

## Possibilities and limitations of digital multitasking for school homework

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*The digitisation of the classroom and the increased use of information and communications technologies (ICTs) at home offer ways to improve students' educational performance. Yet misuse of the Internet and increased digital multitasking at home, where academic study and entertainment intersect, could create barriers towards academic achievement. Based on the concept of "Cognitive Load Theory" and taking a qualitative approach rooted in Critical Communicative Methodology (CCM), this study aims to examine this topic in more depth. After interviewing four focus groups consisting of 40 students from 5th and 6th grade Elementary and 1st and 2nd Grade ESO ("Educación Secundaria Obligatoria"/Compulsory Secondary Education), results revealed that students are accustomed to using computers in environments where digital study and digital entertainment are both available. Students see learning possibilities on the screen in front of them, but are also aware of the distractions in this kind of mixed, instantly available environment. This study suggests that multitasking skills should be taught formally in order to avoid students pursuing a syncopated mix of online work and social media use. Faced with this reality of how students work, the study proposes that instead of teachers focusing exclusively on formal instruction, they should offer a measured/controlled approach to multitasking activities within a reflexive, hyperlinked environment. This is the first tentative conclusion from what will be a wider, more detailed investigation involving teachers, administrators and families all within the same school in Barcelona.*

### Introduction

Over recent years the digitisation of the classroom and use of the Internet for school homework have created steps towards the modernisation of learning and teaching at secondary, as well as elementary, school levels. The digitisation of the classroom/home suggests that, for the production of knowledge and for information searches to increase learning, we must now consider a range of digital tools that are based on an even more extensive range of software (Motiwalla, 2007). Nonetheless, there should be a focus on the relationship between digitisation, academic performance, school homework and digital multitasking. The relationship can be viewed positively if opportunistic skills such as slow multitasking and reflexivity are taken into account; but it can also be viewed negatively if the necessary skills are not addressed (Wood, et al., 2012), a failure which could ultimately give rise to syncopated and unprofitable multitasking (Junco & Cotten, 2012; Rossen et al. 2013; Calderwood et al. 2014; Calderwood et al. 2016; David et al. 2015). Some consider multitasking excessively fragments one's attention span and so inhibits learning.

In Catalonia authors such as Mora and Escardíbul (2016) measured the impact of the assignment of laptops to secondary school pupils through the eduCAT programme introduced by the Catalan Government during the 2009-2010 school year. The eduCAT1x1 programme evolved over the following academic year due to some changes made to it and was then renamed eduCAT2.0. The results of the research by Mora and Escardíbul (2016) showed that the use of laptops by students had a negative impact on the acquisition of the skills analysed. These results lead us to consider whether there is a correlation between the use of laptops and learning based on multitasking. Therefore a research project was carried out using a sample of Catalan students over the same period of time.

After interviewing a total of 40 students (in four communicative discussion groups, each one consisting of 10 participants) from 5th and 6th grade Elementary and 1st and 2nd ESO (secondary school), from a school in Barcelona (Catalonia), about the advantages and disadvantages of the Internet for classroom activities, and, even more important, for homework, the answers received were mixed. Many advantages and disadvantages were discussed. Among the collected responses, the following was common: *“Es más divertido internet pues tiene muchos recursos de consulta y puedes conectarte con los amigos (Facebook, Twitter y Tuenti) pero internet hace el estudio más desorganizado, mientras te concentras mejor ante el papel”* (the Internet is more fun because it has a lot of resources and you can connect with your friends (Facebook, Twitter and Tuenti) but the Internet makes studying more disorganised, while you concentrate better with paper). One possible, and revisable, initial reflection could be that these students lack the abilities that allow them to multitask and as a result, have trouble focusing their attention. This idea and the opinions surrounding this should be examined closely and this is our primary objective. The guiding objective of this paper is to begin a study where the dynamics of multitasking are seen as a variable to be accounted for in analysing academic failure and to focus the practical elements of this variable towards students achieving academic success. This investigation is inspired by the project INCLUD-ED (2006-2011), “Strategies for inclusion and social cohesion from education in Europe,” that the European Commission is incorporating in various documents and recommendations. A key element of INCLUD-ED is the prevention of academic failure and abandonment through the analysis of those educative strategies that contribute to social cohesion/social exclusion. In this specific line of research, Critical Communicative Methodology (CCM) has provided the key method for the study of topics that go beyond academic modes and centre themselves in the voices of social actors: in this case the students, teachers, academic directors and families (Padrós-Cuxart, Duque & Molina, 2011). This investigation begins with the students, as a first step. Later, in following studies, it will continue with the role of the teachers, administrators and the students’ families.

## **Theoretical Framework**

The model from which we work from is the “Limited Capacity Mode” (Lang, 2009). This model provides a base for theoretical reflection, whose concepts are useful in the evaluation of data. Based on their research and data Lang and his collaborators founded and checked out his theory: the human capacity to process information is limited. The second model is that of “Cognitive Load Theory” (Chandler & Sweller, 1991). The basic premise of this model is that the learner, in various stages of learning, operates from a working memory that has a limited capacity for dealing with new information. With regard to a definition of *working memory*, Baddeley and collaborators (2007) conceptualized working memory as a temporal space that permits the storage and manipulation of information while it is developing in certain mental tasks.

These models signal that intellectual work, the processing of information, the organization of learning abilities, the availability of accumulated and operative *working memory* has logical limitations. Some students carry out not two but three, four and more tasks at the 'same' time or, more accurately, at a high, near synchronous, speed: looking at various webpages, instant messaging, updating social networks. In this duplication (or reduplication) of tasks, multitasking can take away from learning efficiency and can decrease academic performance. It can produce interruptions, interferences and distractions that give way to what is known as cognitive overload (DeStefano & LeFevre 2007; Mayer & Moreno, 2003). Welford (1967), a psychologist known before the digital revolution, speaks of a possible cognitive bottleneck that occurs when information concurs with processing that is superior to the capacity of decodification ("Cognitive Bottleneck"). The human capacity to learn, or in our case, successfully to complete school homework, is limited by space and time so, logically, different and abundant digital inputs can lead to a measurable limit.

## Methodology

This investigation uses critical communicative methodology so it was necessary to establish spaces based on the notions of egalitarian dialogue for groups made up of fifth and sixth year Elementary and first and second year ESO students. An objectivist, outsider point of view was taken by the researchers who wanted to distance themselves from the status of an unarguable authority (teachers) and give voice through a social dialogue to the students who were expected to state and defend their own opinions and arguments: to use the concepts of Habermas (1987), there was provision of an egalitarian dialogue that moves away from the pretensions of power and towards a reinforcement of validity. The participants in this investigation should be heard through an open dialogue to be able to 'contribute their knowledge and challenge our own' (Gómez, Puigvert & Flecha, 2011; Gómez & Racionero, 2008). Use of this perspective enabled the students (between 10 and 14 years old) to interact on a level where they are conscious of their linguistic capabilities, their capacity for reflexive thinking and their awareness of being able to impart valuable information through an intersubjective dialogue to the investigator, and, in this way, propose changes that can overcome the educational exclusion factors mentioned in the Introduction.

Analysing critical communicative methodology from its most theoretical point, it is argued that the criteria and forms of data collection should be centred methodologically through a "communicative discussion group." The data collected comes from a school with a middle- and working-class background in the city of Barcelona.

Work in a *communicative discussion group* here assumes that the group reaches a common high reflexivity (Bourdieu, 2003) where some of the components have to be known so that trust as well as fluid face-to-face dialogues can be generated. This enables the researchers to reach the established requirements of rigor and validity. In this first study in a four-part series, 1) there are four discussion groups made up of students aged 10-14. The three further planned studies will be 2) with the students' corresponding teachers, 3) a *focus group* with the school administration team and, finally, 4) a communicative discussion with the families whose children have been selected. Some scholars and scientists, from a positivist or objectivist methodology, do not consider that children, adolescents, or individuals with an illiterate or humble background are able to provide authentic accounts for reflexivity, or even refined reflexivity. This investigation disagrees: in certain contexts and from certain ideal speaking conditions, there was no lack of intersubjectivity. In the school library, for example, participants from the discussion group were able to have a dialogue, question one another equally and reach a point of reflexivity where a consensus and agreement based on our research objective was reached. From some points of view, where respect for the

others opinion had long been established, we, the investigators recognised that participants knew things and were able to help, as well as think alongside the investigator. The role of the investigator was to become part of the discussion group, act an equal who catalyzed discussion with the aim of discovering a common thread as well as to monitor discussion where opinions and perspectives were not imposed but rather contributed with feasible arguments. Each discussion group lasted around 90 minutes. After an hour and half there was a noticeable drop in discussion, further new information was no longer being contributed and similar discussion topics began to recirculate. Dialogue from the discussion groups was recorded in audio and later transcribed and annotated to include certain nuances found in the discussion as well as the aspects of non-verbal communication that the investigator incorporated.

The four discussion groups consisted of ten students (five female and five male in each) and one investigator. The four groups corresponded to the four grade levels: 5th and 6th grade Elementary and 1st and 2nd grade ESO. The generating question, which acted as a springboard for further discussion was: what is the best characteristic of the Internet when you have to study in the classroom and at home? A second, complementary question was also asked: what obstacles can arise when studying and in academic performance if we only work and study with the Internet? Further follow-up questions and clarifications proceeded. Initially, it was hoped to include a fifth discussion group composed of 3rd grade ESO students but there was insufficient interest from them and this is addressed in the Discussion.

## Results and Findings

In general, most participants assumed an active role in the “focus group”, behaved with tact and seriousness and actively contributed their ideas and reflections. Participants recognised the benefits of the Internet for studying but also were aware of its distracting and fragmenting reality.

A collection of the content from all the focus groups revealed several recurring ideas that varied slightly but shared a common thread: studying with the Internet is very positive depending on the method. The method can be “reflexive” if it is used with a hypertextuality that maintains a line of intellectual work; the method can be “fragmented” if it is used with a hypertextuality that is used to “peck” a little here and a little there with regards to maintaining a line of intellectual work. Focus on intellectual work was lost if the interruptions were related to outside factors, with high reference to the combination of intellectual work and digital entertainment. Several transformative as well exclusive dimensions were generated. Exclusive dimensions have to do with losing oneself and/or getting lost in an internet that provides an entertainment/play base when knowing that one’s objective is to work more slowly with an internet that is focused more on academia. Students tell us that Facebook (among other social networks) is an example of this: it serves as a support and can help coordinate studies or, contrary to this positive use, it can be damaging and be used as a form of entertainment where one can post on friends’ or their own profiles (messages, photos, videos, etc.). Students show that they can distinguish between the two “internets” but, nonetheless, find it difficult to resist the mixing of the two. With the threat of an exam, students expressed that they know how to discriminate between the two “internets” but this seems to only occur on the day before the exam and if the exam is very demanding. This is the first phase of a wider investigation that requires a more comparative and contrastive undertaking of this kind of information with teachers, administrators and parents.

Results revealed ten main findings that can be used for future research (Table 1). As the study progresses, the aim is to be able to examine these findings more in depth with students, teachers and families and see

if these types of focus groups and objectives can be applied in other contexts. For now, the initial findings of this investigation will be focused on:

Table 1.

PROVISIONAL FINDINGS
1. Books capture the attention of students, while the Internet, which is more entertaining, can, if not used with caution, disperse it.
2. The Internet offers a wide variety of information and facilitates student work through cutting and pasting.
3. The Internet can postpone or elongate studying indefinitely if work is not focused by use of guidelines.
4. Separating the collection of information with the computer connected to the Internet (online) and the carrying out/writing of work with no Internet connection (offline) can be useful.
5. Some students only study with the Internet and never with books.
6. Some students question the credibility of the Internet (older students, 2nd grade ESO).
7. Students are aware of the positive benefits of the Internet to carry out work and the positive benefits of using books to prepare for exams.
8. Students are conscious that working on the Internet can turn into multitasking with up to five open interfaces (e.g. Facebook, Instagram).
9. Student comprehension is higher with the use of computers and digital blackboards.
10. Students are aware that in class and at home it is very easy to get lost in an entertainment-based internet and lose focus of the academic task at hand

The textual evidence that corresponds to each one of these findings will be looked at closer in Table 2 (below). The evidence selected is representative of the focus groups from this investigation. The criteria that led us to focus on these particular sentences and not others is based on the repetition of certain key words and their textuality. These sentences have not undergone any transcription to change their register to fit academia. We were surprised by the capacity of self-reflection by the students based on how easy it is for them to get distracted on the Internet and stray away from academic purposes. In fact, some results were not accounted for in our original reasearch hypothesis, and from the egalitarian dialogue based on critical communicative methodology, presented themselves as aspects that should be kept in mind for future investigations.

In the following table, no distinction is made between the use of the Internet in the classroom and at home. Students, while explaining themselves, expressed no difference between the classroom and home. This reveals that in both places of study the Internet is used and the investigators chose not to assume to make a distinction between the classroom and home when the participants spoke about them as if they were one entity. This observation is viewed as a short-coming in the present study and should be taken into account for future research.

## Conclusions and Discussion: towards a more critical view

The ability to establish a cause and effect relationship between the use and misuse of the Internet based on the positive and negative results found in this study is difficult to claim. Unlike a quantitative study we cannot construct a scale that can accurately measure the relationship between the amount of time dedicated to media resources and low academic performance in Hispanic speaking countries. We have been presented with an initial insight that explores the opinions of students in regards to these topics, in particular with what they have to say about the possible conflicts that can arise between studying and new technology. The benefits are more than well known: motivation, research abilities, etc. One thing is clear, the students from our discussion groups are able to recognise the pros and cons of studying/school work/homework with or without the Internet - perhaps even more so when they are closer to ESO grade level. Lack of evidence from 3rd grade ESO students is considered to form part of a second shortcoming attributed to the investigators who in future studies should consider an alternative questioning approach. Possible reasons could be that elementary level “focus groups” were not centralised enough or that the initial question needed to be formulated/re-worded in another way. These observations should be taken into account for future research.

Table 2.

FINDINGS	TEXTUAL EVIDENCE
1. Books capture the attention of students, while the Internet, which is more entertaining, can disperse it.	"I like the Internet more, it's more fun but I get off track much more than with notes or a book" (Boy, 11)
2. The Internet offers a wide variety of information and facilitates student work by cutting and pasting.	"[The] internet serves to do work, I copy texts and paste them and it looks really nice." (Girl, 12)
3. The Internet can postpone or elongate studying indefinitely if it is not focalized with guidelines.	"Sometimes on the Internet I know where I begin but I don't know where I end up and then I have to go back and remember what I was looking for." (Boy, 14)
4. A combination of online information searches and a separate offline work study should be considered.	"My parents' idea has worked out for me, I look for information of the Internet for a little while and then I do the work on another, older computer that has no Internet connection." (Girl, 13)
5. Some students only study using the Internet and never with books.	"I can't study with books, I can't stand it, it's much easier with the Internet." (Girl, 14)
6. Some students question the credibility of the Internet (older students, 2nd grade ESO).	"Sometimes the Internet is wrong and you find out because you get corrected on your work" (Boy, 13)
7. Students are aware of the positive benefits of the Internet to carry out work and the positive benefits of using books to prepare for exams.	"The Internet works for schoolwork and for finding images and photos and all that other stuff, but when I have to study for an exam using books and notes work better for me" (Boy, 12)
8. Students are conscious that working on the Internet can turn into multitasking with up to five open interfaces.	"Most of the time I am in a lot of different sites and I do my work at the same time: I'm chatting with friends on Facebook/Tuenti, and other pages and on WhatsApp, etc." (Girl, 12)
9. Student comprehension is higher with the use of computers and digital blackboards.	"If I don't look at the electronic blackboard and the computer I don't understand anything." (Girl, 11)
10. Students are aware that in class and at home it is easy to get lost in an entertainment-based internet and lose focus of the academic task at hand.	"Some of us know how to appear as if we are working in class but we are really on YouTube or Facebook using tricks that the teacher doesn't know about." (Boy, 13)

The objective of the present study has been to call to attention the topic of the digitisation of learning in the classroom and at home so that we keep in mind there is no boundary between digital media use and academic learning. If we have succeeded to capturing attention towards this educational topic, the next step is to investigate, in future studies, the methods in which we can teach how to use the Internet to students who are in last year elementary, ESO and post-ESO. There are several important points to consider: working with digital networks requires being precise and veracious. One example that illustrates just one of the ways in which we can begin to take a step towards these goals is to begin to insist on the illegality of *academic cyberplagiarism* when students are in their last year of Elementary school – or even before. Another example is that students learn to trust in digital networks more critically. The common call of the teacher inviting students to “search the web,” also has to be improved. The teacher should themselves look for ideal content from the web so as to be able to positively direct student homework with this goal in mind. Teachers could begin to ask students to “look at three specific websites, use a glossary of concepts for these particular webpages, and write out a paper using the texts/articles that were found in these webpages as models without forgetting to look back at the maps and schemas that can be found in the digital magazines that have already been consulted.” Web searches can be built around clues and guidelines. The Internet does not answer everything: while it is full of valid information, it also has inexactitudes and propaganda. Google does not resolve nor does Wikipedia act as the mother of all knowledge (Lanier, 2010; Vidhyanathan, 2011). Furthermore, homework based on digital competence should promote students and future citizens to be critical in the consumption of digital media.

We believe that itineraries that include the limitations and strategies to receive optimum results from the Internet and how to avoid off topic material when faced with academic learning objectives should be given, not only with respect to digital media but also in the curriculum. For example, competencies that underline critical thinking, reflexive thinking, co-operative group work and respect between and among peers should be emphasised. The objective is to equip teachers and families to be able to teach how to discriminate between an academic internet and a more entertainment-based internet. Being able to distinguish, limit and dissect the lines in which there is crosslinking is not only positive but also reveals, with qualitative rigor, that this type of multitasking can have a positive effect on academic performance. Students should be consulted, listened to and invited to reflect with parents and professors. The use of Critical Communicative Methodology in this study has revealed the capacity of young people to think and contribute in considerable depth to the reflection of adults. In teaching reflexivity, educators should perhaps listen more to students (Bordieu, 2003), even at school level as there is a need for students to take part in interpretative processes such as this study (Flecha, Vargas & Davila, 2004).

Simultaneously, a variety of literature that takes on a more critical viewpoint on the digital revolution in regards to young people and their use of new technology at school and at home can be found. There are some studies that strongly oppose the use and misuse of ICTs (Baron, 2013; Bauerlein, 2004; Reinking, 2001) as well as studies that underline the complications that ICTs can provoke with focus of attention and learning processes (DeStefano & LeFevre, 2007). A long list of references based on this perspective considers that digital media “contributes to a diminished attention span, declines in fantasy, play, imagination or creativity, or displaces time that could be spent with homework or other educational opportunities” (Comstock, 2013); literature, mostly in essay form, can also be found that disqualify entirely the Internet, social networks (Facebook, Tuenti, etc.) and even Google (Carr, 2010). Coming from a teaching perspective where the positive academic use of ICTs is considered, possible learning risks as well as background in the literature that looks at these possibilities should be taken into account (Sharif, 2010). It is likely that in the beginning a certain ideology of technophobia and caution are present but it is also probable that valuable ideas surface from this as well. Ideas such as the ones found in this study mark the

beginning of a journey towards this goal and can be used as a starting point for continued and future research. Additionally, this topic also calls for a focus on the collaboration of the family in what is known as parental mediation (“parental mediation of children’s media use”).

Teachers, professors and parents should aim for an optimised, positive use of digital media for their children and students. Through achieving this goal a possible resolution of conflicts between reading and ICTs, attention and ICTs, studying and social networks and digital media manipulation could be reached. Students and future citizens will be able to rely on their own individual critical thinking tools and self-awareness to face these manipulations.

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### REFERENCES

Baddeley, A. D. (2007). Working memory, thought and action. Oxford: Oxford University Press.

Baron, N. S. (2013). Redefining Reading: The Impact of Digital Communication Media. *PMLA*, 128(1), 193-200.

(DOI: 10.1632/pmla.2013.128.1.193)

Bauerlein, M. (2004). Revisiting “Reading at Risk”. *American Libraries*, 35(11), 38-38.

Bordieu, P. (2003). El oficio del científico. Ciencia y reflexividad. Barcelona: Anagrama.

Calderwood, C., Ackerman, P. L., & Conklin, E. M. (2014). What else do college students “do” while studying? An investigation of multitasking. *Computers & Education*, 75, 19-29. (DOI:10.1016/j.compedu.2014.02.004)

Calderwood, C., Green, J. D., Joy-Gaba, J. A., & Moloney, J. M. (2016). Forecasting errors in student media multitasking during homework completion. *Computers & Education*, 94, 37- (DOI:10.1016/j.compedu.2015.10.021)



- Carr, N. (2011). *Superficiales. ¿Qué está haciendo Internet con nuestras mentes?* Madrid: Taurus Ediciones.
- Comstock, G. (2013). Media Use, Scholastic Achievement, and Attention Span. *The International Encyclopedia of Media Studies*. (DOI: 10.1002/9781444361506.wbiems133)(28-12-2012)
- Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction*, 8, 293-33. (DOI:10.1207/s1532690xci0804\_2)
- David, P., Kim, J. H., Brickman, J. S., Ran, W., & Curtis, C. M. (2015). Mobile phone distraction while studying. *New media & society*, 17(10), 1661-1679. (DOI: 10.1177/1461444814531692)
- DeStefano, D., & LeFevre, J-A. (2007). Cognitive load in hypertext reading: A review. *Computers in Human Behavior*, 23, 1616-1641. DOI: 10.1016/j.chb.2005.08.012)
- Flecha, R.; Vargas, J. & Davila, A. (2004) Metodología comunicativa crítica en la investigación en ciencias sociales: la investigación Workaló. *Lan Harremanak*, 11. Bilbao: UPV, 21-33.
- Gentile, D. A., Nathanson, A. I., Rasmussen, E. E., Reimer, R. A., & Walsh, D. A. (2012). Do you see what I see? Parent and child reports of parental monitoring of media. *Family Relations*, 61(3), 470-487. (DOI: 10.1111/j.1741-3729.2012.00709.x)
- Gómez, A., & Racionero, S. (2008). El paradigma comunicativo crítico. *Universitas tarraconensis. Revista de ciències de l'educació*, 117-129
- Gómez, A., Puigvert, L., & Flecha, R. (2011). Critical Communicative Methodology: informing real social transformation through research. *Qualitative Inquiry*, 17(3), 235-245. (DOI: 10.1177/1077800410397802)
- Habermas, J. (1987). *Teoría de la Acción Comunicativa*.
- I. Racionalidad de la acción y racionalización social.
- II. Crítica de la razón funcionalista. Madrid: Taurus.
- Junco, R., & Cotten, S. R. (2012). No A 4 U: The relationship between multitasking and academic performance. *Computers & Education*, 59(2), 505-514. (DOI: 10.1016/j.compedu.2011.12.023)
- Lang, A. (2009). The limited capacity model of motivated media message processing. In R. L. Nabi & M. B. Oliver (Eds.), *The SAGE handbook of media processes and effects* (pp. 193-204). Thousand Oaks, CA: SAGE Publication
- Lanier, J (2010). *You're Not a Gadget: A Manifesto*. New York: Knopf.
- Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist*, 38, 43-52. (DOI:10.1207/S15326985EP3801\_6)
- Mora, T. y Escardíbul, J.O. (2017). *Impacte del programa eduCATen l'dquisició de competències de l'alumnat de secundària a Catalunya*. Barcelona: Universitat Internacional de Catalunya
- Motiwalla, L. F. (2007). Mobile learning: a framework and evaluation. *Computers & Education*, 49(3), 581-596. (DOI: 10.1016/j.compedu.2005.10.011)
- Padrós Cuxart, M., Duque, & Molina, S.(2011). Avances en supervisión educativa. *Revista de la Asociación de Inspectores de Educación de España*, 14.

([http://www.adide.org/revista/index.php?option=com\\_content&task=view&id=279&Itemid=70](http://www.adide.org/revista/index.php?option=com_content&task=view&id=279&Itemid=70) (28-12-2011))

Reinking, D. (2001). Multimedia and engaged reading in a digital world. In L. Verhoeven and C. E. Snow (Eds.) *Literacy and motivation: reading engagement in individuals and groups* (pp. 195-221). Mahwah: Lawrence Erlbaum.

Rosen, L. D., Carrier, L. M., & Cheever, N. A. (2013). Facebook and texting made me do it: Media-induced task-switching while studying. *Computers in Human Behavior*, 29(3), 948-958. (DOI:10.1016/j.chb.2012.12.001)

Sharif, I., Wills, T. A., & Sargent, J. D. (2010). Effect of visual media use on school performance: a prospective study. *Journal of Adolescent Health*, 46(1), 52-61. ( DOI: 10.1016/j.jadohealth.2009.05.012)

Sweller, J. (1999). *Instructional design in technical areas*. Camberwell, Australia: ACER Press.

Vaidhyanathan, S. (2011). *The Googlization of Everything (and Why We Should Worry)*. Berkeley, Los Angeles: University of California Press.

Welford, A. T. (1967). Single-channel operation in the brain. *Acta Psychologica*, 27, 5–22. (DOI: 10.1016/0001-6918(67)90040-6)

Wood, E., Zivcakova, L., Gentile, P., Archer, K., De Pasquale, D., & Nosko, A. (2012). Examining the impact of off-task multi-tasking with technology on real-time classroom learning. *Computers & Education*, 58(1), 365–374. (DOI:10.1016/j.compedu.2011.08.029)