Media multitasking, attention, and distraction: a critical discussion

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Abstract Students often multitask with technologies such as computers, laptops, tablets and smartphones during class. Unfortunately, numerous empirical studies firmly establish a significant drop in academic performance caused by this media multitasking. In this paper it is argued that cognitive studies may have clarified the negative *consequences* of this activity, yet they struggle to address the *processes* involved in it. A cognitive characterization of attention as a mental phenomenon neglects the interaction between bodies and technologies, and it is suggested that a postphenomenological understanding is necessary to account for the materiality of practice. Notions of embodied habits and technical mediation are introduced, and an example of a postphenomenological account of media multitasking is introduced. It is argued that this approach enables researchers to investigate media multitasking as it occurs in everyday educational practice.

Keywords Attention · Distraction · Educational technology · Media multitasking · Postphenomenology

1 Introduction

Digital technologies such as laptops, tablets, and smartphones permeate more and more areas of our everyday lives. We inhabit a world full of browsing, scrolling, streaming, and downloading. Young generations are highly affected by these incremental societal changes. According to 2013 findings, as much as 93 % of American teenagers now own a computer or have access to one at home, 78 % have a cellphone, 47 % own a smartphone, and 23 % already own a tablet computer (Madden et al. 2013). Since smartphones, tablets, and all the other toys and tools of the digital age saturate young people's lives at a time when their brains are still maturing, some authors suggest there is something qualitatively different about generations born from 1980 onwards, varyingly described as *digital natives* (Prensky 2001) or *the Net Generation* (Tapscott 1998). Raised in a context where digital technologies form an inextricable part of their lives, technology is said to have changed the way these

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young people think. They have supposedly developed the ability to rapidly process parallel and discontinuous information, are used to immediacy, crave speed, and feel comfortable performing several tasks at once. According to this discourse, future generations will be bored without the rapid changes multimedia-experiences with technology can provide, and we must integrate technology in the educational system to as great an extent as possible. But we simply do not have any evidence of young people's superior technological abilities and multitasking skills (Bennett et al., 2008). Several empirical studies find media multitasking to cause significant drops in academic performance (e.g., Bowman et al., 2010; Fox et al., 2009; Fried 2008; Gaudreau et al., 2014; Hembrooke and Gay 2003; Risko et al., 2013; Sana et al., 2013). So is technology in the educational system a burden or a blessing? In an increasingly digitized world, it is crucial to understand the use of technology in the educational system how it affects and its relation paying attention, and becoming distracted. The purpose of this paper is to challenge and expand the current understanding of media multitasking in order to widen the scope for future studies.

The paper is structured as follows. In the next section, the theoretical structure behind current media multitasking studies is introduced and a number of empirical findings are described. These studies find media multitasking to be detrimental to educational performance. A two-pronged critique of the dominant cognitive paradigm is then launched. First, there is no objective definition of "task", so testing the effects of media multitasking experimentally is fraught with difficulty. Second, a cognitive framework that divides interruptions into mental choices and physical stimuli neglects the role of embodied interaction with material technologies and therefore cannot explain certain agential processes in media multitasking. It is then suggested that a postphenomenological approach is necessary to account for the materiality of media use. Notions of embodied habits and technical mediation are introduced, and an example of a postphenomenological account of media multitasking is provided. Finally, it is argued that a postphenomenological approach enables the study of media use as situated in everyday educational practice.

2 Information overload: the curse of media multitasking

Researchers are increasingly interested in the effects of the large educational influx of technologies on academic performance. Since the widespread dispersion of computers in the 1960's, the digital computer has been elevated to the status of an epistemological engine, a metaphor for the human mind that has become an explicit model for describing the nature of psychological processes (Ihde 2000). This is evident in media multitasking studies, where the mind is generally understood as an information processing device that uses mental resources to carry out operations and complete tasks. Studies employ a variant of the *limited resource* metaphor of attention, which posits the following: There is (a) a limited quantity of mental resources that are (b) controlled by an executive system allocating it where it is deemed most necessary, and (c) does so in a flexible way, applying resources to different goals in a graded fashion, so (d) the amount of attention exerted varies for each task, and this amount (e) affects its quality (Fernandez-Duque and Johnson 2002).

According to this perspective, attention is a mental mechanism that can be focused on stimuli in order to process them, but only a limited quantity of stimuli can be processed at any given time. If demands exceed available attentional capacity, the cognitive system overloads and performance suffers (Sweller et al., 2011). Because of this limitation, the mind must

govern the allocation of attention. This allocation is mostly flexible with the mind having voluntary control over which stimuli it chooses to attend to (this is known as *endogenous*, top-down, or goal-directed attention), but can also be triggered by an external stimulus such as a loud noise or a flashing light (*exogenous*, bottom-up, or stimulus-driven attention) (Corbetta and Shulman 2002; Posner 1980). In certain situations, the mind allocates attention to multiple concurrent sources of information. This is multitasking, the mind's performance of two or more cognitive tasks. Media multitasking, broadly defined, refers to "engaging in one medium along with other media or non-media activities" (Zhang and Zhang 2012:1883). Empirically, the educational impact of media multitasking has been studied in reading comprehension tests, experimentally set up lectures, and in more naturalistic studies.

In *reading comprehension tests*, researchers instruct participants to read a passage of text while engaging in media multitasking such as simultaneously watching background videos or instant messaging. Studies in this domain have established that it takes significantly longer to read a passage of text when media multitasking (Bowman et al. 2010; Fox et al. 2009). Further, when introducing time limits in reading comprehension tests to reflect students' real life time-limited study conditions, media multitasking results in significant performance decrements (Lee et al., 2012; Srivastava 2013).

In *experimentally set up lectures*, researchers instruct participants to attend a lecture while engaging in media multitasking such as simultaneously answering messages or solving additional problems. Studies have found that texting while attending lectures impairs academic performance (Dietz and Henrich 2014; Ellis et al., 2010; Rosen et al., 2011). Similarly, laptop multitaskers achieve lower test scores than those who do not use laptops for multitasking purposes (Risko et al. 2013; Sana et al. 2013; Wood et al. 2012). Further, media multitaskers' laptop use poses a significant distraction to participants sitting in their vicinity (Sana et al. 2013). While this evidence refutes overly optimistic claims about digital natives' media multitasking abilities, it is unknown to which extent these artificial situations correspond to real life situations.[1]

In *naturalistic studies*, researchers attempt to gauge educational effects of naturally occurring media multitasking. In an influential study, Hembrooke and Gay (2003) asked a group of students to use laptops "as usual" during a lecture, while another group was instructed to keep their laptops closed. Results showed that students in the open condition suffered performance decrements on an ensuing memory test. In another influential study built around a long-term lecture course with students free to use laptops as they pleased, students spent an average of 17 out of each 75 min' class period using their laptops for activities other than taking notes for class (Fried 2008). Off-task laptop usage is negatively related to several measures of student learning, including self-reported understanding of course material and overall course performance (Fried 2008; Gaudreau et al. 2014; Kraushaar and Novak 2010). Further, naturally occurring media multitasking hinders fellow students' ability to concentrate (Fried 2008).

In conclusion, media multitasking has significant adverse effects on educational performance. Surprisingly, students are cognizant of this. As Junco and Cotten (2011) summarize, students are "aware that divided attention is detrimental to their academic achievement; however, they continue to engage in the behavior" (p. 376).

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[1] One might question the aptness of e.g., testing "attention in the classroom" by making solitary psychology students watch a 60 min pre-recorded lecture titled *Introduction to Ancient Greek History*: *Lecture 2* (Risko et al. 2013).

3 What are you doing? the tricky task of definition

Since multitasking consumes cognitive resources that could otherwise used for processing primary information, it is not surprising that media multitasking impairs academic performance. In fact, the mentally taxing nature of multitasking means cognitive science struggles to explain cases in which multitasking does *not* impair performance. Multitasking is benign, it is claimed, when tasks are "automated", and examples include "reading an article and sipping coffee" (Sana et al. 2013) or "chewing gum, walking, and talking" (Kirschner and Karpinski 2010). But combining "automated" tasks such as chewing gum, walking, and talking does not seem to involve multitasking at all. [2] Otherwise, why not add to the list swallowing, balancing and listening? Or breathing and blinking? This infinite list denotes an ontological problem: What constitutes something as a "task"? Why is chewing gum, for instance, considered a "task"? There are no necessary and sufficient conditions of delimiting something as a task, so we cannot objectively define "multitasking", which creates a conceptual dilemma: If our concept of multitasking (a) includes the performance of automated tasks such as chewing gum and breathing ("background tasks"), we *always* multitask and the concept is redundant unless all tasks can be objectively delimited and their cognitive loads measured (as in the Task Manager on ones computer). This seems implausible. But if our concept of multitasking (b) excludes the performance of automated tasks, multitasking occurs *only* when we are simultaneously engaged in multiple cognitively demanding tasks and no such thing as "benign multitasking" exists.

The implicit presupposition that media multitasking is cognitively demanding and detrimental to educational practice often leads researchers to pair a primary task of "information processing" (e.g., reading a text or attending a lecture) with a discordant media task (e.g., instant messaging). Media multitasking is experimentally designed to pull in *opposite directions*. What is measured is not the effect of media multitasking per se (whatever that is), but of *distractive media multitasking*. At best, this leads to tautological results ("distraction is distracting"). At worst, it leads to ambiguity and conceptual confusion. For instance, one study asked participants to 1) attend to lecture material and 2) take notes using laptops, but "laptop multitasking" was not thought to occur until these processes were combined with 3) answering unrelated online tasks (Sana et al. 2013). Although fulfilling the requirement of engaging in one medium (i.e., laptop note taking) along with other media or non-media activities (i.e., attending to the lecture), "media multitasking" apparently did not follow. In this case, we can only assume that laptop note taking was taken as an "automated" task and consequently excluded from critical scrutiny. But does that mean laptop note taking during lectures is an educationally trivial task? Without a valid conception of task, experimental media multitasking studies risk losing grasp of their topic. Let us call this the "what-problem". Obviously, these shortcomings do not change the fact that students actually do engage in distractive media activities (such as instant messaging) that pull them away from educational activity (Fried 2008; Gaudreau et al. 2014; Kraushaar and Novak 2010). Yet, while cognitive studies may have clarified the negative *consequences* of such activity, they struggle to address the *processes* involved in it. We will call this the "why-problem".

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[2] To be so dumb that one cannot "chew gum and walk at the same time" is, in fact, a famous putdown delivered by President Lyndon B. Johnson to Republican politician (and later president) Gerald Ford.

4 Intangible agency: the curious disappearance of materiality

In media multitasking studies, attention is embedded in a two-dimensional cognitive framework that divides the world into subjective minds and objective stimuli. These dualist metaphysics give rise to specific explanatory models regarding the processes of attention and distraction. Fried (2008), for instance, argues that attention is often "controlled voluntarily", but that external events and visual stimulation such as pop-ups, instant messages, movement of text, and low-battery warnings can result in "involuntary shifts of attention" (p. 908). Similarly, Hembrooke and Gay (2003) argue that disproportionate allocation of resources result either from "conscious and intentional mechanisms inherent to the individual" or from "attributes intrinsic to the information or message" (p. 50). According to this framework, attention is primarily controlled in an endogenous fashion (active and willful voluntarism), but can occasionally be exogenously triggered by unexpected physical stimuli emanating from technological objects (passive and mechanical determinism) Fig. 1.

This classic conceptualization of human agency contrasts our voluntary actions with things that merely happen to us. In the first case, a bored student entertains himself by directing attention to the Web while attending to a lecture. This media multitasking overloads his cognitive capacity and his performance suffers, but it is nevertheless a fully conscious and voluntary choice. Alternatively, incoming emails, alerts, notifications, and other stimuli (e.g., researchers messaging during class) force themselves upon his mind and mechanically trigger an involuntary reflex. Either way, the relevant area of study is the mind of the student. However, while both kinds of interruption may occur in real life, they do not constitute the full picture of media use: We do not just *look* at computers (unless there is something wrong with them), we actively *handle* them. A narrow focus on information processing produces an image of the subject as an "angelic eye" merely staring at objects (Sampson 1998). This visualist bias relies on the unspoken supposition that engagement with technologies requires a stationary body (Richardson 2005). But using digital technologies not only means being *face-to-face* with a screen, it includes being *hands-on* with some sort of keyboard (Friesen 2011). What seems to be missing from the cognitive picture is embodied interaction with material technologies Fig 2.

To acknowledge the importance of things we manipulate (literally "operate with our hands"), we must replace a traditional cognitive epistemology of the eye with an
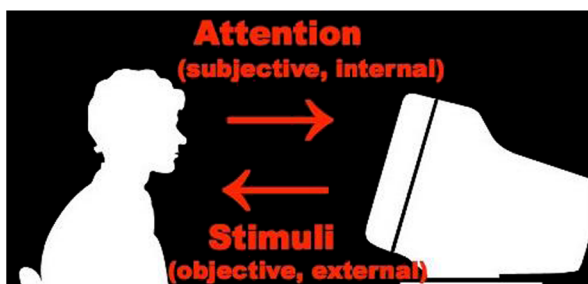

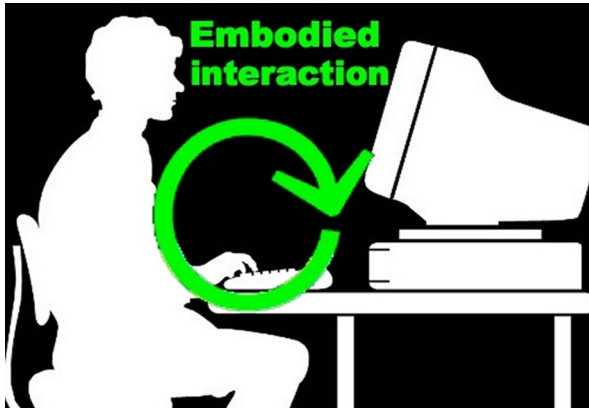**Fig. 1** The bifurcated view of attention

Fig. 2 Embodied interaction with technological artifact

epistemology of the hand (Brinkmann and Tanggaard 2010). Why does this matter? Because cognitive science is characterized by a *dictate of volition* making it unfit to provide adequate accounts of the embodied non-conscious, implicit, skilled, and habitual activities of everyday life (Radman 2012). Because such theoretical skew may ultimately lead to unfortunate practical consequences, since representing is intervening (Hacking 1983). Because matter matters (Barad 2003). We need a theoretical approach that sticks to the phenomenon and acknowledges the materiality of media use. In the remainder of this paper, it will be shown how a postphenomenological approach does exactly that.

5 1. Postphenomenology: embodied habits and technical mediation

The road toward postphenomenology contains a subtle terminological shift from attention to intentionality. While attention and intention share etymological roots in *tendere*, "to stretch", attention has come to signify "mental heeding", stretching one's *mind* toward something. We tend to think of attention as a disembodied gaze, a "cognitive function" rather than "bodily engagement" (Csordas 1993:138). Intentionality, on the other hand, retains connotations of bodily directedness towards the world (Carman 2008). According to Maurice Merleau-Ponty (2002), it is our bodily intentionality that is the basis of all activity in the world.[3] Merleau-Ponty argues that much of our everyday activity is the result of skilled *embodied habits*, which can be explained neither in terms of cognitive decisions nor behavioral reflexes: "If habit is neither a form of knowledge nor an involuntary action, what then is it? It is knowledge in the hands, which is forthcoming only when bodily effort is made, and cannot be formulated in detachment from that effort" (p. 166). A habit is bodily sediment of past activity, which dynamically guides our present activity without determining it (Crossley 2001). It is a predilection to act due to familiarity with certain situations. Although attributable to me as an agent, habitual agency is

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[3] A third generation of cognitive scientists has since attempted to integrate notions of the active body under headings such as *extended*, *enacted*, and *embodied cognition* (e.g., Clark 1997; Noë 2004; Varela et al., 1991).

different from voluntary action ("mind-to-world causation"), since one experiences the situation as drawing movements out of us ("world-to-mind causation") (Dreyfus 2002). According to this phenomenological analysis, it is insufficient to state that a mind voluntarily chooses from a range of action possibilities; instead we are *inclined* toward certain activity according to our embodied habits. This is neither voluntary nor involuntary, but located between these two poles of agency. While emphasizing the role of embodiment, however, Merleau-Ponty showed little interest in technologies (Ihde and Selinger 2004).

To acquire sensitivity to technologies, we turn to a contemporary philosophy of technology called postphenomenology (e.g., Ihde 1990; Rosenberger 2012; Selinger 2006; Verbeek 2005). Postphenomenology adheres to embodied experience with technologies and is grounded in a relational ontology, which means the smallest unit of analysis is the human-technology relation (Ihde 1990). While extending phenomenological insights about embodiment, postphenomenology adds concern for the *technical mediation* of our being-in-the-world. Being directed at the world by way of a technological artifact transforms our experience by amplifying some aspects of perception and reducing others (Ihde 1990). As the old adage goes, to a man with a hammer everything looks like nail. Conversely, we are also transformed by our use of technologies, since technical mediation "does not simply take place *between* a subject and an object, but rather *coshapes* subjectivity and objectivity" (Verbeek 2005:130). When zooming out from cognitive activity to human-technology relations, it becomes obvious that technology use contains a moral dimension (Verbeek 2011). To the extent that technologies transform certain activities that we regularly perform, they influence the cultivation of virtues (Vallor 2012). This also applies to the educational system where emailing instructors, recording lectures, or engaging in distractive media use during class involves notions of formality, privacy, and responsibility (Selinger 2013).

To understand the processes involved in "media multitasking", Robert Rosenberger (2012) explication of *cell-driving* seems pertinent.[4] Using a cellphone while driving a car significantly impairs one's driving abilities. It was previously assumed that this was due to cellphones forcing drivers to grip the steering wheel with only one hand, but research has shown that the use of hands-free cellphones also carries a drop in driving performance. From a cognitive perspective, one might argue that if both handheld and hands-free cellphones impair driving, the cause must be mental rather than physical. Impairment occurs because the mind's limited quantity of attention is stretched too thin across driving and cellphone conversation. Rosenberger (2012) account of cell-driving instead focuses on embodied habits and technical mediation of awareness ("field composition"): When a car is fully functioning, the experienced driver does not focus on the vehicle itself, but is aware of the road ahead, movements of other cars, signs, lights, mirrors, and such. Correspondingly, to users familiar with talking on cellphones, the cellphone itself withdraws in use and awareness instead gravitates toward the presence of the conversational partner and the content of conversation. Rosenberger then suggests that the source of cellphone-induced driving impairment

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[4] Indeed, media multitasking studies often refer to driving studies (e.g., Bowman et al. 2010; Dietz and Henrich 2014).

is the way cellphone use habitually inclines one toward an awareness composed of cellphone conversation at the expense of traffic. The problem is not that attention is divided between two activities, but that it cannot be. Note that conversing with passengers does not cause impairment, because passengers are aware of traffic and modulate conversation accordingly (Rosenberger 2013). In this case, driving and conversing are part of the same materially situated activity, so there is an attunement between driver-traffic perception, passenger-traffic perception, and driver-passenger conversation. Hence, while a notion of cognitive overload might abstractly explain distraction, "cognitive overload" itself cannot be understood without invoking rhythmic interactions of e.g., driver, car, cellphone, traffic, and conversational partner.

A postphenomenological focus on human-technology relations implies a different approach to media use than that of cognitive science. In contrast to a focus on "quantity of cognitive resources", postphenomenology adds concern for the "quality of experience" (Rosenberger 2010:73). In this account, the dynamics of attention-distraction are inextricably tied to material practice, which cannot be reduced to stimuli processed in an individual person's mind. As ecological psychologists say, "Ask not what's inside your head, but what your head's inside of" (Mace 1977).

6 Future studies: more media, less multitasking

Let us now apply this newly developed postphenomenological vocabulary to educational practice. A recent study by Mueller and Oppenheimer (2014) investigated the differences between longhand and laptop note taking. Students were assigned to rooms equipped with either laptops or notebooks, instructed to use normal note-taking strategies, and watched one of five TED talks. They were subsequently given a test on the lecture covering both factual questions ("Approximately how many years ago did the Indus civilization exist?") and conceptual questions ("How do Sweden and Japan differ in their approaches to equality within their societies?"). Results showed that longhand note takers performed significantly better on conceptual questions than laptop note takers. A qualitative analysis of the notes showed that laptop note takers tended to take copious notes that overlapped verbatim with the lecture. This suggests a tipping point in which the benefit of taking more notes is eclipsed by "mindless transcription" (p. 4). In a reiteration of the experiment, the researchers tried to prevent this adverse effect by giving new students precautionary instructions to "Take notes in your own words and don't just write down word-for-word what the speaker is saying" (p. 4). Remarkably, even after being warned and explicitly instructed not to take verbatim laptop notes, students still did it. Apart from an off-hand remark that laptop use facilitates verbatim transcription of content because most students can type "significantly faster than they can write" (p. 2), the authors provide only a sparse theoretical framework, so the study seems open for interpretation.

Before moving on to postphenomenology, how do we understand these results from a cognitive perspective? First of all, the experiment was not carried out in the name of media multitasking, and fortunately so. Since taking laptop notes is not an instance of what we have called *distractive media multitasking*, experimental

studies might dismiss it as a mere "automated" task and exclude it from critical scrutiny. This pertains to the "what-problem" of media multitasking. However, even when "automated" and used solely as intended, laptop note taking does affect educational performance. Second, when attempting to pry open this black box through cognitive science, the two-dimensional cognitive explanatory framework leaves us with the following conundrum: Nothing in the laptop itself *determines* that it be used for mindless transcription, so why don't students just *decide* to take paraphrasing, summarizing, and synthesizing laptop notes - especially when explicitly warned about the negative consequences of verbatim transcription? This puzzle pertains to the dictate of volition and the "why-problem" of cognitive science. Future media multitasking studies might do well to focus more on *media* and less on *multitasking*.

By employing a postphenomenological vocabulary, we can begin to make sense of the study. That laptop and longhand note taking naturally incline students to different note taking strategies is a matter of technical mediation. Since students cannot write as fast as someone talks when using paper and pencil, they must instead engage with the topic enough to make our own sense it. The slowness of writing process inclines students toward paraphrasing notes. When equipped with a laptop, however, students are more prone to perceive the lecture as a flood of words that can (and should perhaps) be captured verbatim and written down word-for-word. This is due to the *compositional speed* of the laptop (Ihde 1990:141). Of course, this speed is not due to the laptop itself. Without Merleau-Pontian knowledge in the hands, nothing happens. Indeed, typing was Merleau-Ponty's primary example of habit. Imagine a person unable to touch type: This person would be totally unable to transcribe anything. Writing on a digital device before one has learned to type is slow and unhandy. "So much time is occupied glancing at and searching for letters on the keypad and double-checking the result on the screen, it is quite impossible to follow a complete train of thought. Until our fingers have learned 'how to type' through practice, the keyboard stands as an insurmountable, present-at-hand obstacle, stubbornly resisting our commands in the immediacy of the moment? (Adams and Pente 2011:252). A laptop inclines toward verbatim transcription of content only because it is "automated", because most students can type significantly faster than they can write. It is because of technical mediation and embodied habits that taking laptop notes inclines students toward "mindless transcription".

7 Conclusion

This paper has discussed the notion of media multitasking. Empirical studies find significant performance decreases as a result of media multitasking and disprove the popular notion of a new generation of highly skilled multitaskers. However, the cognitive understanding of attention seems unable to address the interaction between body and technology in media use. Postphenomenological notions of embodied habits and technical mediation were introduced and exemplified through Rosenberger's theory of cell-driving. This postphenomenological vocabulary was applied to a study on the educational use of technology to make apparent how it helps us understand media use to a greater extent than cognitive psychology. A table summarizing the

Table 1 Differences between cognitive science and postphenomenology

	Cognitive science	Postphenomenology
Main area of interest	Information processing minds	Bodies and technology
Directedness toward media	Attention ("seeing")	Intentionality ("handling")
Potential problem	Cognitive overload	Technical mediation
Suggested main cause	Mental choices	Embodied habits

differences between cognitive science and postphenomenology with regards to media use is listed below Table 1.

Extrapolating from these considerations, it appears vital to supplement cognitive experiments with investigations of embodied habits and technical mediation. Media multitasking studies would benefit greatly from attending to the qualitative experiences of its participants: Why do students continue media multitasking if they are aware of the negative impacts on academic achievements? When using technologies such as laptops and tablets, which things stand forward as significant and which things recede into the background of awareness? How do factors such as the rhythm of lessons, social norms, presented material, or even the physical layout of a classroom influence media multitasking? To my knowledge, however, no research conducted from such perspective has been published. The intention of this paper was thus to address a gap in the existing literature and to bring a new approach into an important and contemporary field of research.

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