The Use of iPods in Education: A Cognitive Perspective

Geraldine Clarebout, Joke Coens, Jan Elen, Katholieke Universiteit Leuven,
Center for Instructional Psychology and Technology, Vesaliusstraat 2, 3000 Leuven (BE)
Email: geraldine.clarebout@ped.kuleuven.be, jan.elen}@ped.kuleuven.be, joke.coens@kuleuven-kortrijk.be

Abstract: Different authors have addressed the benefits of the use of iPods in education (e.g., Flanagan & Calandra, 2005). However, empirical evidence of these benefits is lacking. In line with a study on the use of a mobile phone during driving (Hunton & Rose, 2005), this contribution addresses the influence of a second task while learning from an iPod. Two studies are reported in which two groups of students were compared. The control group learnt material from an iPod while sitting at a desk, and the experimental group learnt material from an iPod while riding on a exercise bike. Results reveal in the two studies that the control group outperformed the experimental group, suggesting that the second task interfered with learning. It seems that even though one could say that the two tasks do not use the same part of working memory and need not to be integrated, a split attention effect did occur.

Introduction

iPods in Education

Recently, different authors have addressed the benefits of using iPods and Podcasting in education. Podcasting allows downloading digitalized recorded audio-and video-material on a computer and/or on an iPod (Flanagan & Calandra, 2005). As such, it is for instance possible to record lectures and distribute them digitally. Theoretically spoken, podcasting and iPods do have some advantages (Anderson & Blackwood, 2004; C & Green, 2006; Corbeil & Valdes-Corbeil, 2007; McCombs & Liu, 2006; Flanagan & Calandra, 2005) such as the easy distribution of and download of materials, recording of lectures and the possibility to listen to them, the use of an iPod as a hard disc, etc. The use of podcasting and iPods seem to enter also education, for instance through the influence of handbooks for teachers on the use of podcasting in their educational practice (e.g., King & Gura, 2007).

A lot of articles on the use of iPods and podcasting suggest that the use of iPods to offer course materials offer an opportunity for students to study where and whenever they want, it is seen as a possibility to learn 'mobile'. There is no time or space restriction. An iPod has the possibility for on-demand delivery and could –according to McCombs and Liu (2006)– form an effective learning aid. McCombs and Liu (2006) offer the following advantages from an educational perspective: availability of course material; equal access to the course material, also for those who could not attend the class; on-demand support; not restricted in space, not restricted in time (see also Essex, 2006; Houk, 2006)

Moreover, not only claims are made, some attempts have also been made to address the use of iPods from a research perspective. In a survey-study (Higginbotham, 2006; Houk, 2006; McCombs & Liu, 2006) university students were asked to indicate all advantages they saw for learning with an iPod, after they participated in a course where course material was offered through an iPod. One of the main advantage students mentioned was the possibility to compensate for something they missed out on. For instance, compensate a lecture they missed by looking at it on an iPod or compensating for notes they did not take. Additionally, they found the preview function an advantage. Prior to taking the course, students could look at the content, which helped them in making a choice whether or not to follow the course. More on the use itself of the iPod, students indicated that they had easy access to the course materials. According to the student, the iPod was flexible and portable (you could use it everywhere), and it was easy to use. In general students indicated that the iPod improved their learning, and made learning more fun, where the main advantage was that they could review the course materials when and whenever they wanted.

Similarly, Maag (2006) found in a survey-study that students are favourably impressed by the use of lecture podcasts. Students reported they learn better if they hear the learning material more than once, and the lecture podcasts assisted them in retaining information. The majority of the students reported the podcasts provided an opportune way to access course materials and more than half of the students reported the podcasts assisted them in preparing for exams and homework assignments. In her study, almost 30% of the students listed to the podcasted lectures on their MP3-player or iPod, while 55% did this on their personal computer. However, Maag (2006) reports that during the semester the students listening to the lectures on their portable device increased.

From the above, one can deduce that students are positive towards the use of iPods. However, research on the effect of the use iPods on learning is missing. This does not mean that we want to position ourselves in a medium-debate, and discuss whether iPods have an added-value. In line with Clark (1994) we claim that,

exactly as the computer, television or video, the use of the iPod will not make the difference. However, what may induce a difference is the educational use of the iPod, and exactly here, the iPod has a very specific characteristic. In the debate on the use of iPod in education, it is claimed that due to the iPod learners can learn while performing another activity (e.g. podcasts can be listened while driving, walking or working out at the gym (Campbell, 2006)). From an instructional science perspective, the use of iPods raises the following question: What is the effect of learning with an iPod while performing an additional activity on learning? Typically, listening to an iPod is combined with other activities, such as taking the train, running, etc. This was also shown in the results from the above mentioned survey-study. 81,6% of the respondents used their iPod while driving a car, hiking or running, while visiting a public place, or while travelling (Higginbotham, 2006; Houk, 2006; McCombs & Liu, 2006). This raises the question on the boundaries of multi-tasking (Higginbotham, 2006). Although it seems common that 'contemporary' students deal with multiple tasks at the same time – for instance studying while chatting with friends – Stone (2006) points out that it is an illusion to think that the personal bandwidth can be extended. With personal bandwidth she refers to an individual's attention amplitude. When performing different activities, the attention is unavoidably divided.

iPods and Cognition

From a cognitive perspective, it is interesting to know how learners process the different tasks; how they divided their attention, and what the effect is on learning. One could make the comparison with a driver who is on the telephone at the same time. Calling with someone interferes with the driving process. More accidents are reported when drivers are on the phone (see study of Hunton & Rose, 2005). One could say that a split attention effect occurred between driving the car and phoning someone. The theory on split attention – extensively described by Chandler and Sweller (1992) – indicates that learners may have difficulties when they have to mentally integrate information from different sources. For instance, Mayer (2000) described the split attention effect when visual and textual information had to be integrated in a cognitive schemata. However, the effect does not need to occur when the different tasks have nothing to do with one another, in other words, when the information coming from both tasks does not need to be integrated, as was the case in the Hunton and Rose (2005)-study. One could argue that while studying course material from an iPod, one does also not necessarily need to integrate the two tasks (e.g., studying course material and taking the train), and that hence no split attention effect should occur. However, given the findings of the cell phone study, it may be that this split attention effect also occurs when integration of the information in both tasks is not necessary.

Luria and Meiran (2005) found additionally, that task demands are also an important element. They found evidence that when the task demands are high, people have the tendency to work sequentially, while when the task demands are low, they tend to work in parallel. Although one can question what makes a task demand high or low, it is interesting to apply this to the use of iPods in education. This would mean that when the task offered through an iPod is complex, people would start working sequentially, this should be reflected in the second task, for instance, that people stop cycling; but if that second task also imply .

A complicating factor for the use of iPods in education may also be that students mostly use an iPod in their free time. According to Higginbotham (2006), it may be that students are conditioned to use the iPod only for relaxation, and that prior to using iPods in education, students will have to be made aware of the educational possibilities of the iPod. This corresponds to the Salomon's study (1984) on the use of television. He performed a study with Israeli and American children and concluded that the way students view a specific medium (c.q. television) influenced the mental effort students invested for learning (television as relaxation or learning aid).

Independent of the mental investment that is asked from multi-tasking, the question can also be raised to what extent the society indicates that it is important that its future employees are capable of multi-tasking, and to what extent education should prepare for that. If this is the case, not only the amount of automation and the kind of task should be looked at, but also the possibilities in training learners to do multi-tasking. A study of Bherer, Kramer, Peterson, Colcombe, Erickson, and Becic (2005), reveals that it is possible to train people to execute two physical tasks at the same time, as well for adults as for children. The question one can raise then is whether this is also applicable for cognitive tasks.

In general it can be said that the iPod may have some potential for education, but that only little empirical studies are available in which participants have to study while working on another task. This contribution is an attempt to contribute to this field by presenting two studies that are seen as a start for gaining more insight in the effect of multi-tasking on learning, and hence on the potentials of iPods as a mobile learning device.

Study 1

Method

Participants

Participants were 23 first year Instructional Sciences bachelor students from a Belgian university (year 2006-2007). Three male and twenty female students participated, on average 20.2 years old (SD = 3.41). Participation in this study was part of a particular course in their training program.

Design and Procedure

Participants were randomly divided in two groups. In a first group (iPod-group) students received course material on an iPod while sitting at a desk. They were asked to study the material, and it was indicated that they would receive a test about the study material afterwards. Students from the other group (iPod+-group) received the same material, but were additionally asked to ride on an exercise bike. The last instruction was added to avoid that students would stop cycling. The material consisted of auditory and visual information. Different movies were shown with people that gave their opinion of drinking cups on a music festival (plastic, glass,…; see Clarebout & Elen, 2006). Every person was announced through a text on the screen, for instance, 'the major', after which the movie started. Students had to start themselves the different movies. In total there were 6 movies to view. This material was opted for because it was known that this was new material for all students, and hence prior knowledge could not interfere.

Every student entered individually the room. The researcher asked the student whether (s)he was acquainted with the use of an iPod or an MP3 player. This was noted down. Every student – also those who did know how to use an iPod – received a short instruction on the use of the iPod. Specific attention was given to the navigation between different videos. Students got 10 minutes to watch the different movies. Students did know that they would receive a test afterwards. The test consisted of 18 items that related to the opinions of the different people in the movies. Some statements were given that represented an opinion on a specific cup. Students had to indicate which person had agreed with this claim; for instance 'Drinking glasses can be used on this festival, since it is so small.' There was also the option to indicate that no one had expressed that opinion. Additionally, students also had to link the movies to the name of the persons. This allowed seeing whether students paid attention to textual information on the screen. The researcher observed the whole session.

For the analyses a score was calculated (TOT1) for each student by adding the correct answers on the different items. A second score (TOT2) was calculated for the link between the movies and the names of the persons. Two ANOVA's were performed with the condition as independent variable (iPod versus iPod+) and respectively TOT1 and TOT2 as dependent variables.

Results and Conclusion Study 1

From the observation it became clear that navigating through the different movies was for no participant a problem, hence it was not needed to control for prior experience with an iPod or MP3-player.

The ANOVA with TOT1 as a dependent variable reveals a significant large effect of condition, $F(1,22) = 5.35$; $p = .03$; $\eta^2 = .20$. The iPod-group scores significantly better on the test than the iPod+-group (see Table 1). Combining the two tasks led to worse results than performing only one task. Also for TOT2, a significant large effect was found, $F(1,22) = 11.59$; $p = .01$; $\eta^2 = 36$. Similarly, the iPod-group outperforms the iPod+-group. Participants in the iPod-group are more capable of linking the names of the persons to the videos. Apparently, they did not only listened better (auditory information), but also looked better at the displayed information (textual information).

Table 1: Means and standard deviation for the 2 groups of study 1

Condition	Mean	SD	N
TOT1			
iPod+	8.73	3.50	11
iPod	11.50	2.15	12
Total	9.96	3.26	23
TOT2			
iPod+	2.55	1.13	11
iPod	4.50	1.57	12
Total	3.57	1.67	23

While the results of this study reveal that performing a second task interferes with the information processing process, it must be said, that although the second task was aimed at being a highly automated task, difficulties with operating the exercise bike (1970's-model) caused probably a high load for students (all students complained about the exercise bike), and hence made the task no longer automated. The observations show that it was difficult for the participants to keep the 10km/h. This may also have lead the task to become

more cognitive – focussing on the 10km/h – rather than mainly physical. For this reason it was opted to replicate the study with a modern version of an exercise bike.

Study 2

Method

Participants

Participants were 27 first year Educational Sciences bachelor students from a Belgian University (academic year 2007-2008). Two male and twenty-five female students participated, on average 20.33 age (SD= 5.60). Participation in this experiment was part of a specific course in their program.

Design and procedure

The design and procedure were identical to study 1, except that now instead of an old exercise bike, a modern version (Kettler Vienna) was used, on which no effort was needed to keep the 10km/h. .

Results and Conclusion from Study 2

The ANOVA for TOT1 revealed again a significant large effect of condition, $F(1,26) = 6.21$; $p = .02$; $\eta^2 = .20$. The iPod-group outperforms the iPod+-group on the test (see Table 2). For the TOT2-scores, no significant effect was found, $F(1,26) = 3.31$; $p = .08$; $\eta^2 = .12$. This means that, although the descriptives (Table 2) show that the mean of the iPod-group is higher than the mean of the iPod+-group, that they do not significantly differ. In this group, the execution of a second task interfered for the auditory material, but not for the visual material. The latter may be due to the fact that students did not need to look at the speedometer, or only once to know that they could easily attain to the 10km/h, hence they could focus on the visual information on the iPod.

Table 2: Means and standard deviation for the 2 groups of study 2

Condition	Mean	SD	N
TOT1			
iPod+	9.64	2.62	14
iPod	11.69	1.44	13
Total	10.63	2.34	27
TOT2			
iPod+	4.00	1.84	14
iPod	5.15	1.41	13
Total	4.56	1.72	27

Discussion and Conclusion

The two exploratory studies reveal that it is not so evident to study while performing an additional task. The parallel processing seems to interfere with the study process. At the same time riding a bike and processing information from videos caused a split attention effect. Surprisingly, although this study works with small number of participants, the effect sizes were rather high. The effect sizes in the first study reveal that the split attention effect occurred even more in reading the textual information compared to listening to auditory information. This effect was not longer found in the second study. It may be that the degree of automation of the second task plays a role. In any case, the results reveal that this split attention effect occurs even when information involved in the two tasks does not need to be integrated, when the two tasks are not related to one another.

In this study, two not fully automated tasks were used (especially in study 1). While cycling one had to pay attention to the speed, one could not go below 10 km/h. While one could expect that performing a physical and a cognitive task would not cause any interference, this was the case here. While one could argue that this relates to the degree of automation –although study 2 proves otherwise- it may also be related to the kind of task. In the study by Hunton and Rose (2005) on driving while calling, it was found that not all tasks interfere to the same extent. For instance, talking to a passenger did not lead to more car accidents. This suggest that depending on the kind of task a split attention effect may occur; given the finding that no difference was found in the number of car accidents when drivers where driving alone or having a conservation with a passenger; but the number of car accidents did rise when the driver was on the phone. Although it may that even there a split attention effect has occurred but that the passenger is able to compensate for it, by also looking at the traffic and stopping to talk when traffic gets busy.

The presented studies reveal that the easiness with which the iPod is introduced in education is based on large optimism and that, prior to providing course material on an iPod the question should be raised what the mental investment is students have to make to learn study material from an iPod (while performing an additional task). Apparently a very simple, highly automated task like cycling interferes already with the information processing of the material offered through an iPod. Further research is needed that clearly shows when students are capable of addressing two tasks simultaneously in an efficient and effective way, by for instance, looking at the degree of automation, the kind of task, etc. Additionally, the question can be raised whether specific learner related variables come into play, such as for instance, students' perception of the medium (cf. Salomon, 1984) or students' prior knowledge about the content offered through the iPod. Additionally and specifically related to the findings of Luria and Meiran (2005), the performance on the second task may also be a variable of interest.

The results of these two studies, even if they are rather explorative- do also raise questions on the theory of cognitive load and the relation with working memory. While some researchers indicate that cognitive load can be measured by introducing a second task, but indicating that this task has to require the same cognitive activities (Brünken, Plass, & Leutner, 2003), the studies here suggest that this is not the case, and that even a non-cognitive task poses cognitive load for students.

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