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Multimedia in Education: What do the Students Think?☆

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Abstract

Purpose: Multimedia is considered a cost effective and practical learning medium. This study aimed to investigate the attitudes of medical and allied healthcare students towards the use of various multimedia learning aids and explored students' attitudes towards these learning aids.
Method: An online questionnaire was used to collect data. Students were invited to partake in the study via email and data was collected over a six-month period.
Results: A total of 153 students responded to the survey. The data shows that students have had a positive experience using devices like smartphones (88.88%, n = 136) and laptops (89.19%, n = 132). Students are confident searching for multimedia resources (76.31%, n = 116), and have some familiarity or exposure to multimedia as part of their learning experience. Students preferred traditional teaching methods to learning with multimedia (58.59%, n = 75), but regarded multimedia as an effective and efficient tool for practical learning (73.02%, n = 111). The participants reported using e-learning tools and 2D animations more frequently than other multimedia tools and reported being least familiar with Augmented Reality and 3D websites. Finally, students expressed an interest in the development of 3D animations (66.66%, n = 80), interactive 3D teaching tools (65.45%, n = 72), and simulators (64.07%, n = 66) to complement their future studies.
Conclusion: The results of the study show that participants acknowledged the important role of multimedia as a practical learning tool that can greatly complement and enhance the traditional teaching methods but cannot replace them. Medical and healthcare students expressed a particular interest in the development of interactive tools including simulators to supplement their studies and enhance the learning process.

Keywords: Attitudes; Medical and healthcare; Multimedia; Students; Survey

1. Introduction

Healthcare education is undergoing pioneering changes with traditional teaching complimented with innovative technology enhanced learning tools and multimedia resources such as computer assisted learning (CAL) and mobile applications. Recent

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studies have demonstrated that the current generation of students are routinely using these tools for educational purposes.[1]

The term 'Multimedia' has been described as a combination of sound, text, animation, video or art delivered by a computer or other digital platform[2] and encompasses simple teaching tools like videos or animations to complex teaching tools like Virtual Reality (VR) and 3D Augmented Reality (AR).[3]

Multimedia has been shown to be effective for learning: animations effectively stimulate learner interest and thus enhance the learning experience[4] with augmented reality improving the students' cognitive skills by provided a platform to combine digital and physical parameters.[5] Gaming has been shown to enhance medical education[6] while improving the academic writing skills of dental students[7] and improving empathy in nursing[8] and pharmacy students.[9] Positive findings of these studies suggest that the use of multimedia as a form of blended-learning technique cater to the multiple learning styles and have been found to provide better outcomes than traditional lecture delivery.[10]

Research conducted into the learning styles of the students provided an explanation to why interactive multimedia may prove beneficial to their learning experience. In most cases, research concerned with the learning styles of medical students use the Visual, Aural, Read or Write and Kinesthetic (VARK) learning styles questionnaire and guide.[11] Lujan et al.[12] and Baykan et al.[13] found from their research with 166 and 155 first year medical students respectively, that the majority of students were kinesthetic learners. Overall these studies demonstrate a tendency for medical students to be kinesthetic learners who prefer multiple modes of presentation.

VR is becoming widely implemented and researched in the medical health sector.[14] VR has proven numerous benefits for education and medical training. More recently, it has demonstrated an improvement in healthcare professional's knowledge and skills in surgical training.[15] Furthermore, it has also been found that VR can accommodate for variations in learning styles.[9]

Nowadays, universities and colleges are relying heavily on online resources to engage and connect with students on day to day basis, providing platforms for communication between students and hold discussions between the students and their teachers.[16] Technology is becoming an integral part of institutes of higher education for learning and communication purposes with web-based learning added to the existing teaching curriculum.[17]

The aim of this study is to identify the attitudes of medical and healthcare students towards the use of multimedia in education. For this research study, multimedia most closely follows the definition as described by computer science in that it is a combination of sound, text, visuals on a digital platform and encompasses an interactive element.

2. Materials and methods

2.1. Study design

This is a descriptive study which was designed to collect data pertaining to the attitudes of medical and allied healthcare students for using multimedia learning aids to assist their educational learning. This study aimed to explore which technological aid students used to support their learning and found most useful.

2.2. Project timeline

The timeline for this project was the end of 2016. An online questionnaire was developed and made available online for the students from October 2016 and was closed in March 2017. The data was collected in this six month period.

2.3. Setting

First and second year medical and healthcare students attending anatomy lab practicals were invited to participate in this online survey via email. Students who would attend these practicals include medical (first year n = 120), nursing (second year, n = 180), and dentistry (second year, n = 65) undergraduate students. During one week of practicals, the researchers held an information session with the students, outlining the participant information leaflet. Participants were also made aware that the survey was available for six months via the Virtual Learning Environment, Blackboard. Consent was obtained from the students at the start of the study. The inclusion criteria for this study were first and second year medical and healthcare students attending anatomy lab practicals. Exclusion criteria were applied to third, fourth, and fifth year medical and healthcare students.

2.4. Questionnaire design

A questionnaire was designed by a multidisciplinary team of anatomists and multimedia specialists to gather data about the students' use of multimedia technology. The questionnaire consisted of 19 questions some of which are multiple choice, 5-point Likert scale questions ranging from negative to positive scales (strongly disagree/disagree/least remember to strongly agree/agree/remember most) and open ended questions (as seen Fig. 1.). Four senior medical demonstrators in the Department of Anatomy and Neuroscience and five computer science researchers at University College Cork, Ireland were invited to participate in a pilot study for the validation of the questionnaire. This was followed by a focus group session with the above-mentioned participants to discuss their feedback on the questionnaires. Questions were modified based on the feedback session. The survey questions focused on several topics which included collecting data on background, Learning Preference Indicator, Device Usage, Interests in Technology, Multimedia Familiarity, Attitudes towards Multimedia, Multimedia Usage, and Perception of Multimedia Services in the University.

2.5. Data collection

First and second year medical and healthcare students attending anatomy lab practicals were invited to participate in this online survey. Students who would attend these practicals include medical, nursing, and dentistry undergraduate students. A custom survey was developed using web technologies such as HTML, JavaScript, PHP, and CSS and results were stored in a Microsoft Excel Workbook. The website containing the survey also included an information sheet about the project, explaining that participation is voluntary, and details on how to retract their data. This survey was made available online from October 2016 and was closed in March 2017.

2.6. Ethical Approval

Ethical approval for the study was received by the Social Research Ethics Committee in University College Cork, log number 2016–109. The study was conducted from October 2016 to March 2017. Participation in the study was voluntary and all data collected was pseudo-anonymised. Participants had the option to withdraw from the study at any stage. Participation and answering of the questions was voluntary. The statistics below is calculated based on the number of respondents for each question.

2.7. Statistical analysis

Since this was a descriptive study and data was collected which was pseudoanonymized only mean values and percentages could be calculated for the data. Since paired data was not obtained non-parametric tests could not be performed on the data.

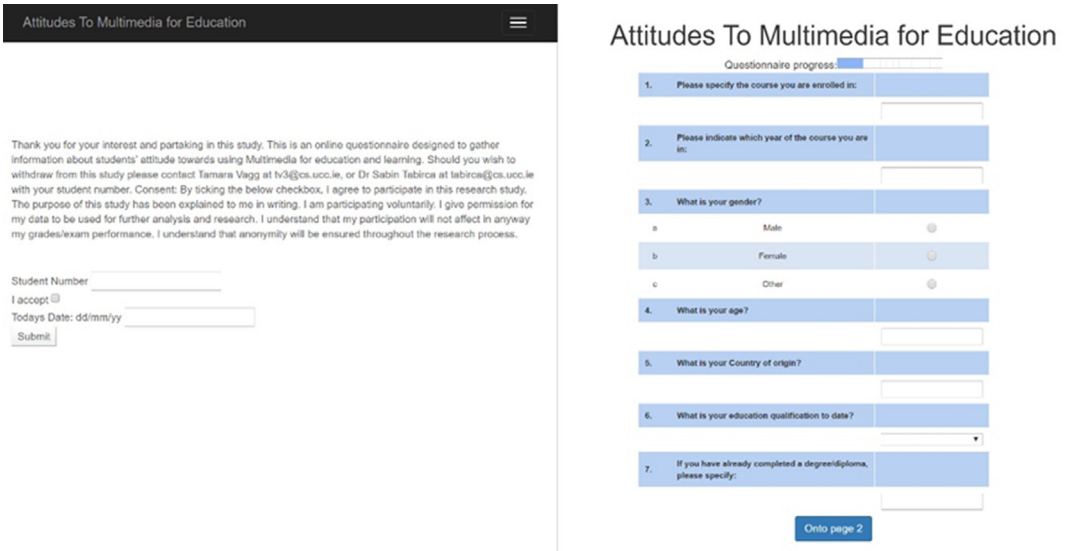

Fig. 1. Screenshot of the consent form and first page of the online survey.

Table 1
Participant Profile Summary. 153 medical and health student respondents, University College Cork, 2016.

Participant Profile Summary	
Number of Participants	153
Age Range	18-50 (average 22)
Male	57
Female	96
Educational Background	Medicine (n = 79), Dentistry (n = 47), Nursing (n = 27)
Year of Education	1st year (n = 78) and 2nd year (n = 75)
Educational Institution & Country	University College Cork, Ireland

Table 2
Learning preference indicator response percentage. 109 of the 153 medical and health student respondents, University College Cork, 2016.

Ranking (1–3)	Watching video with audio	Reading lecture notes and looking at images	Reading notes while listening to a lecture
Remember Least (1)	18.34% (n = 20)	20.18% (n = 22)	52.29% (n = 57)
Remember Some (2)	29.35% (n = 32)	50.45% (n = 55)	27.52% (n = 30)
Remember Most (3)	52.29% (n = 57)	29.35% (n = 32)	20.18% (n = 22)

3. Results

3.1. Background

During the six month availability of the survey, the survey was completed by 153 students yielding a response of 42% (n = 365). Of these 153 students, 79 were medical students, 47 were dental students, and 27 were nursing students. From the participating students, 78 students were in their first year and 75 were in the second year. The majority of participants were females (n = 96) with 57 male respondents. The youngest participant was 18 years old whereas the oldest was 50 years with an average age of 22 years. Of this cohort, 26 students had already acquired an undergraduate degree and 12 students had achieved a postgraduate degree. A summary of the participant profile can be seen in Table 1. The remaining results of this survey is outlined below in accordance to the survey structure previously outlined.

3.2. Learning Preference Indicators

Students were given five statements regarding their memory and learning preference. They were then asked to rank the statements from 1 to 5 with 1 as remember the least and 5 as remember the most. Students who answered this question, regarded things they 'practice or do' as the most memorable (71%, n = 69). This was followed by 'things that they write after reading' (55.3%, n = 53) and 'things they see or watch' (36.9%, n = 46). The results of this question state that the participants found that 'things they read' (53.1%, n = 51) and 'things they hear' (35.4%, n = 34) to be least memorable. This was followed by another question whereby students were asked to comparatively rank three scenarios involving multimodal learning, in terms of how well they remember the content from 1 to 3 (1 being remembered the least and 3 being remembered the most). Results show that students remembered the least from reading notes while listening to a lecture and remembered the most from watching video with audio as demonstrated in Table 2.

3.3. Device Usage

Students were first asked to select the devices they currently own or have owned in the past. They were then asked to rate their experience of these devices from 1 to 5 (1 being an unpleasant experience and 5 being pleasant), the results of which can be seen in Table 3 below. The first two rows represent the number of students who selected each option. The percentage values for user experience in the remaining three rows is calculated based on those who reported owning the device.

3.4. Interest in technology

Students were asked to rate four statements about their interests in technology from 1 to 5 (1 being strongly disagree and 5 being strongly agree). Results show that students have an interest in technology

Table 3
Number of students reported device usage and students experience of those devices. 153 medical and health student respondents, University College Cork, 2016.

	Smartphone	Desktop	Laptop	Notebook	Tablet/iPad	Game Console
Students owning and using the below devices						
Own	139	84	136	48	78	60
Use Frequently (daily/weekly)	137	35	131	37	38	14
Students' experience based on those who own the device						
Unpleasant Experience (1,2)	2	11	3	7	8	7
Neutral Experience (3)	11	29	8	8	19	14
Pleasant Experience (4,5)	124	42	121	32	49	36

Table 4
A breakdown of medical student's familiarity, usage and need with multimedia. 153 medical and health student respondents, University College Cork, 2016.

	No. Of respondents who are familiar with	No. Of respondents who used during study	No. Of respondents who want to see more of in education
3D animations	120	57	80
Mobile Apps	120	59	54
E-Learning	113	74	50
Interactive 3D	110	50	72
2D animations	106	78	34
Simulators	103	30	66
Virtual Reality	101	12	50
Game Based Learning	95	23	44
3D Websites	80	24	41
Augmented Reality	74	7	37

(58.16%, n = 89) and do not find technology intimidating (51.3%, n = 78). However, the students had a more varied response to whether technology was frustrating for them, with 41.83% (n = 64) disagreeing and 32.67% (n = 50) agreeing. A similar distribution was seen in the final question of this section whereby users rated how up-to-date they attempt to stay with advances in technology, 29.41% (n = 45) of participants responded that they do not, 39.21% (n = 60) attempt to keep up-to-date, and 31.37% (n = 48) neither agree nor disagree that they keep up with technology.

3.5. Multimedia familiarity

Several Likert questions regarding the students' confidence with multimedia were also asked, and ranged from 1 to 5 (1 being the lowest and 5 being the highest). These questions found that the students are confident with:

- Using a computer to search for educational multimedia online (76.31%, n = 116),
- Manoeuvring/rotating 3D models on a smartphone (60.92%, n = 92),

Table 5
Reasons why students do not use multimedia response percentage. 124 of the 153 medical and health student respondents, University College Cork, 2016.

Option	Frequency
I like traditional learning with textbooks, diagrams and lecture notes	58.59% (n = 75)
Advances in technology intimidate me	5.46% (n = 7)
I cannot understand 3D or VR	3.12% (n = 4)
I don't have the time for using technology while studying	11.71% (n = 15)
There is no multimedia resources available to benefit my learning	16.4% (n = 21)
I had a bad experience with multimedia learning	1.56% (n = 2)

- Manoeuvring/rotating 3D models on a laptop or personal computer (62%, n = 93).

To gauge multimedia familiarity, students were provided with a table of common multimedia interventions and asked to select the multimedia they are most familiar with, that they have used during any point of their study, and what multimedia they want to see more of in health and medical education. The results are displayed in Table 4. The first column lists multimedia interventions, with the second representing the number of users who reported being familiar with the intervention. The final two columns represent the percentage of familiarised students who reported using this intervention and wanting more of this multimedia to support their learning.

3.6. Attitudes towards multimedia

When asked if students find multimedia to be as good as a class or lecture, 34.21% (n = 52) of students neither agreed nor disagreed, while 40.13% (n = 61) agreed; however, 58.55% (n = 89) reported that they prefer lectures over multimedia content. A total of 69.53% (n = 105) students agreed they would like to utilise more multimedia interventions and content to support their learning, and 71.05% (n = 108) students agree that multimedia for education is engaging. Likewise, 73.02% (n = 111) agreed that interactive multimedia is a good resource for practical learning and 74.17% (n = 112) agree that it is important for educational multimedia to be interactive in-some way. Similarly, 72.36% (n = 110) agree that multimedia can help them garner a better understanding of topics which were covered in a class or lecture. When asked if the students preferred multimedia to textbooks, 47.36% (n = 72) of students agreed that they did, while 25% (n = 38) were unsure. The students were then asked if they prefer 2D or 3D multimedia; this question showed that 58.66% (n = 88) of students prefer 3D multimedia, and 28.66% (n = 43) were unsure. It was also found that 52.02% (n = 77) of students believe that educational multimedia is expensive. Finally, the students were presented with six statements and asked to choose which option more accurately reflects why they do not use multimedia. The results of this can be seen in Table 5.

3.7. Multimedia usage

During further questioning regarding their multimedia usage, 84.66% (n = 127) of students agreed they would search for additional visual content such as videos, animations, images online or via a smartphone when revising or studying. Furthermore, 98.03% (n = 150) of students also confirmed that they have searched for an animation/video to explain a difficult topic encountered during their learning. With 98.68% (n = 150) students having watched an educational video or animation, 52.02% (n = 77) of students reported educational multimedia as being easy to locate. Similarly, 78% (n = 117) of students agreed they would look for text-based content such as research papers when studying or revising. Additionally, 71.24% (n = 109) of students also reported using a 3D educational tool, such as a 3D website. It was also found that 54.9% (n = 84) of students have used educational games to support their learning and 54.05% (n = 80) enjoy learning with games; however, only 13.72% (n = 21) currently own an educational game. In contrast, a high number of students (65.5%, n = 99) have an educational app in-stalled on their phone. Virtual Reality (8%, n = 12), Simulators (7.9%, n = 12), and Augmented Reality (12%, n = 18) were found to be the least utilised multimedia interventions, however all participants who reported using these interventions also considered the multimedia to be beneficial to their learning.

3.8. Perception of Multimedia Services in the university

Next, the students were asked to rate from 1 to 5 (1 being disagree and 5 agree) whether they believe their university has sufficient multimedia to support their learning. Of the respondents, 36% (n = 54) feel there was sufficient multimedia whereas 22.66% (n = 34) felt that the university did not and 41.33% (n = 62) were unsure.

4. Discussion

A total of 153 healthcare students participated in the survey, whose perceptions about multimedia usage should reflect the current student cohort. There was a high amount of female respondents raising the possibility of gender bias. However, similar gender bias has been reported in other studies.[1] The respondents in the study were all first and second-year healthcare students attending the anatomy practicals in the university. However, 38 students had already achieved a third level qualification (undergraduate or postgraduate degree). Looking at the age profile of the participants, there was a variation between the age categories. The

average age of 22 years is more reflective of a student in their final years of their degree (4th or 5th year). This could suggest that the student cohort are mature learners.[18]

The total student cohort included 127 new students (<24 years) and 26 mature students (25 years or older). We were interested to see if there was any notable difference between mature and new students as such we extrapolated the mature student data across all the results and compared against the new student data. No notable difference was found between the attitudes and opinions of the two sub-cohorts. Therefore, the results stated and discussed are representative of both groups as a single cohort.

Overall, it can be seen that smartphone, laptop, and desktop are the students' most frequently owned devices. In each case, students tend to rate their experiences positively with the majority of devices they owned and have used. However, it can be clearly seen that within all the devices the student owned, smartphones and laptops are the most preferred devices among students.[1] Advantages of smartphone and laptop have been listed as transportability thus allowing students easier access to the internet for social media, education and communication purposes.[1,19]

The results of this survey suggest that medical and healthcare students prefer traditional teaching methods to educational multimedia,[20] and believe that multimedia cannot replace these traditional teaching methods. However, this study found that the students prefer interactive multimedia as a feasible resource for practical learning.[21] Multimedia resources were found to be both favourable and effective by the students which is reflective of their indicated learning preferences[21,22] The participants of this study also regard multimedia as complimentary to their traditional learning.[23] and often seek multimedia to support or further explain difficult concepts encountered during their study.[24] Using multimedia resources improves not only the teaching to the students[25] but also the learning by the students.[26]

In addition to this, it can be seen that this particular student population do not appear to be intimidated by technology and use smartphones and laptops regularly which is also reported in literature.[27] These students also report being confident at sourcing and interacting with multimedia with about 40% (n = 60) of students attempting to stay up to date with technological advancements and developments. This data indicated healthcare students' keen interest in digital learning and technology.

From the multimedia familiarity table it can be seen that these healthcare students are most familiar with 3D animations and educational smartphone apps, a similar finding to other research in the area.[28–30] They appear to be the least familiar with Augmented Reality (AR) and 3D websites, with very few studies about its uses and efficiency.[31] It was also found that students use e-learning tools and 2D animations more frequently than other multimedia during the course of their study. Interestingly, students also reported being the least interested in the development of more 2D animations to support learning, perhaps due to the high availability of this resource.[30] Finally, students expressed the most interest in seeing 3D animations, Interactive 3D teaching tools, and Simulators incorporated to support their studies in the future[32] and found it significantly affecting their learning.[33]

Our findings of the survey are in line with those of Prensky (2009), demonstrating that this generation of healthcare students are considered to be 'digitally wise',[34] in that they have access to on-demand digital information via their smartphones and laptops. These digitally wise cohorts are considered to have enhanced analytical abilities due to increased exposure to multimedia resources (animations and simulations).[34] Furthermore, they also have accelerated ability to extract information from these complex systems.[34] Moreover, the participants indicated having a pleasant experience of learning with multimedia resources and regarded it as enhancing their learning. This is also reflective in learning preferences of students where multimedia resources can engage the various learning approaches through a single multimedia platform. It is acknowledged that learning preferences can change over time and for various topics and hence multimedia can accommodate for these changes easily.[35]

Furthermore, with the advent of Virtual Learning Environments (Moodle, Blackboard, and Canvas) and their advanced capabilities, multimedia is becoming ever more accessible and tangible as a teaching resource. In addition, this survey also proves that students, themselves, would like to see more multimedia included in their curriculum. Hence, this study and its data can inform the development and use of multimedia for students learning and educational purposes.[36]

5. Limitations

Firstly, the manner in which the students were recruited can cause potential bias, i.e., online learners

may be more inclined to answer the survey. However, as the survey was made available via Blackboard, which every current student must access in order to obtain course materials, it provided equal opportunity for every student to participate. Furthermore, the survey was developed with multiple choice questions which did not require any additional technical abilities.

It is also acknowledged that due to the high number of female respondents there is the possibility of gender bias. Secondly, the participants of this survey were first- and second-year students. It would be interesting to see if the student preference changes over their curriculum years. To note a small number of participants had already achieved a third level qualification, however, this number was too small to investigate preference change over time. Another limitation is that this survey was conducted with a small number of healthcare students in one institution. The discrepancy in the VR definition also presents a possible limitation to the questions surrounding VR as the definition is open to interpretation. However, there are still some commonalities among these definitions, such as interactive 3D visualisation. While we can apply these results to other student cohorts, more research is needed to gauge students' attitudes to multimedia. Moreover, this study looked at the multimedia perception of only first and second year healthcare student, it would be interesting to see if this perception changed once students made the transition into clinical years and if they prefer a certain multimedia at that stage.

6. Conclusion

This survey allows general observations to be drawn and to inform the development of educational multimedia for medical/healthcare students and professionals. Specifically, it was found that medical and health students use multimedia routinely for learning and regard interactive multimedia as a plausible intervention for practical learning. The multimedia resources of most interest to these students appears to be 3D animations, Interactive 3D, and Simulators.

Ethical Approval

Ethical Approval was obtained from the Social Research Ethics Committee at University College Cork: 2016-109.

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Declaration of competing interests

There are no conflicts of interest.

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