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Cognitive preferences displayed by the recipients of short, educational multimedia messages

Abstract: Contemporary students have had contact with dynamic multimedia transmission practically from birth. It is intensive exposure to hypertext sources of information, usually in the form of short multimedia messages, that has shaped their cognitive preferences. Research findings in the field of brain imaging even suggest changes in its structure. As a result, a series of reports about "digital dementia" of the young generation have sprouted. A pedagogical experiment carried out at the Department of Media and Information Technology revealed that the use of multimedia, prepared in accordance with preferences of the new kind of audience, has increased the quality and pace of the educational process. In this paper, the findings of the subsequent stage of the research, aimed at determining the optimal form of educational multimedia online messages, will be presented.

Key words: e-learning, blended learning, multimedia, ICT, cognitive preferences, teaching and learning methods.

Introduction

Laboratory classes at the Department of Media and Information Technology of the University of Zielona Góra are run by means of instructions available online. Observations made during the classes and in the course of students' own study, conducted between 2008 and 2014, revealed that timely and proper execution of tasks is increasingly becoming a problem. Even a preliminary analysis of the phenomenon suggests that snowballing difficulties in reading comprehension lie at the root of the conundrum. Also Aleksander Nalaskowski (2012, pp. 10-11) publishes data attesting to a steadily growing number of lower secondary school graduates with difficulties in understanding texts. The system of recruitment to upper secondary schools and to higher educational institutions that has been adopted in Poland fails to disqualify such persons, leading to a drastic decline in professional competence of graduates.

The scale of the phenomenon is evidenced by readership ratings for the year 2015, as revealed by research carried out by TNS Poland for the National Library. As many as 63.1% respondents maintained that in the year preceding the interviewer's visit had failed to read a single book, 18% had never read any books, and 57% had stopped reading upon completion of school education. General reluctance to read is clearly illustrated by the declaration of 54.4% of respondents that in the month preceding the interviewer's visit, they had failed to read a text longer than three typewritten pages.

Therefore, it was decided to explain the reasons behind the disappearance of readership and to ensure adequate effectiveness of education. The first stage of the research confirmed that it was the written form of communication that constituted the main component of students' ineffectiveness in understanding the content laboratory tasks. The assumption made it possible to continue our search aimed at determining the optimal forms of media education available online.

Reluctance to read as a symptom of changing cognitive preferences

It was assumed that the factors hindering reading comprehension skills appeared in early childhood as a consequence of uncontrolled access to electronic media. Children have contact with video messages almost from birth. The very dynamic pace of many cartoons is conducive to the cessation of the hiatus between the perception of a stimulus and the ensuing response, the result of which is a difficulty or even impossibility to create meaning from the ephemeral content. The uninterpreted message is somehow implanted into the brain of the child, replacing its own opinions and beliefs, thus creating a way of being, and even shaping worldviews.

Attempts to interpret the rapidly changing images instigate the formation of the so-called "brief glances." Children repeatedly look at different parts of the screen, collecting information necessary to understand the content of a message. Such TV/video viewers are finally enrolled in school, expected to learn to read, where letters must be placed next to other letters, words next to words, sentences next to sentences. Cognitive strategies employed to watching cartoons fail to yield satisfactory results and the emerging disappointment and weariness intensify the reluctance to read (D. de Kerckhove, 2001 pp.27-34).

Taking into account the achievements of modern cognitive psychology, we may assume that there occurs reorganisation of cognitive structures of the brain in children watching video streaming for many hours every day. This phenomenon (brain plasticity) was empirically confirmed by means of the functional magnetic resonance method, which allows observing the reorganisation and the formation of new synaptic connections between neurons as a result of the learning process. "Brief glances" therefore indicate at the existence of cognitive preferences aimed at the use of dynamic video messages.

Parents, having been persuaded by the media to believe that access to modern information technology constitutes a precondition of proper intellectual development of their children, hand their first tablet, computer and smartphone in to small children at early stages of their lives. Typically, the offspring, in an uncontrolled fashion, get access to dynamic video games and unlimited Internet resources. Thus, for many years they are immersed in entertainment content in the form of hypertext structures. The multitasking features of computers shape their competence in the use of multiple communication channels. Unfortunately, this requires haste and superficial analysis of the received messages.

The new way of perception is reflected in immense popularity of sites such as YouTube, Instagram, Flickr, Demotywatory, Kwejk, Vimeo, iTunes, Spotify or Facebook, all of which offer a number of short multimedia messages, i.e. photos, music, as well as audio and video recordings. Even popular channels of interpersonal communication make use of multimedia forms of communication and very short text messages.

Nicholas Carr (2013) attempted to determine the impact of the Internet on the human brain. He noted that as a result of the use of online hypertext sources, Internet users' manner of thinking follows suit. Thus, creativity and the ability to concentrate on longer batches of text disappear. Instead, there is a need to turn to network resources for ready-made solutions. He believes that long-term use of Internet resources leads to permanent changes in the brains of users, which he defines simply as digital stupidity.

Manfred Spitzer (2015) is of a similar view when presenting a series of arguments about the negative impact of computers on learning outcomes. He proves that the brain which receives ready information without the need for mental effort loses the ability to think independently. In this way, the use of own memory is accordingly impaired. The conviction about the availability of information demotivates Internet users to make attempts at remembering. People learn through expanding the existing knowledge with new information, thus the deliberately created gaps in knowledge hamper the process of learning.

Not all scientists agree with the statement that new forms of access to information and the corresponding cognitive strategies are a leading cause of contemporary pupils' educational difficulties. The authors of the report "L'enfant et les ecrans" see numerous changes in the behaviour of young people when in contact with the new media. However, they believe that these changes are of cultural nature, and they place the conviction of profound anthropological changes involving the transformation of the brain among pseudoscientific myths (E. Bendyk, 2013, p. 89).

James R. Flynn maintains that, contrary to general belief, a systematic increase in IQ is observed in all societies, which particularly manifests itself in mental abilities allowing to better cope with the complexity of the modern world (J. R. Flynn, 2012). Even the arguments against computers as impeding or even pre-empting the process of learning, contained in the "Digital dementia" by Manfred Spitzer, primarily relate to their misuse at home. Thus, rather than spend time outdoors or learn, children resort to playing computer games or communicating online with friends. Therefore, it is not the arrival of computers at schools that has caused significant deterioration of learning outcomes, but almost total lack of control at home.

Naturally, it is impossible to refute the allegations concerning some teaching materials, which fail to respect the basic didactic principles (in particular the visual reference principle). There is a prevailing idea that the new media should be introduced wherever possible. It is very often forgotten that the visual reference principle, derived from the "Great Didactics" by Jan Amos Comenius (1883), clearly indicates at particular teaching situations which require visual references (B. Siemieniecki, 2001, p. 85; J. Jędryczkowski, 2008, p. 10).

Schools are recipients of a number of computer programs which may be a perfect illustration of allegations regarding the shallowing of the depth of information processing. It is known that the shallower the level at which information is processed, the less lasting is the memory trace left in the brain (M. Spitzer, 2015, p. 59). However, we must remember that this type of shallowing began not at the moment of the emergence of computers and tablets, but at the moment of the introduction of workbooks with stickers to be placed in gapped text.

Manfred Spitzer (2015, p. 80) is less critical when analysing the case of adult education by means of ICT, even citing research results that revealed a positive effect of computers on academic performance of college students in northern California.

Despite the lack of consensus concerning the negative impact of the Internet and computers on the level of users' intelligence, no one denies the changes in cognitive preferences. Herbert M. McLuhan (2001) as well as Derrick de Kerckhove (2001) indicate at a relationship between a medium that is dominant in a given society and the dynamics of socio-cultural transformations. In the course of the last twenty years, there has been increased stimulation of the right hemisphere of the brain by the increase of occurrence of visual messages in contrast to the centuries-old dominance of alphabetic writing stimulating the left hemisphere. It is this change that may prove to be one of the most momentous factors determining changes in cognitive preferences.

A short multimedia message in the learning process

Contemporary adolescents have different cognitive preferences than the generation of their parents and teachers. This means that educational materials are prepared by people who learn in a different way and do not understand their pupils' cognitive needs. It was thus assumed that since there is no possibility to change pupils' cognitive preferences, preparation of instructions for laboratory tasks in their preferred format should be attempted instead.

At the Department of Media and Information Technology of the University of Zielona Góra, a concept of distance learning by means of multimedia educational modules was developed. An educational module is an integrated system of multimedia messages and

mechanisms individualising the learning process, which is instituted in a variety of functional structures. These solutions have been empirically implemented and verified (J. Jędrzycki, 2013, pp. 10-19, 2014, pp. 36-45).

Currently, the existing didactic concept is supplemented with solutions which take into account pupils' changing cognitive preferences. It was assumed that their preferred sources of information are short multimedia messages. The term should be understood as a several-minute long piece of music, a video or a meme (a single image or a short comic strip with a brief comment) embedded in a hypertext structure of a website.

For the purposes of the research, new multimedia instructions for laboratory tasks were developed. It was assumed that the introduced changes would be consistent with pupils' cognitive preferences, which may significantly increase their pace of work. The need for relevant comparisons was decisive in the selection of a research method adopted for the pedagogical experiment, which was completed in 2014.

The control group made use of a traditional online manual. In the experimental group, the first statement was in the form of a comic, and the next was a didactic video. As a result of the experiment, it was found that the introduction of instructions in the form of short multimedia messages had been in both cases associated with a statistically significant increase in the pace of work. Also, the number of correctly and timely performed tasks had increased. Thus, a requirement to introduce changes to the construction of educational media in accordance with contemporary adolescents' cognitive preferences was reinforced (J. Jędrzycki, 2014, pp. 36-45).

The experimentally confirmed impact of the use of short multimedia messages on learning efficiency constituted a point of departure for further research into their optimisation.

Motivation versus reception of short multimedia messages

Motivation is understood as a process of initiation, direction and maintenance of physical and mental activity that determines initiatives and the energy that is sacrificed for the sake of pursuing a given goal (P. G. Zimbardo, R. J. Gerrig, 2012, p. 468). This means that in the case of learning, it is necessary to define the objective of an activity (an indication of real usefulness of the presented range of knowledge), and to interiorise it. The objective should be consistent with learners' interests, ambitions, needs and inclinations.

In school practice, the motivating factors are for the most part external, i.e. primarily marks and avoidance of unpleasant consequences. In the case of students, internal motivation, resulting from individual interests and aspirations, is more likely to be expected. Factors determining the occurrence of intrinsic motivation are most commonly identified as: curiosity and the desire to develop own potential. In this case, satisfaction with own achievements constitutes a prize.

Exploration of the surrounding reality is only possible when attention mechanisms are activated. Psychologists agree that out of the multitude of what happens around we are aware only of what we focus on (Zimbardo, 1999, p. 285). Hence, focus and attention on stimuli that are carriers of information are preconditions for learning (cf. Włodarski, 1996, pp. 31-35; Zimbardo, 1999, p. 285).

Only a small part of stimuli reaching the senses are subject to conscious attention. Sufficiently long maintenance of attention on given material is a precondition for the creation of impressions and thoughts, and then for the process of storing the content (P. G. Zimbardo, 1999, p. 362). Therefore, the learning process, especially in distance education, requires strong motivation and appropriately intense stimulation. Directing attention through the use of mechanisms available in media messages can therefore exert impact on the learning process, favouring the remembering of the most important educational content.

The report: "Attention spans. Consumer Insights, Microsoft Canada" (2015) informs that the increasing share of digital media in Canadians' everyday life causes a significantly reduced ability to focus attention on new, dynamic stimuli. The ability of focus amounted to twelve seconds in 2000, whereas it dropped to only eight seconds in 2013. However, this does not mean deterioration of cognitive competences, as it has been discovered that the use of digital devices improves multi-tasking skills, so the users of the new technology can effectively filter information that is relevant to them and very well cope with intense focus for a short period of time. Also, it was found that hasty viewing of ever newer content is a source of pleasure, which unfortunately points to increasing levels of addiction.

Please note that this type of research is commissioned by companies interested in the possibility of effective focus of attention on advertising messages. Low ability to concentrate attention thus relates to the content in which viewers are not interested (or consciously avoid it) or to irrelevant content for entertainment purposes. In the course of the research, motivation directed towards learning the content of a given message is not present.

Implementation and organisation of the research

Two studies on the use of copyright teaching materials posted on YouTube are presented in this paper. The selection of such a format stems from the fact that there is the feature of YouTube Analytics available, which offers very detailed viewing statistics for each video.

It was also assumed that the right level of external and internal motivation is an immediate factor in the effectiveness of distance learning. Thus, the main difference between the two videos lies in the fact that one is a compulsory task that is marked, highly targeted and nested within a time framework, whereas in the case of the second video, its contents are chosen in such a way that will interest students who are in the course of writing their master's thesis. It was assumed that students who are internally motivated will find materials that interest them, primarily using YouTube search or browsing for multimedia courses. Such an approach was meant to investigate the manner in which students, when driven by different types of motivation, make use of multimedia short messages. Naturally, in the case of the second video, a combination of motivating factors should be expected.

Being aware that the appearance of motivating factors may significantly increase the level of recipients' attention on videos lasting approx. 15 minutes were prepared for research purposes.

Within a website featuring online courses, both videos were made available as a standard YouTube Full HD player. In the case of videos intended for students attending the subject of Information Technology (IT), an additional instruction was placed under the player, containing specified information on the project content and assessment criteria. The course was also supplemented by an anonymous online survey with questions related to optimisation of the form of the course, with particular regard to the preferred length of videos and the level of satisfaction.

External motivation versus learning processes using multimedia short messages – research findings

Basic information about the video:

- title: " CMS Website ",
- duration: 15 minutes 56 seconds,
- measurement period: 01.01.2016 - 22.02.2016,
- number of views: 174,
- total viewing time: 1255 minutes,
- average viewing time: 7 minutes 12 seconds,

- average viewing time (uz.zgora.pl): 8 minutes 59 seconds,
- other: 60 performed tasks; 42 completed surveys.

The largest number of views (Table 1) was related to entries from the level of the course website (79%), which was due to the fact that additional instructions were posted there, concerning the content and volume of a webpage which was to be prepared as a task for evaluation, among other things.

Table 1. Sources of views – a video *CMS webpage*

Source	Viewing time (in minutes)	Views	Average viewing time	Average percentage of viewing time
Course website	1204 (96%)	134 (79%)	8:59	56%
Other Internet websites	0 (0.0%)	3 (0.2%)	0:04	0.5%
YouTube channel	39 (3.1%)	20 (12%)	1:56	12%
Suggested videos	11 (0.8%)	13 (7.5%)	0:49	5.1%
Another video in the playlist	1 (0.1%)	1 (0.6%)	1:24	8.8%
Subscriptions	0 (0.0%)	1 (0.6%)	0:10	1.1%
Unknown	0 (0.0%)	2 (1.1%)	0:03	0.4%

The direct use of YouTube (12%) must be traced back to those who remembered the name of the video message. The values for the other sources suggest accidental activation of the video.

The task was performed by all students (60 persons). It was found that in the case of obligatory tasks, footages were divided into fragments with an average duration of 8 minutes and 59 seconds, which in this case constituted 56% of the entire footage. Naturally, we must keep in mind that there was plenty of reversing and scrolling.

Similar conclusions can be reached by analysing the list of devices used for familiarisation with the content (Table 2).

Table 2. Devices on which the video *CMS website* was played

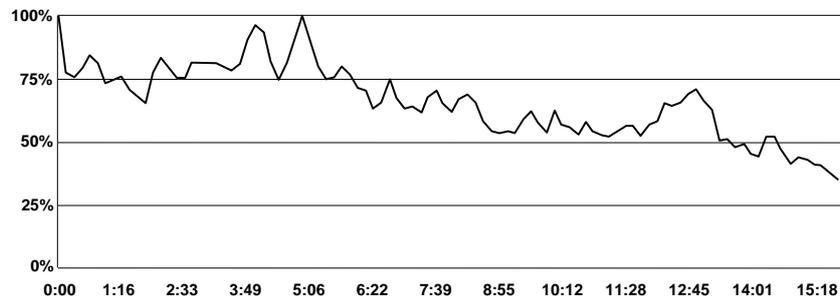
Source	Viewing time (in minutes)	Views	Average viewing time	Average percentage of viewing time
Computers	1141 (91%)	158 (91%)	7:13	45%
TV sets	93 (7.4%)	13 (7.5%)	7:09	45%
Smartphones	21 (1.7%)	3 (1.7%)	7:09	45%

Computers accounted for 91% of visits. It can therefore be assumed that students first viewed a fragment of the video and then performed the memorised sequences. This solution was associated with average viewing time of 7 minutes and 13 seconds, which corresponded to 45% of the available material. Those who prefer the use of multiple screens (TV or smartphone) attained almost identical average viewing time and percentage.

Depending on the manner of interpreting data, the average viewing time amounted to 7 minutes and 9 seconds or 8 minutes and 59 seconds. This means that in the case of mandatory tasks, the ability to focus attention was much higher than in the case of viewing for entertainment or advertising purposes.

The YouTube Analytics tool makes it possible to simultaneously monitor the content of the video and the vertical axis moving up the absolute involvement chart, which allows for correlation of the content with engagement. The parameter defined as *absolute involvement* indicates what percentage of the total number of views is represented by particular fragments of the video.

Its analysis led us to the conclusion that the curve on graph 1 rose when presentation of a new operation appeared in the video. Immediately after the introduction of new content, the level of attention declined. This attests to the fact that students stopped playing and independently performed the previously presented steps.

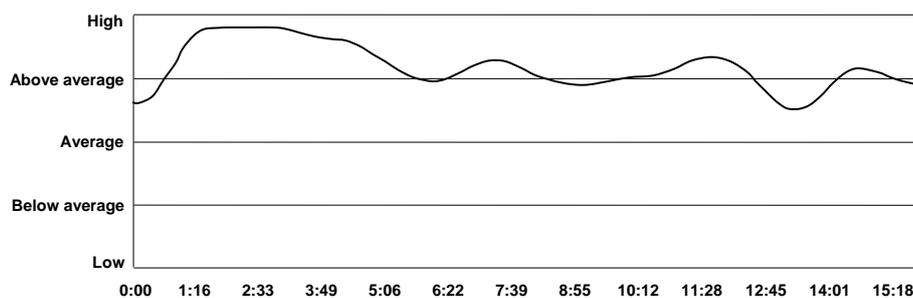


Graph 1. The percentage absolute retention of involvement in the course of viewing the video (external motivation)

This confirms our assumption as to students' competence in the use of multimedia forms of communication. In particular, the ability to dispense and select information provided in their preferred format.

The fact that the condition for obtaining credit from the subject of Information Technology (IT) was to prepare a project on the basis of a YouTube video instruction meant that all students had to become familiar with its contents. Presumably, a relatively short notice within which to complete the task was not without significance when commitment and work rate were concerned.

It was assumed that the mandatory nature of the task would constitute an important factor in stimulating recipients' external motivation. The analysis of the YouTube Analytics parameter, defined as relative maintenance of attention, may confirm the adopted assumption. It informs about the level of attention on the basis of viewers' activity in comparison with all videos of similar length.



Graph 2. The relative level of viewers' attention as compared to all YouTube videos of similar length (external motivation)

The analysis of the data included in graph 2 confirms that the motivating factors and the use of the preferred short forms of multimedia communication contributed to high levels of concentration and attention. In the case of the analysed video, this level fluctuated within the section *above average*. This confirms our assumption about the need of short forms of multimedia communication in educational processes.

Very low ability to maintain prolonged focus was not confirmed in the study. This may be due to the fact that high levels of motivation and developed expertise in metering and analysing visual material facilitated effective use of multimedia in the learning process.

Similar results were obtained in the survey (42 respondents), where 85.7% (36) of respondents felt that the length of the video was suitable, 7.1% (3) suggested that it should be divided into shorter fragments and 7.1% (3) alleged that was too long.

The obtained values confirm that a fifteen-minute instructional video is of the right length for most students. We must keep in mind that all YouTube users have a player at their disposal, which allows pausing and rewinding videos, and despite of this 14.3% (6) respondents found the material too long. The answers to the question concerning preferences when watching YouTube videos may provide explanation for this state of affairs. For 83.3% (35) of students, duration does not matter and the remainder just watch short videos.

Expecting that for some students the homework may be of interest, they were asked about the level of satisfaction with their own work. Their answers were marked on a five-point scale, where the fifth section represented the highest level of satisfaction.

The fourth section featured 19% (8) of responses and the fifth 81% (34). This result suggests that the homework was interesting and that students understood the usefulness of the acquired competences. Unfortunately, subsequent analysis of their work failed to reveal a high degree of creativity, as only three out of sixty students had made use of features that were missing in the instructional video. It should be noted that the new features had required the use of procedures that were known to the students.

Only eight students prepared projects containing more material than specified in the necessary minimum to obtain the credit. Unfortunately, this confirms the conclusions expressed by the authors of "Shallow Mind" and "Digital Dementia." The high level of competence in the use of the new media and the developed multitasking skills do not go hand in hand with creativity. The reasons for this state of affairs must be further investigated. The question whether the shallow mind is to blame or whether young people have so many interesting activities (especially in the virtual world) that they simply do not want to waste time doing homework, remains topical.

Internal or mixed motivation versus the learning process by means of short multimedia messages – research findings

Basic information about the video:

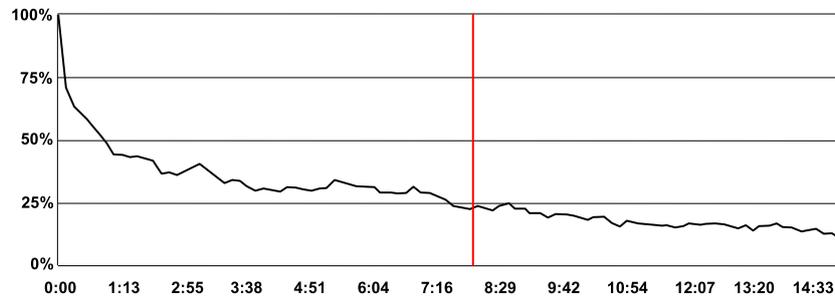
- title: "MA thesis. The Methodology Chapter",
- duration: 15 minutes 9 seconds,
- measurement period: 22.11.2015 - 22.02.2016,
- number of views: 631,
- average viewing time: 3 minutes 15 seconds,
- total viewing time: 2052 minutes.

Another analysis was meant to check the average time of students' use of video courses as instructional material not to be directly evaluated. The adopted research assumptions were a major challenge as recipients and the educational nature of the course had been specifically stipulated and there was the question of how to motivate students to find and watch the videos. It was assumed that the course would be widely accessible on YouTube. The video was about preparation of the methodology chapter in MA theses, which was conducive to an assumption that students would themselves search for this type of content.

Following the publication of the video on the YouTube channel, it was observed that it was viewed on average 210 times a month.

The first half (exactly 8 minutes) is a theoretical introduction. After the eighth minute, simple actions correlating all the elements of the methodology chapter are discussed. The introduction features information about the content and benefits of the video (stimulation of optional attention). However, as evident from chart 3, after 1 minute and 58 seconds the level

of absolute attention falls to 37%, to further fall below 25% after 7 minutes and 35 seconds. It can be assumed that the first two minutes allowed users to assess the usefulness of the presented material. After the second minute, the video is viewed by those interested in the subject. Unfortunately, the most significant part of the communication (after the eighth minute) was reached only by few determined viewers.



Graph 3. Absolute attention indicator in the course of using the video (internal or mixed motivation)

The flattened curve suggests that there were few cases of stopping and resuming, which means that even those who were interested did not take notes. This confirms the position of the supporters of the "digital dementia", suggesting that Internet resources are treated as external memory, i.e. a link posted on e.g. Facebook absolves from memorising its content.

Table 3. Sources – video *MA Thesis. The Methodology Chapter*

Source	Viewing time (in minutes)	Views	Average viewing time	Average percentage of viewing time
External	1018 (50%)	330 (52%)	3:05	20%
YouTube search engine	459 (22%)	135 (21%)	3:24	22%
Suggested videos	289 (14%)	81 (13%)	3:34	24%
www address of the video	211 (10%)	42 (6.7%)	5:01	33%
YouTube course channel	46 (2.3%)	33 (5.2%)	1:24	9.3%
Another video in a playlist	16 (0.8%)	3 (0.5%)	5:23	36%
Viewing history	12 (0.6%)	4 (0.6%)	2:53	19%
Messages	1 (0.0%)	1 (0.2%)	0:58	6.4%

The average viewing time was just 3 minutes and 15 seconds. When analysing the data from Table 3, it can be said that the longest average viewing times corresponded to when the video was shown in the playlist. This happens when a recipient collects materials with similar content offered by YouTube. Similar results were scored by direct entering of the address of the video, which suggests that it had been transmitted to the recipients via an outside channel.

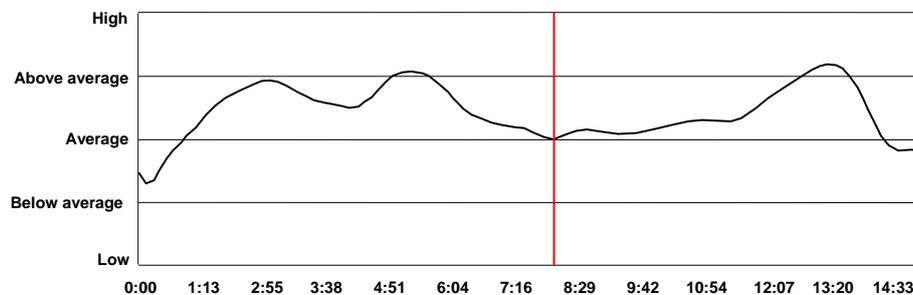
Half of the time spent viewing the video footage (1,018 minutes) accounts for external visits (Table 4). Of all external sources, Facebook accounted for up to 77%, which means that more than half of the visits were the result of mutual recommendations, something that had not been previously anticipated.

Table 4. Basic sources of external (non-YouTube) visits

Source	Viewing time (in minutes)	Views	Average viewing time	Average percentage of viewing time
Facebook	836 (82%)	254 (77%)	3:17	22%
Google Search	93 (9.2%)	31 (9.4%)	3:00	20%
Unknown	29 (2.9%)	12 (3.6%)	2:27	16%
Gmail	27 (2.7%)	11 (3.3%)	2:28	16%
Other Google domains	19 (1.9%)	6 (1.8%)	3:08	21%
Interia.pl	6 (0.6%)	1 (0.3%)	6:22	42%
Course website	5 (0.5%)	12 (3.6%)	0:27	3%

The low value of average viewing times suggests that only a part of the audience was driven by self-motivation. The subject of the video was such that there were frequent cases of external motivation.

It appears that the obtained results were also affected by the period of time during which the measurements were taken. Students who write a thesis gather relevant materials in the middle of the term and their analysis is done at later time.



Graph 4. Relative levels of attention as compared to all YouTube videos of similar length (internal or mixed motivation)

Graph 4, illustrating relatively high levels of attention, is optimistic. The vertical line located on the eighth minute of the video signifies the moment of introduction of the most important content (pre-announced at the beginning of the footage). From that point onwards, the level of attention is on the rise, which means that those interested in the footage actively benefited from its educational message.

Summary

The use of short multimedia messages in the teaching-learning process facilitates the retention of attention on their content. Thus, a necessary condition for its memorisation is achieved. It was found that external motivation retains attention for approx. 7 to 9 minutes.

Moreover, students who make use of the multimedia e-learning course have competence in selecting and dosing media content. Increasing complexity of communication is matched by an increasing number of pauses and resumed playback, whereas known and obvious content is skipped.

Unfortunately, the competence in efficient use of the media is not accompanied by creativity. Students exclusively focus on the execution of their basic task. Only occasionally do they go beyond the scope of the assigned material and expand their own projects.

Comparing the statistics in relation to both videos, it was found that lack of strong external motivation is associated with clear decrease in the average time devoted to educational materials of approx. three minutes. It can be assumed that after finding the

required information, students did not make any attempts to memorise the content of the message. Thus, after cursory familiarisation with the message, they only put down the Internet address, placing it in their "own external memory".

It must be remembered that increased involvement and attention to the content of messages to be achieved by means of short multimedia messages may concern only a small number of subjects, whereas in many cases, their use is not permitted by the principle of visual reference. There is therefore no possibility of abandoning the traditional work with a textbook. Thus, intensified work on finding ways to overcome the symptoms of the "digital dementia" is of utmost importance, as shallowing the range of self-knowledge leads to a situation which is well illustrated by the following quotation: " In order to ask a question you must already know most of the answer " (R. Sheckley, 1988, p. 275).

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