The Impact of Short and Very Short Videos on the Effectiveness of Teaching and the Principles of Their Development

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Abstract - **Short video content for education is increasingly appearing as part of educational content. This was especially evident during the COVID19 crisis. Not only have they persisted, but they are taking an ever-increasing share in classical education Video material not only needs to be developed in accordance with the pedagogical principles, it also needs to keep students' engagement and promote active learning. The length of video material is an important element that needs to be considered in development of teaching contents - how long the video should be. The article outlines active learning guidelines for teaching with video materials and the impact of the length of video materials (short and even shorter) on learning effectiveness. This article reviews previously published research and the results of the research projects conducted in three sixth grade classes in primary schools in Juršići, Marčana and Rovinj. The research included 55 elementary school students and video materials for the subject of Informatics. Students in each class were divided into two groups: One group of students was presented with a short video of 13:27 minutes, and the other group was presented with ten very short videos, ranging from 0:27 to 2:59 minutes.**

Keywords - short videos; very short videos; effectiveness of teaching

I. INTRODUCTION

Videos has become an big part of all levels of education. It is integrated into schools and universities as part of traditional teaching. The question arises as to how long the video teaching material should be. How long is too long and how short is too short? A number of studies have been conducted on how long a video lesson should be in order for viewers to follow it from start to finish. A 45-minute lecture is more than the average student can handle, and not because of shrinking attention spans. It is too hard to listen to someone's monologue for a long time. In addition, video content works in a different way than traditional teaching, and a long video is not only unnecessary, but can also be counterproductive. The majority of users in the conducted research stated that they want educational video content to be shorter than 20 minutes, and they prefer concentrated video content lasting 3 to 6 minutes. As teachers, we know how difficult it is to make a 6-minutes video teaching unit.

A 2018 study [1] "New Research: Video Statistics, Habits, and Trends You Need To Know" found that more than 50% of people prefer videos between three and six minutes long, and just over 25% of them prefer video length of 3 to 4 minutes and the same percentage prefers video recordings of 5 to 6 minutes. The question a video course developer asks is "How long can the viewer's attention be held to deliver the necessary information. Knot [1] states that the reason people stop watching content has nothing to do with the length of the video. They found that 83% of viewers will continue watching the video recording if they are interested in the content's topic.

TED talk [2] has an 18 minute speech rule. According to TED curator Chris Anderson, the 18-minute video is long enough to be serious and short enough to hold attention. Speakers who are used to speaking for 45 minutes think about what exactly they want to say and then shorten their presentation.

Keep in mind that video content is a passive type of learning. How much attention can you expect from students in a one-way conversation? Students want the opportunity to put the acquired knowledge into action. After watching the video, they want to experience what they have learned. Therefore, a 45-minute lecture divided into seven or eight videos will be more effective than a single presentation [2].

Teachers who create teaching material using the method of instructional designers sometimes exaggerate the amount of content they offer students at the expense of greater content value. These are not the same [3]

In creating teaching content, teaching outcomes should always be the main objective. It is important for students to get to the essence of the lesson in as little time as possible [4]

Research conducted on a large number of Massive open online courses found that the most acceptable educational video contents are those lasting up to 6 minutes, and students were most focused on those lasting up to 3 minutes [4].

As many as 95% of the videos on the Boclips platform are shorter than 6 minutes. [5]

A study conducted at the University of Wisconsin-Stout concluded that videos had a positive impact on their learning. Students at the University of Wisconsin-Stout want the videos to last no longer than 15 minutes [6]

The Wistia (Video Hosting and Marketing Tools for Business) web portal hosts over half a million business educational videos, with more than 1.3 billion views. It was found that student engagement initially declines from the first to the third minute; it is constant from the third to the twelfth minute and it drops significantly after the 12th minute mark [7]

YouTube offers many educational videos. It has been measured that the median user's engagement time for videos up to six minutes long was close to 100%, however, with videos of 9-12 minute long, the engagement was 50% and for videos that were 12-40 minute long, the engagement was ~20% [8][9].

The next aspect that needs to be addressed is the question: How video content affects cognitive development, that is, how students remember the material presented through video lessons. Teachers, when creating video content, should try to minimize the external cognitive load, that is, they should take into account the intrinsic (what leads the students to the activity) cognitive load of the students. Two facts are known: first, working memory has a limited capacity and second, working memory must process information to be encoded in long-term memory. Working memory should accept, process and send only important information to long-term memory [10].

Additionally, the cognitive theory of multimedia learning considers that working memory has two channels (visual and verbal) for collecting and processing information [11][12]. Using both channels increases the working memory capacity, but both can become overloaded [13]. Consequently, if a video content creator uses both channels, there is a greater chance for better teaching.

Brame [13] points out that when creating teaching material, it is necessary to take care of three components: a) cognitive load, b) content that encourages student engagement and c) content that will contribute to active learning. Cognitive load is represented by a) Signaling, b) segmentation for sharing information, removing redundant information and c) using audio and visual channels to convey complementary information. Student engagement includes several recommendations: a) keep each video short, b) the teacher when creating the video should use simple language and speak quickly and enthusiastically, and c) should create videos to emphasize relevance to the lesson. Active student learning implies the following elements: a) give students both video and questions to help them learn, b) videos should have features that allow students to have control over the video, and d) videos are a good source of learning material that students will use for their homework.

"Signaling (cueing) [14], is the use of text or symbols in videos to highlight important information." Signaling helps direct students' attention and serves to process information in working memory. Signaling can reduce external load on users and thus helps determine which content is important. Mayer and Moreno [12] and deKoning et al. [14] showed that this approach improves students' ability to learn from animations, and Ibrahim et al. [10] showed that these effects extend to video content as well.

As previously known, active learning has great advantages over passive learning [15] (in [16] and [17]). If video contents promote cognitive activity, teaching effectiveness will increase. Self-regulation is a process that requires students to monitor their own learning. This will allow them to recognize learning difficulties and adapt to the process of active learning. Active learning is aided by the creation of interactive videos. Interactive video, according to Matijević, is a non-linear digital video technology that allows students to pay full attention to educational materials and review each part of the video as many times as they want" [18].

There are two ways of learning interactively: In the first, the student is given feedback after their answer, and in the second, the student is invited to participate in activities that trigger cognitive processes. There are three structures of an interactive video. In the first, students decide at the beginning of the video which video they want to watch. In order for the student to choose another video recording, they must go back to the beginning. In the second structure, the student can choose an-other path at any time, i.e. watch another video. The third structure is one in which the student decides what will happen at each step, that is, there are several possible pathways that the student can choose [18]. The main purpose of interactive visual essays is for students to receive feedback and to move from passive to active learning.

Brame [13] gives recommendations for developing videos:

• Keep videos short and focused on learning objectives.

• It is necessary to use audio and visual elements in teaching to make these elements complementary and not redundant.

• It is necessary to use signaling to highlight important ideas or concepts.

• Use an enthusiastic conversational style in the speech to increase student engagement.

• Videos need to encourage active learning with the help of guiding questions, interactive elements or link them to homework.

The website learndash.com [2] suggests creation of shorter videos. Some of the reasons are:

1 - Learning in *small bites*

2 - Increased student engagement

3 - Makes the most of available learning time

4 - Increases the perceived value of video content (material)

II. RESEARCH

A) Methods and Participants

For the purposes of teaching in primary schools and for this research project, an educational material called Maps and Files was created for students of the 6th grade in the subject of Informatics, in the domain Information and digital technology, which covers the teaching unit Creation and basic operations with maps and files, on to the OneDrive service. A video between 6 and 18 minutes long is considered a short video, and less than 6 minutes is considered a very short video. The length of the entire educational video is 13:40 minutes (available on the YouTube service at the link: https://www.youtube.com/watch?v=jelv6KQr8AE). Teaching material contains ten short units. The short video is presented as one unit, while the category of very short videos is presented in 10 short (separate) video units.

Teaching units are:

1. Login to the OneDrive system - 0:21 minutes long (available at https://www.youtube.com/watch?v=BSE22o84BJM),
2. Creating maps - 1:17 minutes long (available at https://www.youtube.com/watch?v=bAxlI-ClsGY),
3. Creating Word (Office 365) file - 0:17 minutes long (available at https://www.youtube.com/watch?v=film3Np7a8o),
4. Editing of Word file - 2:00 minutes long (available at https://www.youtube.com/watch?v=UfnHPONJ4Qw)
5. Renaming – 0:48 minutes long (available at https://www.youtube.com/watch?v=KSN9kvuspaQ),
6. Downloading file on the computer – 1:40 minutes long (available at https://www.youtube.com/watch?v=QsgFRzPLERg),
7. Transferring file – 2:59 minutes long (available at https://www.youtube.com/watch?v=rNiQyvj__bI),
8. Sharing maps or files via usernames – 1:55 minutes long (available at https://www.youtube.com/watch?v=KIauRF6Momg),
9. Sharing via links – 1:34 minutes long (available at https://www.youtube.com/watch?v=m32Xq6dn_t8) i
10. Finding maps and editing files – 0:40 minutes long (available at https://www.youtube.com/watch?v=vR5CUUbEUQw).

Fiftyfive 6th grade primary school students (34 girls and 21 boys) of primary schools in Rovinj (*Vladimir Nazor* Elementary School), Marčana and Juršići participated in the research.

Students were divided into two groups: Group I learned from a short video, one continues teaching unit and Group X learned from 10 very short videos.

Group I consisted of 27 students (14 girls and 13 boys), and Group X consisted of 28 students (20 girls and 8 boys). Group I had an average grade in Informatics from the previous (fifth) grade of 4.50 (girls 4.55 and boys 4.38 - using the *t-test* it was determined that there was no statistically significant difference in the average grade between boys and girls, t=1.38, p<0.05), and Group X had an average grade of 4.11 (girls 3.86 and boys 4.38 - using the *t-test* it was determined that there was no statistically significant difference in the average grades

between boys and girls, t=1.38, p<0.05). Boys from Group I and Group X had the same average (4.38). The girls from Group I had an average score of 4.55, and the girls from Group X, had an average score of 3.86. Using the *t-test*, it was determined that there is a statistically significant difference in the average grade between the girls of Group I and Group X with t=2.1 and p<0.05. Girls from Group I have a higher average score than girls from Group X.

Using the *t-test*, it was determined that there was no statistically significant difference in the average grade of all students between Group I and Group X with t=1.63 and p<0.05.

B) Student's Testing

In order to test what students learned, a test consisting of eight practical tasks was created. For each task, students could get from a minimum of 0 to a maximum from 2-5 points (depending on the task). No points were scored for an incomplete task. The entire test could bring a total of 29 points. Testing was done via a remote learning system, which also evaluated the test results.

III. RESULTS AND ANALYSIS OF THE CONDUCTED RESEARCH

Obtained results of the conducted research are presented in Table I.

TABLE I.   OBTAINED RESULTS OF STUDENT'S TESTING

	Group I.	Group X.
Total number of students [n]	27,00	28,00
Average points, all students [max=29]	22,11	23,19
Standard deviation	8,38	6,87
Average points, girls [max=29]	22,95	22,64
Standard deviation	7,72	7,72
Average points, boys [max=29]	20,00	23,77
Standard deviation	10,11	6,07

Students in Group X achieved slightly better results, but using the t-test it was determined that there was no statistically significant difference in the results of all students between Group I and Group X with t=0.52 at the significance level p<0.05.

The average results of the boys are slightly different (23.77 against 20.00 in favor of the boys from Group X) between Group I and Group X, but using the t-test it was determined that there is no statistically significant difference in the achieved results of all students between Group I. and Group X. with t=1.07, at the level of significance p<0.05.

The average results achieved by girls and boys within Group I are similar, and this also applies to Group X.

The average scores of girls between Group I and Group X are the same. With the fact that the initial level of knowledge of girls from Group I was significantly

higher than girls from Group X, it is concluded that there is a certain difference in favor of learning from shorter videos.

The obtained results indicated that there are no statistically significant difference between the effectiveness of short (length from 6 to 18 minutes) and very short (length up to 6 minutes) videos for students aged 12-13 years. This conclusion is limited by a) a relatively small sample, b) only one teaching unit and c) one teaching subject. To create a quality video material, the creator of teaching contents should ask the following questions: Who is my audience? What problem are they trying to solve? What are their goals? What will they need from me to accomplish those goals? What is their skill level? [19] and also be guided by the above guidelines: keep the video short, let it be about elements that influence student engagement and elements that promote active student learning.

IV. CONCLUSION

Many studies and articles have shown that learning from educational videos can be effective, depending on the approach to its development. It is important to take care that the video content is adapted to the age for which it is intended, and it is necessary to use clear and articulate speech and try to make such video content that will encourage student engagement. One long video of 45 minutes can always be divided into videos of up to 6 minutes, so it will be easier for students to adopt the material. Although the research clearly shows that short videos provide more benefits for students and the teachers who make them, sometimes it is justified to choose a video longer than six minutes, even though the attention slowly decreases. However, regardless of the potential of an individual or group to hold their attention, educational video materials should not be about testing people's mental stamina. Student needs or learning outcomes should be the main guidelines when creating video materials.

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