantly older GEM students may simply be more academically autonomous. However, it may simply be due to a lack of clarity about the exact purpose(s) and content that such a social media page would be/contain, *e.g.* “*I’m not sure what you mean by course materials on a social [sic] media page: if you mean facebook [sic], then I disagree because it is distracting for me; if you mean videos and interactive activities/ quizzes, then I strongly agree.*” (GEM female).

Limitations

One potential drawback of our study is that it did not quantitatively measure the impact of social media usage on student learning and/or exam performance. A further limitation of the study is that students were recruited from two different medical programmes within UCC,

that are each taught and assessed differently. Whilst associated alterations in data could be attributable in some way to the fact that they are taught and assessed separately and distinctly, it may also indicate that their significantly different educational backgrounds and age demographics engender different and distinct educational requirements.

Conclusion

Here, we contribute to medical/physiology education literature by revealing the extent of social media use in graduate and direct entry pre-clinical medical physiology learning. It is clear that medical students are becoming increasingly reliant on digital resources to supplement their academic-led curricular resources (6, 12, 13, 22, 41). As such, awareness of the growing digital divide that exists between students and faculty is rapidly becoming a key asset in addressing the educational and communicative needs of the next generation of medical students.

Disclosures

No conflicts of interest, financial or otherwise, are declared by the authors.

Author Contributions

MGR conceived and designed the study; drafted manuscript; edited and revised manuscript; approved final version of manuscript.

DoM gathered and conducted the statistical analysis of submitted student responses; edited and revised manuscript; approved final version of manuscript.

DSB edited and revised manuscript; approved final version of manuscript.

Acknowledgments

324 Elements of the work described in this manuscript were included in abstracts delivered at
325 Europhysiology 2018 (38) and EdTech 2019, and have also been described in a short article
326 published in Physiology News (44). The authors would also like to thank Dr Ger O’Keeffe
327 (Dept. Anatomy & Neuroscience, UCC) for his advice regarding the statistical analysis
328 employed for this manuscript.

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465

466 **Figure Captions**

467 **Figure 1. Students' social media usage.** Graph depicting combined DEM and GEM

468 students' general and physiology-specific social media use with each line representing the
469 mean \pm standard deviation (A). Pie charts illustrating overall student responses to the
470 questions, "If you use YouTube to source online physiology material, what channel do you
471 view most frequently?" (B) and "If you have used online video clips to help you with your
472 understanding of Physiological concepts, where do you mostly source them from?" (C).

473 **Figure 2. Students' general social media use.** Pie charts illustrating the number of times per

474 week during term time that both GEM and DEM students combined accessed social media
475 generally per week (A) and frequency of use of "online video clips" to facilitate students'
476 physiology learning per week (B). Histogram illustrating the same data as in pie chart B, but
477 including GEM/DEM and male/female composition. Overall, GEM students viewed
478 physiology video clips significantly more frequently than DEM students ($p=0.053$, #), with
479 GEM males viewing these significantly more frequently than DEM females ($p=0.047$, *).

480 **Figure 3. Students' perceptions of social media resources utilised for their**

481 **understanding of physiology.** Graph depicting combined DEM and GEM students'

482 perceptions of physiology-specific online videos for their understanding of physiology with
483 each line representing the mean \pm standard deviation. Histogram illustrating the breakdown
484 of data for student responses to the statement "If you use online video clips, do you find them
485 generally more useful for your understanding of physiological concepts than taught lecture
486 material/lecture slides?", into GEM and DEM, male and female subgroups. Significantly
487 more GEM females than either DEM females ($p=0.04$, *) or males ($p=0.04$, *) found online
488 physiology videos to be significantly more useful for their "understanding of physiological
489 concepts than taught lecture material/slides".

Figure 4. Students' preferences for interactions with physiology faculty and online

physiology platforms. Graph depicting students' attitudes towards interactions with faculty

versus social media with each line representing mean \pm standard deviation (A). Pie charts

illustrating overall student responses to the statements, "I automatically trust information

which has been obtained from online sources" (B) and, "I always 'fact-check' Physiology

information obtained from online sources using textbooks, papers and/or instructors" (C).

NA=not applicable, UA=unanswered.

Figure 5. Students' perceptions of a dedicated physiology social media page. Histogram

illustrating student responses to the statement, "I would enjoy interacting with course

materials on a social media page". Overall, DEM students were significantly ($p < 0.01$; ##)

more in favor of a dedicated physiology social media page than GEM students. DEM females

were significantly more in favor of the creation of such a page than all other individual

groups (all p values relative to DEM female, * $p < 0.05$, ** $p < 0.01$).

Appendix

Physiology Internet Usage Survey 17-18

This questionnaire is designed to provide Dr Rae with information as to how both GEM and direct entry medical students, utilise online material for their understanding of Physiology. It is hoped that this little researched question will be disseminated to other interested parties (e.g. as a research paper) but that no personal information (names, student numbers, etc.) will be linked to any of the information provided. Indeed, I can give you my word that I will not even attempt to gather this type of information from the survey responses. Thank you in advance for your participation.

Please note that by completing the survey either in full or in part you are indicating that you are voluntarily participating in the study and that any anonymised information provided by you may be analysed and disseminated by the designer of the survey, Dr Mark G. Rae.

Which gender do you identify as?

Male

Female

Other

Please specify your age profile:

A. 18-20

B. 21-23

C. 24-27

D. 28+

Please specify your region of origin:

A. Africa

B. Asia

C. Europe

D. Middle East

E. North America/Canada

F. Other

Would you consider your educational background to be biomedical or non-biomedical (this question probably only relates to graduate entry students)?

Biomedical

Non-biomedical

Not applicable

Which one of the following is your preferred method of sourcing physiology information?

- A. Recommended textbooks
- B. Instructor
- C. Social media platforms (e.g. Facebook, Twitter, WhatsApp, etc., not including YouTube or Wikipedia)
- D. YouTube
- E. Wikipedia
- F. Random internet search engine hits
- G. Other

How many internet ready devices (Laptop, Smartphone, ipad etc) do you possess?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5
- F. 6+

"I am very comfortable using social media (Facebook, Twitter, etc)."

- A. Strongly Agree
- B. Agree
- C. Neither Agree nor Disagree
- D. Disagree
- E. Strongly Disagree
- F. Not Applicable

During the academic term, how often do you interact with social media (e.g. Twitter, Snapchat, Facebook, etc.) in a week?

- A. Never
- B. 1-2 times
- C. 3-5 times
- D. 6-8 times
- E. 9-11 times
- F. 12 times or more

"I use social media to discuss Physiology-related issues with my classmates on a regular basis (e.g. every 1-2 weeks)."

- A. Strongly Agree
- B. Agree
- C. Neither Agree nor Disagree
- D. Disagree
- E. Strongly Disagree
- F. Not Applicable

602 **“If I don’t understand something when I study Physiology I contact my instructor by**
603 **email.”**

- 604
605 A. Strongly Agree
606 B. Agree
607 C. Neither Agree nor Disagree
608 D. Disagree
609 E. Strongly Disagree
610 F. Not Applicable

611
612 **“If I don’t understand something when I study Physiology I ask my instructor a**
613 **question in person.”**

- 614
615 A. Strongly Agree
616 B. Agree
617 C. Neither Agree nor Disagree
618 D. Disagree
619 E. Strongly Disagree
620 F. Not Applicable

621
622 **“If I don’t understand something when I study Physiology I first search for an answer**
623 **online.”**

- 624
625 A. Strongly Agree
626 B. Agree
627 C. Neither Agree nor Disagree
628 D. Disagree
629 E. Strongly Disagree
630 F. Not Applicable

631
632 **How quickly do you expect a response from an instructor regarding a Physiology**
633 **question? Within:**

- 634
635 A. 2 hours
636 B. 6 hours
637 C. The same day
638 D. The same week
639 E. I don't mind as long as I receive a reply at some point.

640
641 **“The speed at which I want an answer to my question determines whether I ask my**
642 **instructor or search for an answer online.”**

- 643
644 A. Strongly Agree
645 B. Agree
646 C. Neither Agree nor Disagree
647 D. Disagree
648 E. Strongly Disagree
649 F. Not Applicable

650

651 **“As part of my current degree I have used internet search engines to investigate the**
652 **Physiological topic I am studying”**

- 653
654 A. Strongly Agree
655 B. Agree
656 C. Neither Agree nor Disagree
657 D. Disagree
658 E. Strongly Disagree
659 F. Not Applicable

660
661 **During the academic year, how often do you use online video clips to facilitate your**
662 **Physiology learning in a week?**

- 663
664 a. Never
665 b. 1-2 times
666 c. 3-5 times
667 d. 6-8 times
668 e. 9-11 times
669 f. 12 times or more

670
671 **If you use online video clips, do you find them generally useful for your understanding**
672 **of Physiological concepts?**

- 673
674 A. Strongly Agree
675 B. Agree
676 C. Neither Agree nor Disagree
677 D. Disagree
678 E. Strongly Disagree
679 F. Not Applicable

680
681 **If you use online video clips, do you find them generally more useful for your**
682 **understanding of Physiological concepts than taught lecture material/lecture slides?**

- 683
684 A. Strongly Agree
685 B. Agree
686 C. Neither Agree nor Disagree
687 D. Disagree
688 E. Strongly Disagree
689 F. Not Applicable

690
691 **If you have used online video clips to help you with your understanding of Physiological**
692 **concepts, where do you mostly source them from?**

- 693
694 A. YouTube
695 B. Facebook or other social media site
696 C. Random search engine hits
697 D. Physiology/Medical textbook online material
698 E. Medical / health oriented websites
699 F. Non-internet sources, e.g. DVDs associated with textbooks

700

If you use YouTube to source online Physiology video material, what channel do you view most frequently?

- A. Khan Academy
- B. Crash Course Anatomy & Physiology
- C. The Physiological Society
- D. No preference for any specific channel, just view videos generated by search hits
- E. Other
- F. Not applicable

“I automatically trust information which has been obtained from online sources (e.g. Wikipedia, YouTube, Facebook)”

- A. Strongly Agree
- B. Agree
- C. Neither Agree nor Disagree
- D. Disagree
- E. Strongly Disagree
- F. Not Applicable

“I always ‘fact-check’ Physiology information obtained from online sources using textbooks, papers and/or instructors”

- A. Strongly Agree
- B. Agree
- C. Neither Agree nor Disagree
- D. Disagree
- E. Strongly Disagree
- F. Not Applicable

“I would enjoy interacting with course materials on a social media page.”

- A. Strongly Agree
- B. Agree
- C. Neither Agree nor Disagree
- D. Disagree
- E. Strongly Disagree
- F. Not Applicable

How do you generally view online Physiology material?

- 1. On a computer only.
- 2. Only on a portable media device (i.e. tablet, ipod, generic MP3 player, etc.)
- 3. I utilise both computers and portable media devices to view / listen to online material.
- 4. I do not use them at all as I prefer to use my notes and / or textbooks

Please insert any other comments and/or suggestions relating to your use of online Physiology material, particularly if it is not covered in the survey or if you want to expand upon any of your provided answers.