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Blended Learning - The Efficiency of Video Resources and YouTube in the Modern Dental Education

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Abstract

The media-enhanced teaching techniques became popular in the last years because they stimulate the students' engagement and motivation. The educational movies uploaded on YouTube became nowadays a highly used resource for learning in the academic environment. We conducted an opinion survey among the students at the Faculty of Dental Medicine, "Grigore T. Popa" University of Medicine

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and Pharmacy, Romania, about their agreement and interest in using educational movies as didactic tools, compared with the traditional teaching methods, and about the features they prefer in such materials. The study group included 170 students with average age 20.93 ± 2.751. Most students (91.2%) use didactic movies in their practical training; 77.6% think that the didactic movies from YouTube contain correct scientific information. 74.6% of the students like to learn using didactic movies, 39.7% of them appreciate the oral speech accompanied by PowerPoint Presentations and 46.6% like the oral speech accompanied by written explanations, with no significant differences between genders and age groups. The most popular features of the educational movies are: human narrator (94.7%), who speaks in Romanian (82.4%). The narrator's speech must be accompanied by animated schemes with exp lanations (90.6%) and drawings (93.5%). The movie must have a clear structure, evolving from basic to complex (85.9%). The educational movies uploaded on YouTube are an adequate source of information for the dental students; the professionals in universities must survey better the scientific quality of such materials.

Keywords: blended learning, didactic movies, YouTube, dental education.

Introduction

The media-enhanced teaching techniques became more and more popularly in the last years. Today's students in universities belong to a generation which was fully exposed to the Internet and mobile communications since the begin of their lives (Bock *et al.,* 2018) that is why they developed new styles of learning and documenting, entirely based on multimedia resources and communication, and totally different from traditional methods, based on individual study in libraries. Such students obviously prefer the blended learning approaches (which combine the digital media and conventional classroom methods) instead of the traditional format of academic teaching, which must be adjusted to accommodate these new developments (Bains *et al.,* 2011).

Literature review

Over the past 20 years, the research regarding the multimedia's effect on the learning quality, pointed out that using it in educational process, stimulates the students' engagement and motivation and eventually triggers the deep learning (Andrews, Clark, & Knowles, 2019). The scientific literature identified and debated the so-called "multimedia effect", according to which the students learn better from text and pictures than from text alone (Mayer, 2019). This effect is not systematic being influenced by certain variables, such as the content to be learned, the

students background of knowledge, learning abilities and spatial skills (Logan & Mayer, 2018), but it is enough important to be considered, especially because it is explained by well-known cerebral processes, like: 1) pictures facilitate the building of mental models (Eitel *et al.*, 2013), speeding up the information processing; 2) pictures combined with text lead to distinct representations of the same information in the long-term memory, generating separated access points which speed up the searching (Van Genuchten, Scheiter, & Schuler, 2012); 3) pictures stimulate the inference generation (Colliot & Jamet, 2018) by building referential connections between representations.

The animations and didactic movies, eventually uploaded on YouTube, are "the next level" and bring new advantages: the animations play the role of a cognitive prosthesis, facilitating the learning of dynamic information (Bétrancourt, 2017), compensating the learners' insufficient aptitudes to simulate motion and to understand the changes in time and improving their spatial abilities. There are some principles to be followed in the design of useful animations and videos. For example, Meyer, Rasch and Schnotz (2010) showed that running presentations at high speed facilitates the perceiving of macro-events; still, the animations do not have to be too fast, because they may overwhelm the learners' working memory (De Koning & Tabbers, 2013) making them to skip significant steps and to omit relevant information. The insertion of breaks during animations is also necessary because it highlights the material's structure and helps the understanding (Spanjers *et al.*, 2012). It is recommended to fill these breaks with pictures, related to the content and not randomly selected; in this way the main steps of the process are better emphasized (Lau *et al.*, 2013) and the learner's attention is maintained (Lowe & Boucheix, 2016). De Koning also analysed the role of explanations in animations (De Koning *et al.*, 2010); their results indicate that the learners understand better the message's signification when the movie is accompanied by external explanations, compared with the case when these explanations are pre-recorded in the movie's soundtrack.

In which concerns the YouTube using, it worth to know that, at the level of 2019 years, this was the second most frequently visited Internet platform in the world, and the third most popular application for mobile devices. YouTube is the most used video platform for surgical trainees (Hrastinski & Aghaee, 2012), as well as for other medical specializations.

Among the modern training tools, YouTube has certain advantages which justify its good reputation: the platform is stable, fast and user friendly, it has efficient built-in mechanisms to search and filter content and an increased capacity to be shared on social media (Topps, Helmer, & Ellaway, 2013). Its major drawbacks are instead the lack of a peer-review process (McGee & Kanter, 2011) and the design of the algorithms used to search content, based on likes and views (Covington, Adams, & Sargin, 2016) and not on quality analyses. Therefore, it is essential to correctly evaluate the educational potential of such materials, for their objective use.

Many studies were carried out to investigate the particularities of this new learning resource; a few examples are: which contents are the most popular (Susarla, Oh, & Tan 2012), which are the characteristics of content providers (Saurabh & Sairam, 2013), which is the quality of higher education materials (Chen & Gilchrist, 2013) and their position in academic libraries (Cho, 2013), how useful are them for individual lectures in classroom settings (Everson, Gundlach, & Miller, 2013) and to support the collaborative learning (Hrastinski & Aghaee, 2012) as well as how useful are the training videos in specialized medical subjects, like: the clinical skills developing (Topps, Helmer, & Ellaway, 2013; Duncan, Yarwood-Ross, & Haigh, 2013), the performing of certain procedures (i.e. facelifts, Derakhshan *et al.*, 2019), the understanding of electrocardiograms (Akgun *et al.*, 2014), the infection prevention and control (Lim *et al.*, 2018), the diabetes foot care (Abedin *et al.*, 2015), the paediatric physical examination (Lehmann *et al.*, 2016) and so on. The general conclusion is obvious: YouTube is a popular and useful resource for learning in academic environment and not only and offers to its users a wide area of advantages.

In this regard, in our study we decided to investigate the place of these multimedia resources in the Romanian dental teaching. We conducted an opinion survey among the students at the Faculty of Dental Medicine, "Grigore T. Popa" University of Medicine and Pharmacy, about their agreement and interest in using educational movies as didactic tools, compared with the traditional teaching methods and about the features they prefer in such materials. The starting point was a library of educational movies that explain theoretic and practical concepts in the field of Medical Informatics and Biostatistics.

Methodology

Our library of didactic movies for students is used during the practical stages of Medical Informatics and Biostatistics. The videos are classified in two categories: (1) Explanations for theoretical concepts: the concept of database, the Microsoft Access general presentation, general notions about Microsoft Word, Excel and PowerPoint; (2) Demonstrations of practical procedures: how to create a database in Access, how to write queries in Access, how to calculate statistical and mathematical functions in Excel and how to use the commands from Data Analysis tools pack in order to perform statistics.

The videos are developed using Sony Vegas Movie Studio Platinum 15.0 and contain live demonstrations, combined with oral explanations and static images. The live demonstrations are registered using Movavi Screen Recorder 9, software which allows to record the computer screen while different operations are made using the operating system or particular applications; the exact workflow is recorded as a WMV standalone file. Static images and animations were combined with live demonstrations, in order to emphasize certain aspects. The animations

are made in Microsoft PowerPoint and are also saved as WMV files. The oral explanations are recorded separately, as audio files, being synchronized later with the video content and an accompanying musical background.

We intend to upload all these videos on YouTube, on a personal channel. In order to perform our opinion survey, we used an anonymously questionnaire with 27 items, composed from two parts: the first 12 items investigate the students' opinion about the utility of didactic movies for their training during the faculty and the last 15 items investigate their opinion about certain features of the didactic movies, which can be included or avoided in order to stimulate the learning. In the first part of the questionnaire the students were invited to formulate their opinions through comparisons between the didactic movies and other two highly used styles of teaching, i.e. the oral speech combined with PowerPoint presentations and the oral and written presentations at the blackboard, without multimedia support.

Participants

The study group included 170 students, 76 (44.7%) from the Dental Medicine specialization (year of study I, III and V) and 94 (55.3%) from the Dental Technique specialization (year of study I, II and III). The sample's structure on genders shows a prevalence of the female students (74.1%) compared with the male gender students (25.9%) – fact which is rather usual in the Faculties of Dental Medicine, preferred by the girls more than by the boys. The students average age is around 20 years, without significant difference between girls and boys (Mann-Whitney $p = 0.848$, NS, *Table 1*).

Table 1. The age values in the study sample – descriptive statistics

Gender	N	Mean	SD	SEM	Minimum	Maximum
Feminine gender	126	20.69	1.690	0.151	18	28
Masculine gender	44	21.61	4.561	0.688	19	46
Total	170	20.93	2.751	0.211	18	46

Taking in consideration that the students' mental maturity can influence significantly their opinion about learning tools, we split them in two distinct age groups – the students with age <= 21 years (128, 75.3%) and the students with age > 21 years (42, 24.7%).

Data collection

The questionnaire was presented and explained to each subject separately, along with the research objectives. All questions had binary answers, the students

being invited to respond with YES if they agree with the assertion proposed and with NO otherwise.

Variables

The gender and the age were considered as *independent variables*.
The answers at the questionnaire items were considered as *dependent variables*.

Statistical analysis

Data from the questionnaire were recorded in a datafile in SPSS 24.0 (SPSS Inc., Chicago, IL) for Windows. The answers at each item were characterized through frequency distributions and contingency tables; to compare the answers between samples the Chi-squared test was used (with the Fisher's correction if necessary) and the Odds Ratios were calculated. We considered the $p \leq 0.05$ value as statistically significant (*) and the $p \leq 0.01$ value as highly significant (**).

Ethical statement

The participation in our study was voluntary. The subjects were informed about the study, the content of the questionnaire and signed the informed consent. The questionnaires were filled anonymously, in order to protect the subjects' intimacy and to obtain objective answers as much as possible.

Results

The first 5 items contain general assertions about the video resources available on YouTube, the students being asked if they agree or not with them, as it follows:
– Item 1: I use didactic movies from YouTube or proposed by my teachers, in my practical training;
– Item 2: I believe that the didactic movies from YouTube contain correct scientific information;
– Item 3: I believe that the didactic movies from YouTube contain complete scientific information;
– Item 4: I believe that the didactic movies from YouTube contain more scientific information than the regular lectures and practical stages;
– Item 5: I saw didactic movies on YouTube which contained wrong information.

The obtained results are presented in *Table 2* and *Table 3*.

Table 2. The students' general opinion about didactic movies

	Level of agreement - % YES answers						
	Total sample	Feminine gender	Masculine gender	p value	Age <=21	Age > 21	p value
Item 1	91.2%	93.7%	84.1%	0.054	89.1%	97.6%	0.074
Item 2	77.6%	77.8%	77.3%	0.945	76.6%	81.0%	0.553
Item 3	17.1%	17.5%	15.9%	0.814	12.5%	31.0%	0.006**
Item 4	21.8%	23.0%	18.2%	0.504	24.2%	14.3%	0.176
Item 5	68.2%	70.6%	61.4%	0.255	65.6%	76.2%	0.202

Table 3. The Odds Ratios for agreement with Items 1-5

	Masculine gender			Feminine gender			AGE <= 21			AGE > 21		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
		Lower	Upper		Lower	Upper		Lower	Upper		Lower	Upper
Item 1	0.358	0.122	1.055	2.791	0.948	8.213	0.199	0.025	1.558	5.035	0.642	39.502
Item 2	0.971	0.428	2.207	1.029	0.453	2.339	0.769	0.321	1.838	1.301	0.544	3.112
Item 3	0.894	0.353	2.266	1.118	0.441	2.833	0.319	0.138	0.737	3.138	1.357	7.255
Item 4	0.743	0.311	1.776	1.345	0.563	3.215	1.918	0.738	4.979	0.522	0.201	1.354
Item 5	0.660	0.322	1.354	1.515	0.739	3.105	0.597	0.269	1.325	1.676	0.754	3.724

From these results we can see that most students (91.2%) use didactic movies in their practical training, more girls than boys, with ages bigger than 21. More than three quarters of students (77.6%) think that the didactic movies from YouTube contain correct scientific information, with no differences between genders and a slight increase in the case of older students. It is instead interesting to notice that, even if the didactic movies from YouTube are popular, the students are reserved in which concerns their quality: only 17.1% of them think that such movies contain complete information and only 21.8% think that such resources are more useful than the regular lectures and practical stages; the girls like more than boys, but not statistically significant, these resources, as well as the younger students (with age <12); a significant percentage of older students (31.0%) think that the didactic movies contain complete scientific information (table 2). The Odds Ratios study show increased chances for the older students (3.138) to have a very good opinion about the scientific quality of these resources (table 3). It is also important to

notice that most students (68.2% of them) declared that they saw didactic movies on YouTube with wrong information, fact that explain their reserve (*Table 2*).

The next 7 items ask the students to make a comparison between the quality of learning using didactic movies uploaded on YouTube and the traditional methods – oral speech accompanied by written explanations and oral speech accompanied by PowerPoint presentations. The three teaching methods (depicted with M1, M2 and M3) are characterized through specific assertions, labelled from Item 6 to Item 12, as it follows:

– Item 6: The method M1/M2/M3 is the clearest way to explain new concepts;
– Item 7: The method M1/M2/M3 is the most detailed way to explain new concepts;
– Item 8: The method M1/M2/M3 catches the best my attention during the classes of practical stages;
– Item 9: The method M1/M2/M3 stimulates the best my interest during the classes of practical stages;
– Item 10: The method M1/M2/M3 helps me to understand better the presented concepts;
– Item 11: The method M1/M2/M3 helps me to learn easier the presented concepts;
– Item 12: The method M1/M2/M3 helps me to perform better the practical maneuvers.

The students were asked if they agree or not with each assertion. The results are presented in *Tables 4 - 9*.

Table 4. The students' opinion about the quality of learning using didactic movies (M1)

Item:	Level of agreement - % YES answers						
	Total sample	Feminine gender	Masculine gender	p value	Age <=21	Age > 21	p value
M1 – Item 6	51.8%	52.4%	50.0%	0.786	48.4%	61.9%	0.130
M1 – Item 7	51.2%	51.6%	50.0%	0.856	46.1%	66.7%	0.021*
M1 – Item 8	78.8%	76.2%	86.4%	0.155	76.6%	85.7%	0.208
M1 – Item 9	77.1%	76.2%	79.5%	0.649	77.3%	76.2%	0.877
M1 – Item 10	87.6%	88.1%	86.4%	0.764	85.9%	92.9%	0.183
M1 – Item 11	87.1%	85.7%	90.9%	0.377	83.6%	97.6%	0.011*
M1 – Item 12	88.8%	90.5%	84.1%	0.247	89.1%	88.1%	0.863

The 74.6% of the students have a good opinion about the quality of learning using didactic movies. They are slightly reserved in which concerns the clarity and accuracy of didactic movies –and become more trustful with the age: 61.9% students with age > 21 appreciate the clarity of didactic movies, and 66.7% students with age > 21 appreciate the level of details – amount significantly higher than the global average of 51.2%. Instead, the most students (over 75%) appreciate the other features of didactic movies, i.e. their potential to catch attention and interest and to facilitate the understanding and learning processes (*Table 4*).

Table 6. The students' opinion about the quality of learning using oral speech accompanied by PowerPoint presentations (M2)

	Level of agreement - % YES answers						
	Total sample	Female students	Male students	p value	Age <=21	Age > 21	p value
M2 – Item6	37.1%	38.9%	31.8%	0.403	38.3%	33.3%	0.565
M2– Item7	37.6%	38.9%	34.1%	0.572	37.5%	38.1%	0.945
M2 – Item8	31.8%	31.7%	31.8%	0.993	31.3%	33.3%	0.801
M2 – Item9	30.6%	33.3%	22.7%	0.189	31.3%	28.6%	0.744
M2 – Item10	50.0%	50.0%	50.0%	1.000	48.4%	54.8%	0.477
M2 – Item11	51.2%	54.0%	43.2%	0.218	50.0%	54.8%	0.592
M2 – Item 12	40.0%	42.9%	31.8%	0.198	39.1%	42.9%	0.663

Table 7. The Odds Ratios for agreement with M2 - Items 6-12

	Masculine gender			Female students			AGE <= 21			AGE > 21		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
		Lower	Upper		Lower	Upper		Lower	Upper		Lower	Upper
M2 -Item 6	0.733	0.354	1.519	1.364	0.658	2.825	1.241	0.595	2.584	0.806	0.387	1.679
M2 - Item 7	0.813	0.396	1.668	1.230	0.599	2.525	0.975	0.475	2.000	1.026	0.500	2.103
M2 - Item 8	1.003	0.480	2.097	0.997	0.477	2.083	0.909	0.433	1.910	1.100	0.524	2.311
M2 - Item 9	0.588	0.265	1.304	1.700	0.767	3.770	1.136	0.528	2.446	0.880	0.409	1.894
M2 - Item 10	1.000	0.503	1.987	1.000	0.503	1.987	0.776	0.386	1.562	1.289	0.640	2.594

M2 - Item 11	0.648	0.325	1.295	1.543	0.772	3.081	0.826	0.410	1.663	1.211	0.601	2.436
M2 - Item 12	0.622	0.301	1.286	1.607	0.778	3.321	0.855	0.422	1.733	1.170	0.577	2.372

The teaching using oral speech accompanied by PowerPoint Presentations, even if is still widely used, is not so popular among students. About one third of them (39.7%) appreciate its clarity, accuracy and its potential to catch attention and interest, and about half value its potential to facilitate the understanding and learning processes, without significant differences between genders and age groups (table 6). The male students do not like particularly this teaching style and the female students are more likely to appreciate its capacity to stimulate the interest (1.700) and to facilitate the learning of practical skills (1.607); the separation of students in age ranges doesn't reveal significant chances for any group (younger and older) to appreciate for specific reasons the teaching using oral speech and PowerPoint Presentations (*Table 7*).

Table 8. The students' opinion about the quality of learning using oral speech accompanied by written explanations at the blackboard (M3)

	Level of agreement - % YES answers						
	Total sample	Female students	Male students	p value	Age <=21	Age > 21	p value
M3 – Item6	48.8%	50.0%	45.5%	0.604	55.5%	28.6%	0.002**
M3 – Item7	51.8%	52.4%	50.0%	0.786	59.4%	28.6%	0.001**
M3 – Item8	41.8%	46.8%	27.3%	0.024*	44.5%	33.3%	0.202
M3 – Item9	41.2%	46.0%	27.3%	0.030*	43.0%	35.7%	0.407
M3 – Item10	59.4%	61.1%	54.5%	0.445	64.1%	45.2%	0.031*
M3 – Item11	47.6%	52.4%	34.1%	0.037*	48.4%	45.2%	0.719
M3 – Item 12	35.3%	38.9%	25.0%	0.097	34.4%	38.1%	0.662

Table 9. The Odds Ratios for agreement with M3 - Items 6-12

	MALE students			FEMALE students			AGE <= 21			AGE > 21		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
		Lower	Upper		Lower	Upper		Lower	Upper		Lower	Upper
M3 -Item 6	0.833	0.419	1.659	1.200	0.603	2.389	3.114	1.464	6.624	0.321	0.151	0.683
M3 - Item 7	0.909	0.458	1.806	1.100	0.554	2.186	3.654	1.714	7.787	0.274	0.128	0.583
M3 - Item 8	0.426	0.201	0.902	2.348	1.109	4.972	1.606	0.774	3.332	0.623	0.300	1.293
M3 - Item 9	0.440	0.208	0.931	2.275	1.074	4.816	1.356	0.659	2.791	0.737	0.358	1.517
M3 - Item 10	0.764	0.382	1.527	1.310	0.655	2.619	2.158	1.064	4.375	0.463	0.229	0.940
M3 - Item 11	0.470	0.230	0.961	2.127	1.041	4.346	1.137	0.565	2.289	0.879	0.437	1.770
M3 - Item 12	0.524	0.242	1.132	1.909	0.883	4.126	0.851	0.414	1.752	1.175	0.571	2.418

The last analyzed teaching method was the traditional one, i.e. oral speech accompanied by written explanations at the blackboard. It is interesting to notice that this teaching method is slightly more popular among students than the using of PowerPoint presentations; the global percentage of students which approve it is 46.6%. The female students appreciate significantly more than the males its potential to catch the attention (46.8%), to stimulate the interest (46.0%) and to facilitate the learning (52.4%). The younger students appreciate significantly more than the older its clarity (55.5%), level of details (59.4%) and its potential to facilitate the understanding (64.1%), (table 8).

The last 15 items in the questionnaire enlist several features that can be used in the design of didactic movies; they were not randomly selected, being directly responsible for the educational videos' cognitive value. This parameter measures an educational video's quality as a function of the number of Likes, its quality being defined as the level of learning or understanding provided (Shoufan, 2019).

The researches on this subject identified a few features as significant for the video cognitive value: (1) The spatial contiguity principle: The placing of printed words near corresponding parts of graphics; (2) The modality principle: The text is presented as narration rather than on-screen words; (3) The pretraining principle: The names and behaviors of new system components are explained before explaining the entire system; (4) The embodiment principle: The explaining

of already-drawn diagrams instead of drawing diagrams during explanations; (5) The Khan-style of production (Khan, 2011), which comes behind using paper explanations and PowerPoint presentations; (6) The instructor's skills: English speaking as native language and increased talking speed.

Other features were also analyzed, being found as not significant (Lagerstrom, Johanes, & Ponsukcharoen, 2015): the speaker's gender, the video length, the coherence principle (the exclusion of unrelated images or background music), the signalling principle (the highlighting and visual pointing of particular aspects which are also verbally described), the redundancy principle (the narration without on-screen doubling text), the temporal contiguity principle (the simultaneously presentation of narration and related animation), the personalization principle (the conversational style using instead of formal style) and the voice principle (the using of spoken friendly human voice instead of a machine voice).

We analyzed also these features, asking the students whether they like them or not, in order to compare them with the results known from literature; we depicted them as it follows:

– Feature 1-a: The narrator's voice is human;
– Feature 1-b: The narrator's voice is computer generated;
– Feature 2-a: The narrator is male;
– Feature 2-b: The narrator is female;
– Feature 3-a: The narrator is speaking in English;
– Feature 3-b: The narrator is speaking in Romanian;
– Feature 4-a: The narrator's talking speed is high;
– Feature 4-b: The narrator's talking speed is low;
– Feature 5-a: The narrator's talking style is friendly;
– Feature 5-b: The narrator's talking style is formal;
– Feature 6-a: The movie contains background music;
– Feature 6-b: The movie doesn't contain background music;
– Feature 7-a: The movie contains images used to fill the breaks, for esthetic reasons;
– Feature 7-b: The movie doesn't contain images used to fill the breaks;
– Feature 8-a: The narrator's speech is accompanied by subtitles;
– Feature 8-b: The narrator's speech is not accompanied by subtitles;
– Feature 9-a: The explicative notes for figures are displayed at the bottom of the screen;
– Feature 9-b: The explicative notes for figures are displayed directly on the drawing;
– Feature 10-a: The explanatory figures are already drawn, being just explained in the movie;
– Feature 10-b: The explanatory figures are drawn during the explanations;
– Feature 11-a: The narrator's speech is accompanied by animated schemes with explanations;

– Feature 11-b: The narrator's speech is not accompanied by animated schemes with explanations;
– Feature 12-a: The narrator's speech is accompanied by drawings to emphasize the key points;
– Feature 12-b: The narrator's speech is not accompanied by drawings to emphasize the key points;
– Feature 13-a: The movie is well-structured; it explains the basic notions at first and then the complex ones;
– Feature 13-b: The movie is heterogeneous, like a free exposure;
– Feature 14-a: The movie is designed as a lecture hour; the teacher is recorded at the blackboard, where he explains and makes drawings and schemes;
– Feature 14-b: The movie is designed as a PowerPoint presentation, with images, diagrams and animated schemes;
– Feature 15-a: The movie's total length is at most 6 minutes;
– Feature 15-b: The movie is as long as it should be.

Our goal was to identify those features which increase the didactic movies degree of attraction, making them more popular. The obtained results are presented in *Tables 10* and *11*.

Table 10. The students' opinion about certain features that can be used in the design of didactic movies

	Level of agreement - % YES answers						
	Total sample	Female students	Male students	p value	Age <=21	Age > 21	p value
Feature 1-a	94.7%	93.7%	97.7%	0.299	96.1%	90.5%	0.155
Feature 1-b	5.3%	6.3%	2.3%		3.9%	9.5%	
Feature 2-a	48.8%	50.8%	43.2%	0.116	46.9%	54.8%	0.445
Feature 2-b	35.9%	37.3%	31.8%		35.9%	35.7%	
Feature 3-a	5.3%	6.3%	2.3%	0.442	7.0%	0.0%	0.152
Feature 3-b	82.4%	82.5%	81.8%		79.7%	90.5%	
Feature 4-a	22.4%	21.4%	25.0%	0.624	22.7%	21.4%	0.868
Feature 4-b	77.6%	78.6%	75.0%		77.3%	78.6%	
Feature 5-a	74.7%	77.0%	68.2%	0.472	75.8%	71.4%	0.776
Feature 5-b	22.4%	20.6%	27.3%		21.1%	26.2%	
Feature 6-a	35.3%	33.3%	40.9%	0.263	35.2%	35.7%	0.898
Feature 6-b	61.2%	61.9%	59.1%		60.9%	61.9%	

Feature 7-a	56.5%	57.1%	54.5%	0.765	53.9%	64.3%	0.239
Feature 7-b	43.5%	42.9%	45.5%		46.1%	35.7%	
Feature 8-a	75.3%	75.4%	75.0%	0.910	74.2%	78.6%	0.652
Feature 8-b	21.2%	21.4%	20.5%		22.7%	16.7%	
Feature 9-a	29.4%	23.8%	45.5%	0.009 **	26.6%	38.1%	0.029 *
Feature 9-b	66.5%	73.0%	47.7%		71.1%	52.4%	
Feature 10-a	24.7%	23.0%	29.5%	0.654	24.2%	26.2%	0.919
Feature 10-b	69.4%	70.6%	65.9%		69.4%	69.0%	
Feature 11-a	90.6%	90.5%	90.9%	0.950	91.4%	88.1%	0.703
Feature 11-b	6.5%	6.3%	6.8%		6.3%	7.1%	
Feature 12-a	93.5%	92.9%	95.5%	0.423	93.0%	95.2%	0.460
Feature 12-b	6.5%	7.1%	4.5%		7.0%	4.8%	
Feature 13-a	85.9%	85.7%	86.4%	0.915	85.9%	85.7%	0.971
Feature 13-b	14.1%	14.3%	13.6%		14.1%	14.3%	
Feature 14-a	55.3%	54.8%	56.8%	0.953	53.1%	61.9%	0.404
Feature 14-b	39.4%	39.7%	38.6%		42.2%	31.0%	
Feature 15-a	37.1%	42.1%	22.7%	0.051*	40.6%	26.2%	0.149
Feature 15-b	60.6%	56.3%	72.7%		57.8%	69.0%	

In some cases, we found several students who didn't express a clear option, agreeing to both presented variants; those cases were removed from the analysis. Our study does not reveal many significant differences between boys and girls and between younger and older students in which concerns the features they prefer in the design of didactic movies.

Table 10 shows that the most popular movies among students have the following features: human (94.7%), male (48.8%) narrator, who speaks in Romanian (82.4%), slowly (77.6%), friendly (74.7%), without background music (61.2%) and with images to fill the breaks (56.5%). The narrator's speech must be accompanied by subtitles (75.3%), the explicative notes for charts and drawings must be displayed directly on the drawing (66.5%), the explanatory schemes and diagrams must be drawn during the explanations (69.4%) and the narrator's speech must be accompanied by animated schemes with explanations (90.6%) and by drawings to emphasize the key points (93.5%). The movie must have a clear structure, starting from basic notions and continuing with the complex ones (85.9%), and it is better to design it as a lecture hour, recording the teacher at the blackboard, where he explains and makes drawings and schemes (55.3%); the movie's length is not restricted, denying the "Myth of the Six Minute rule" (60.6%) – this confirm the results reported by literature (Lagerstrom , Johanes, & Ponsukcharoen, 2015), according to which the students maintain attention for long time when they

understand well the explanations. The only significant differences between the students' opinions are the followings: (1) most female students (73.0%), as well as younger students (71.1%) prefer the displaying of explicative notes for charts directly on the drawing, while the male students and the older ones have equally distributed opinions about this; (2) most male students (72.7%) think that the movie must be as long as necessary, while the females' opinions are split; 56.3% of them think the same, but 42.1% think that a didactic movie must have at most 6 minutes.

Table 11. The Odds Ratios for agreement with Features 1-15, a-b

	MALE students			FEMALE students			AGE <= 21			AGE > 21		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
		Lower	Upper		Lower	Upper		Lower	Upper		Lower	Upper
Feature 1-a	2.915	0.354	23.997	0.343	0.042	2.824	2.589	0.662	10.131	0.386	0.099	1.511
Feature 1-b	0.343	0.042	2.824	2.915	0.360	21.708	0.386	0.099	1.511	2.589	0.662	10.131
Feature 2-a	0.736	0.369	1.470	1.358	0.680	2.711	0.729	0.362	1.468	1.372	0.681	2.762
Feature 2-b	0.784	0.378	1.628	1.275	0.614	2.645	1.010	0.488	2.089	0.990	0.479	2.049
Feature 3-a	0.343	0.042	2.824	2.915	0.354	23.997						
Feature 3-b	0.952	0.390	2.326	1.051	0.430	2.567	0.413	0.135	1.261	2.422	0.793	7.397
Feature 4-a	1.222	0.547	2.732	0.818	0.366	1.829	1.074	0.461	2.501	0.931	0.400	2.168
Feature 4-b	0.818	0.366	1.829	1.222	0.547	2.732	0.931	0.400	2.168	1.074	0.461	2.501

Feature 5-a	0.641	0.300	1.367	1.561	0.731	3.331	1.252	0.573	2.736	0.799	0.365	1.747	
Feature 5-b	1.442	0.654	3.182	0.693	0.314	1.530	0.753	0.336	1.691	1.327	0.591	2.979	
Feature 6-a	1.385	0.684	2.805	0.722	0.357	1.463	0.976	0.471	2.021	1.025	0.495	2.122	
Feature 6-b	0.889	0.441	1.791	1.125	0.558	2.266	0.960	0.469	1.966	1.042	0.509	2.133	
Feature 7-a	0.900	0.451	1.795	1.111	0.557	2.216	0.650	0.316	1.336	1.539	0.749	3.164	
Feature 7-b	1.111	0.557	2.216	0.900	0.451	1.795	1.539	0.749	3.164	0.650	0.316	1.336	
Feature 8-a	0.979	0.443	2.165	1.022	0.462	2.259	0.785	0.340	1.813	1.274	0.552	2.941	
Feature 8-b	0.943	0.404	2.200	1.061	0.455	2.474	1.465	0.589	3.642	0.683	0.275	1.698	
Feature 9-a	2.667	1.296	5.485	0.375	0.182	0.771	0.588	0.282	1.227	1.701	0.815	3.552	
Feature 9-b	0.337	0.166	0.687	2.964	1.456	6.030	2.236	1.093	4.575	0.447	0.219	0.915	
Feature 10-a	1.403	0.650	3.027	0.713	0.330	1.538	0.901	0.406	2.000	1.110	0.500	2.466	
Feature 10-b	0.804	0.387	1.671	1.244	0.598	2.586	1.023	0.481	2.176	0.978	0.460	2.079	
Feature 11-a	1.053	0.321	3.452	0.950	0.290	3.115	1.437	0.469	4.405	0.696	0.227	2.132	
Feature 11-b	1.079	0.273	4.263	0.927	0.235	3.660	0.867	0.219	3.428	1.154	0.292	4.564	

Feature 12-a	1.615	0.335	7.782	0.619	0.129	2.982	0.661	0.137	3.189	1.513	0.314	7.296
Feature 12-b	0.619	0.129	2.982	1.615	0.335	7.782	1.513	0.314	7.296	0.661	0.137	3.189
Feature 13-a	1.056	0.390	2.855	0.947	0.350	2.563	1.019	0.376	2.762	0.982	0.362	2.663
Feature 13-b	0.947	0.350	2.563	1.056	0.390	2.855	0.982	0.362	2.663	1.019	0.376	2.762
Feature 14-a	1.087	0.544	2.171	0.920	0.461	1.838	0.697	0.342	1.423	1.434	0.703	2.925
Feature 14-b	0.957	0.473	1.935	1.045	0.517	2.113	1.628	0.775	3.420	0.614	0.292	1.291
Feature 15-a	0.405	0.184	0.892	2.468	1.122	5.433	1.928	0.890	4.177	0.519	0.239	1.123
Feature 15-b	2.066	0.975	4.378	0.484	0.228	1.026	0.614	0.292	1.291	1.628	0.775	3.420

Discussion

Previous studies (Saurabh & Gautam, 2019; Klobas *et al.*, 2018) reported that the male students are more attracted by YouTube resources than the female students; our study, instead, found that the female students (93.7%) are more attracted than male students (84.1%) to use didactic movies in their professional training, even if the difference is not statistically significant. This is not a contradiction with the scientific literature; we can correlate it with the fact that, in dental medicine specialization, the amount of female students is generally bigger than the amount of male students. Our sample of study was not perfectly balanced in which concerns the gender distribution, and this situation can be the source of some discrepancies we found.

The students older than 21 are the most interested in learning with didactic movies; they agree that the didactic movies are the most detailed way to explain new concepts (OR = 2.339), helping them to learn easier the scientific concepts (OR = 8.047); it is obvious that such students have a bigger experience, being more capable to make the difference between valuable information and random errors.

Our results confirm the data from literature, according to which the multimedia, and especially the movies, are able to catch very well the learner's attention; this is a significant advantage, but it also has some drawbacks, because the research showed equally that such resources can split the learner's attention between the information sources (Amadieu, Lemarie, & Tricot, 2017), disrupting the generation of relations between representations.

In which concerns the teaching with traditional methods, the Odd Ratio calculation (table 9) shows no particular interest of male students, aged > 21, in this teaching method, while the female students are more likely to appreciate, again, its potential to catch the attention (2.348) and the interest (2.275) and to facilitate the learning of theoretical concepts (2.127). The younger students (age <= 21) have increased chances to appreciate this teaching method for clarity (3.114), level of provided details (3.654) and potential to facilitate the understanding (2.158) of new concepts. A possible explanation for this preference is the fact that the younger students are still familiar with this teaching style, which is widely used in high schools.

Regarding the study of features preferred by students in didactic movies, we found only two significant observations (*Table 11*): (1) The female students are more likely to prefer the following features of didactic movies: displaying the explicative notes for charts directly on the drawing (2.964) and movie's length at most 6 minutes (2.468); (2) The younger students (age ≤ 21) have increased chances to prefer the displaying the explicative notes for charts directly on the drawing (2.236).

Therefore, the results of our study generally confirm the data known from literature, according to which the students appreciate this teaching method, learning better from text and pictures than from text alone (Mayer, 2019) and the multimedia using in educational process catch the students' attention and interest (Logan & Mayer, 2018). The multimedia and animations help the learners (Amadieu, Lemarie, & Tricot, 2017) by facilitating the deep comprehension of the material and the construction of coherent mental models involving the relevant information.

There is no doubt that we are facing nowadays with a paradigm shift in teaching; the classical style becomes slowly obsolete, and the students react better and better to new teaching styles, based on visual information, with dynamic content. Our results confirm those previously reported (Gutierrez-Braojos, *et al.*, 2019; Dziuban *et al.*, 2011; Raes *et al.*, 2020), which showed a high degree of satisfaction with multimedia learning approaches in universities in general, as well as particular in the faculties of dentistry (Varthis & Anderson, 2018). Most students believe that such blended methods have an increased potential to improve their knowledge (Reissmann *et al.*, 2015; Cheng *et al.*., 2019) and the analyses of their results generally confirm that they perform better in their final examinations than those who had been taught only by traditional methods (Cheng *et al.*, 2019). Evans Ozdalga, & Ahuja (2016) showed that the future trend will probably be towards a

minimal use of traditional lectures (Ariana *et al*., 2016), to which the attendance will become unnecessary (Twenge, 2013; El-Ali *et al.*, 2019) and a wider use of web-meetings, online classes and "hands-on" courses, which combine the new teaching styles based on multimedia (Lancaster, McQueeney, & Van Amburgh, 2011; Phillips, 2015).

Conclusion

It is undeniable that the educational movies uploaded on YouTube are an adequate source of information for the dental students and its popularity increases constantly. The teachers' task is to accept the potential of this quite new didactic tool and to use its advantages in a constructive way, by searching such materials and challenging the students with them. The main difficulty in this endeavour is the scientific quality of the available resources, which sometimes has shortcomings. Since it is not reasonable to think about collecting and evaluating all the existent materials, in order to identify the useful ones and to eliminate the others, the only pragmatic solution is more involvement, from universities and medical schools, in the developing of new such resources, designed by professionals and containing authentic valuable information.

Recommendations

Considering these results and their possible implications, several recommendations for future research can be made. This study was about the efficacy of video resources among dental students, so that future research should investigate the same issue among general medicine students; this may be extremely helpful to see the larger picture. Also, we investigated a limited list of preferred features in didactic movies; this list can be extended by identifying more significant features, eventually correlated with the new technologies. For example, the 3D movies and the FX effects can have a great potential and bigger audience among students and, particularly speaking, among medical students. Third, the students' appetite for teaching films can be correlated with other related issues, such as the frequent use of other Internet services, the appetite for online education, and even the general psychological profile.

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