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The Impact of Technological Multitasking in Education

Intro

I am choosing to write my paper on the impact of technological multitasking in the classroom, particularly as it relates to the college population. My aim is to discuss the role of technology within the classroom environment. This topic is significant because it is relatable to a mass audience. As individuals living in the 21st century, our lives are dominated by the constantly evolving roles of technology. As a culture, we are able to recognize the ways in which technology alters our focus. My paper aims to make this broad concept applicable to the field of higher education. I believe the general public would be interested in this paper topic because regardless of their own educational background, the reader's future and the future of society rests in the hands of the students who are preparing to enter the workforce. The multitasking induced by technology impacts the future workforce and is therefore an applicable subject to the general audience.

There were several overarching questions that guided my research. How does the role of technology impact multitasking within the college classroom? Does technological multitasking impact the educational experience of college learners and which forms of technology and multitasking affect student success?

In this paper, I will explore the ways in which technological multitasking impacts student learning. While I argue that multitasking negatively affects learners, I will consider the opposing

viewpoint, that technology and the ability to multitask do not alter the abilities of the collegiate learner. Within my paper, I hope to convey the point that, with the proper pedagogical approaches, and reduced multitasking, technology can be a useful learning tool in the collegiate classroom environment.

Different Perspectives on Multitasking

In my paper, I will examine both the Educational and Psychological perspectives. The research that I have conducted indicates that the field of Education views technology in terms of learning. The discipline of Psychology however, seems to understand multitasking in terms of the human brain. Sources from the journal *Computers and Education* examine the impact that technological multitasking has on the classroom environment. They use experimental or observational research to determine how much time college students spend using technology for something other than educational purposes, the duration of their off-topic technology use and the consequences that in-class multitasking has on student academic performance as it relates to student GPA. The Educational research reflects experimental studies and observational research conducted with a sample of college students. These studies examine the amount of time and the type of technology utilized by students in the observational studies. Additionally, researchers conducted experiments that required students to utilize technology during learning. This was followed by an assessment that demonstrated the student's ability to multitask and comprehend material. Secondly, the field of psychology examines multitasking in terms of the human brain. The sources that are from the field of psychology describe multitasking through neuroscience. Psychologists examine how the brain works and processes multitasking. Primarily, the psychological research examines the ways in which the prefrontal cortex and working memory are involved in multitasking.

Both the psychological and educational research support the argument that technological multitasking has an adverse impact on the learning of college students. Although the development of technology in education was intended to be beneficial to student learning and to adapt the classroom into the 21st century, the multitasking that often occurs in conjunction with the use of technology is detrimental to student comprehension. It is important to note that the multitasking that is associated with technology is not specifically related to the classroom experience. Although technology is now commonly used within every educational level, including college level classes, it is normally specifically directed by the teacher to avoid the negative impacts of multitasking. Technological multitasking is typically student generated, especially among college students who have more freedom within the classroom. It was for this reason that I chose to focus on the college population for my paper.

Within this paper, I hope to demonstrate the ways in which digital multitasking can contribute to decreased student success. My argument insists that while technology may be a useful tool when the correct pedagogical approaches are applied to reduce multitasking, the multitasking that does occur within the collegiate classroom environment will undoubtedly impact student test scores, GPA and comprehension. Technological multitasking not only distracts students from the learning that should be occurring within the classroom, but it also reduces learning time, reading time and ultimately produces a negative effect on the assessment of student achievement.

The Antithesis

Research within the field of Education provides support for the argument that technological multitasking produces negative effects within the collegiate classroom. However, research has also been conducted to support the antithesis to this argument; that students who

engage in technological multitasking are capable of producing effective results in the classroom. Specifically, there is educational research that examines the impact that technology has on the ability for students to read and comprehend material. While it was originally assumed that this type of research would yield results that supported my argument, it actually demonstrated the opposite. The research that provided the antithesis to this argument focused specifically on the impact of instant messaging on student reading comprehension. The researchers developed an experimental study expecting the results to prove that college students who engaged in instant messaging while reading would exhibit a longer duration of reading time as well as lower scores on a comprehension assessment. Although the essential question of their research asked "Can students really multitask?", their experimental study reported that college students were, in some ways, capable of technological multitasking (Bowman 927).

Although research has provided a sound basis for my argument, it is important to consider the research that presents the opposite viewpoint. The study, entitled "Can students really multitask? An experimental study of instant messaging while reading," operated on the premise of previous research, that it is difficult to perform multiple tasks simultaneously and that task-switching requires additional time diverted from educational practice (Bowman et al 928). It has often been concluded that technological multitasking within the classroom results in divided attention and therefore shows negative outcomes in test scores. The results of this study refute this concept. It is important to note that, as Bowman discussed, prior studies have shown that "when students use IM to help them with their academic work, it enhances online participation in classes" (Bowman et al 927). The difference between using IM for educational purposes versus for social interaction during classroom time is imperative in Bowman's study. Bowman's study

examines the impact that socialized technology usage has on the educational experience of college students.

Bowman's study examined the "effects of instant messaging while reading a textbook"(Bowman et al 927). The study had participating students read a passage from a textbook online while they would simultaneously respond to instant messages. Previous research by Pashler had shown that stimuli that "is novel, has an abrupt onset, change over time, or are distinctive when compared to other stimuli are likely to attract attention" (Bowman et al 928). It can therefore be concluded that the novelty of an instant message would distract students from their reading of an online text. The question of attention and instant messaging is further addressed by Bowman and colleagues throughout their study.

Bowman's study included eighty nine college students. Although the student participants were from a wide-range of academic majors, all participants were enrolled in a general psychology class, and the textbook passage chosen for the study was a psychology text (Bowman et al 929). The students were assigned randomly to one condition; either IM before reading, IM during reading or no IMs (Bowman et al 929). The time taken by participants to read the online text and respond to instant messages and follow-up questions was recorded electronically (Bowman et al 929).

The results of this study demonstrated that there were significant differences in time in the reading duration of the three groups. It was shown that the group who IMed before reading took the least amount of time to read their textbook passage while the group who IMed during reading took the longest. The results also showed that there was no difference in the comprehension test scores that followed the reading. This illustrated that technological multitasking does not always impact student success within the classroom (Bowman et al 930).

The study performed by Bowman and fellow researchers evidentially supports the antithesis of my paper's argument. Although it was proven that technological multi-tasking does distract attention away from academic tasks, it also demonstrated that this lack of attention did not impact student test scores. It is important to note that a control group who did not read the article but did take the comprehension exam averaged 7 correct answers while those in the study who read the article only answered 5-6 additional answers correctly. While the results of the study found few differences in comprehension among those who IMed during reading and those who did not, it may be possible that the students who IMed during reading may have background knowledge that better allowed them to answer the questions, not that the IMing itself had no effect on their comprehension. Although this study found that multitasking did not impact student test scores, the toll that multitasking takes on the brain was evident through prolonged reading time.

Multitasking and the Brain

The brain is incapable of effectively performing during a multitasking situation, either technologically based or otherwise. The brain's inability to effectively multitask would therefore prevent student success in the classroom when they are indiscriminately using technology. There is a multitude of evidence that supports the idea that multitasking is detrimental to the individual, both in their performance and the state of their neurological health. For example, Borst's research suggests that individuals are only capable of retrieving "one fact at a time from our declarative memory" (Borst et al 1). This would imply that, from an educational standpoint, multitasking in any form would prevent a student from appropriately responding to academic coursework in conjunction with another distraction eg. technology. There have been studies that show that swapping between tasks does result in prolonged retrieval rate of information. The study

conducted by Borst and his colleagues demonstrated that the extended length of time it took to access information between two tasks had less to do with the actual retrieval of facts from the brain and more to do with the time it took to switch between tasks. Borst's study concluded that multitasking and a person's ability to switch between tasks is dependable on the time between the two tasks; if they are in quick succession of each other, the information is still readily available in the mind (Borst et al 15). With this in mind, it is arguable that technological multitasking in the collegiate classroom would impact the learning of the students who engage in technology use for extended periods of time. College students are more likely to engage in multiple uses of media at once such as frequently answering text messages or checking email accounts. Borst's article supports the argument that there would be a detrimental impact on student learning if technological resources were utilized for several minutes at a time before resuming coursework.

The conflict of interest that results from technology is visible in the brains response to fast-paced media. The brain is unable to prevent diverted student attention especially when communicative media is involved. Research has concluded that the human brain will store memories based on the novelty of the situation or task being conducted. "The hippocampus compares incoming sensory impressions with prior predictions, and when it detects a mismatch, it signals the substantia nigra and ventral tegmental area in the midbrain in a feedback loop that enhances memory retention" (Cheshire 20). In other words, the brain is more likely to store information if it is unexpected in the regular context of the moment. This same idea can be applied to the technological multitasking that occurs within the collegiate classroom. If it is to be expected by the student that the class or lesson they are partaking in is boring or predictable, the spontaneous text or social media alerts they receive would undoubtedly catch their attention. Their brain would perceive this mismatch of the senses and convert the media message to

memory while allowing the academic lesson to be momentarily irretrievable. If this is an ongoing occurrence within the structure of the classroom, it can be inferred that the success of a multitasking student within the course would be negatively impacted. The student would be more likely to be engaged with an unanticipated media alert than with the coursework itself, thus resulting in poor assessment scores.

Psychological research also documents the delays in thinking caused by multitasking. Studies show that younger brains use specific regions of the brain for specific functions (Berger 667). The ability for the brain to switch between tasks that use different portions of the brain would therefore take a more extended period of time than would staying devoted to one task that utilizes only one particular part of the brain. Studies have shown that it is more difficult to multitask between a cognitive and a motor task because it requires both hemispheres of the brain simultaneously (Berger 668). This is due to the delay in time that it takes for the brain to adjust and compensate for the task by using separate parts of the brain. With this in mind, it can be understood that switching between a cognitive task, such as engaging in course discussion or listening to a lecture, and a motor task, such as picking up a cell phone and responding to a text message would result in delayed cognitive functioning. Knowledge of the neuroscience involved in multitasking provides a clear support for the argument that technological multitasking would result in decreased student success within higher education.

Since the brain has difficulty transitioning from one sector to another, tasks suffer because of the time overlap. Research completed by Menno Nijboer and colleagues uses MRI Neuroimaging to discover the areas of the brain that are affected by multitasking. Nijboer's study claims that there is previous evidence to suggest that there is a multitasking locus in the brain; or that one specific section of the brain is stimulated during multitasking. There is also research

that suggests that multitasking involves the interaction of several brain regions, thus causing the interference associated with multitasking (Nijboer et al 60). Nijboer's study aimed to determine which of these previous findings was correct by using Magnetic Resonance Imaging on the brain.

Ultimately, Nijboer's study poses the question " is multitasking interference caused by interference in a single, universal, "multitasking" brain region or if it is the result of widespread interactions in the brain?" (Nijboer et al 60). This study described that in situations involving multitasking, the prefrontal cortex and parietal regions of the brain were involved, and that the cerebellum was also activated when attempting to add one task to another (Nijboer et al 61). In order to test the validity of the above statement, Nijboer's study utilized three testing conditions; 2-back, tracking and tone-counting. The 2-back task required the participants to recognize whether or not a stream of letters was the same or different as the second previous stream (Nijboer et al 61). The tracking condition required participants to keep a computer cursor centered on a dot as it moved from left to right and the tone counting condition asked participants to count the number of high pitch tones while ignoring low pitch ones (Nijboer et al 61). Each of these conditions required the use of different types of memory with several of the conditions showing overlap. The 2-back condition required motor, visual and working memory, the tracking condition required motor and visual memory and the tone-counting condition utilizing aural, working and motor memory (Nijboer et al 61).

The results of Nijboer's study showed that when multitasking occurred that required working memory in addition to any other memory type, the results of the condition were more inaccurate (Nijboer et al 63). This supports my argument. The brain was unable to adjust between the two portions needed to complete the task. Since the brain is not as efficient at using

two parts of the brain at once, the participants could not perform the task effectively. This implies that when different areas of the brain are required for different types of memory, the ability for the brain to focus on one task is altered. In the event that there are two tasks competing for the same type of memory, they are also attempting to utilize the same areas of the brain at one time. The results of the tasks being completed will be inadequate as they both are competing to use the same parts of the brain at once.

Why Collegiate Education?

The focus of this paper is on the collegiate level of education because college students are more able to exercise freedom in their coursework and study habits, and are therefore more likely to engage in multitasking behaviors associated with technology in the classroom. It is also commonly understood that the young adult cohort that predominates the student body has been immersed in the technological era. This would make them more likely than older or younger adults to utilize the forms of technology associated with multitasking. College students appear to be more susceptible to technological multitasking during scholarly activities inside and outside of the classroom, such as homework and studying. There are empirical studies which suggest that as grade level increases, so does the expected amount of work to be completed outside of the classroom (Calderwood et al 19). This, coupled with the access to communication technologies and decreased parental involvement in the college years, allows for increased use of technologies during homework completion.

How Prominent is Multitasking Among College Students?

College students utilize indiscriminate technology at an alarming rate during academic activities. Often these technologies are used both inside the classroom and during the completion of homework assignments outside of the classroom. In a study completed by Charles

Calderwood and his colleagues, they measured and recorded the frequency and duration of any non-academic activities observed during the span of a three hour homework session. Their study found that multiple forms of technology are typically utilized in conjunction with each other; for instance, students tended to listen to music throughout their study time as well as engaging in other technological multitasking behaviors (Calderwood et al 25). The study concluded that the mean number of distractions was approximately 35 in three hours, not including the use of music, while the duration of these behaviors averaged about 25 minutes (Calderwood et al 25). It was also found that cell phone usage, mainly to receive and send text messages and non-homework related computer usage were the two major distractions among college level students during their homework time (Calderwood et al 25). This research demonstrates that collegiate students are typically more vulnerable to technological multitasking during academic activities. Calderwood's study also proves that college students average about a half hour of time engaged with non-school related technologies in only a three hour time period. This research provides evidence that students are less able to complete and focus on academic activities when communication technologies are available which would thus result in substandard academic performance.

Multitasking and GPA

The higher frequency of technology use during academic routines can be correlated with a decrease in student achievement. The increased use of technology fosters divided attention which can negatively impact a student's ability to perform well in school. A study completed by Reynol Junco compared technology usage with student GPA. His study found that students were most likely to utilize text messaging during class with 69% of the sample population reporting texting; this was followed by use of Facebook and email (Junco 2241). The study concluded that

GPA was only negatively affected by the use of text messaging and social media accounts (Facebook), not by email, IM or other phone usage. This can be attributed to the lower-frequency of these activities within the classroom (Junco 2241). This demonstrates that increased multitasking decreases GPA; the more students used a particular form of technology, the larger impact it had on their overall grades.

Junco's study supports the argument that technological multitasking negatively impacts student success. The study showed that increased use of communicative technologies within the educational setting significantly affected student GPA. The more frequent the use of technology, the greater impact on student grade point average. Frequency is the significant component to understanding the impact of digital multitasking in the college classroom. Only when technology is used in conjunction with coursework and is repeatedly used over an extended period of time is it detrimental to student achievement. There is little evidence to support the idea that any technology usage during educational work would be detrimental, but it can be argued that the use of technologies such as text messaging require prolonged attention among a conversation. Therefore, it is unlikely that a student would be able to attend to and understand course material at the same time they were using communication technologies.

Multitasking and Test Scores

The extent and frequency of non-structured technology use in the classroom is the most prominent when examining the impact technology has on learning. It has been repeatedly shown that media-multitasking prevents full learning, but learning is more severely affected the more the technology is used over time. Eileen Wood and her colleagues completed a study which supports the thesis that the use of technology in the classroom environment is detrimental to student learning. Her study aimed to understand the impact of utilizing digital technology while

simultaneously attempting to listen and respond to a lecture in the university classroom. The introduction to the Wood study makes the same claim as my paper, that "although technologies can be harnessed for positive educational outcomes, research suggests that these digital technologies can impair performance and distract learners if used inappropriately" (Wood et al 365).

The experimental design set up in the Wood study included 145 college participants assigned randomly to seven groups; a Facebook group, texting group, natural technology use (as they would in lecture), a Word Processing group, paper and pencil group and lastly an MSN/email conditions group (Wood et al 368). The participants attended three lectures under identical conditions all three times. The participants were asked to use their assigned form of technology throughout the lecture and were prompted to do specific tasks for each form of technology used. The word processing and paper and pencil groups were asked to take notes using their specified condition and all students were expected to attend to the lecture since it was a part of their course work (Wood et al 368). After each twenty minute lecture, participants were asked to complete a fifteen question multiple choice test to assess their understanding of the content presented (Wood et al 368).

The results of the Wood study show that the use of technological multi-tasking within the classroom does in fact alter academic performance. It was concluded that not all multi-tasking conditions produced significant decreases in performance but that, overall, media multitasking was detrimental (Wood et al 369). It was found that students who engaged in the use of Facebook and MSN scored significantly lower than the pencil note-taking group in all three assessments (Wood et al 369). Additionally, in the majority of the three trials, all participants who engaged with any technology during the lectures scored lower than the paper and pencil

group (Wood et al 369). It is evident that technology usage in the collegiate classroom does impact student test scores, and although Wood's study found the results to be less significant than expected, it does not take into account the effect of prolonged technology use throughout an entire semester. The impact of multitasking on student test scores would likely be more noticeable as students more frequently engaged in multitasking behaviors. The study showed that there was a slight impact, and it can be hypothesized that this impact would be enhanced by repeated technology usage in the classroom.

Multitasking and its Effects on Students

The growing use of technology within the classroom influences not only the students who directly interact with these technologies, but their nearby classmates as well. With the growing trend of laptop usage within the college classroom community, research studies have been conducted linking laptop multitasking within the classroom to poorer test scores. Increased allowance for students to utilize personal computers to take notes during class also results in increased digital multitasking within the classroom. A study completed by Faria Sana, et al, examines how laptop usage within the classroom impacts student test scores. In addition to exploring the impact that laptop multi-tasking has on student achievement, the researchers also investigated the effect of laptop usage on nearby students. Sana's study proposed that not only would the student utilizing the laptop for multitasking have poorer test scores, but their classmates who observed their behavior would also be subject to poor performance (Sana et al 24).

Sana's study included forty-four undergraduate student participants who were asked to attend a Psychology lecture for their class and take notes on their laptops, one half of the participants were randomly assigned to complete other online tasks not related to the lecture

(Sana et al 25). The tasks included looking up information on news websites, Google and YouTube or Facebook and were meant to mimic the type and amount of time that college students would typically multitask, having them complete these tasks for approximately 15 minutes of the 45 minute lecture (Sana et al 26). A twenty question multiple choice assessment was the main measure of comprehension for this experiment.

The results of this study found that students who utilized media multitasking scored significantly lower than those who did not with "participants who multitasked scoring 11% lower on the post-lecture comprehension test" (Sana et al 27). The results of their first experiment demonstrate a support of my paper's thesis; that digital multitasking unrelated to course work results in a decline of academic performance.

The second experiment conducted by Sana and her colleagues had randomly assigned participants complete the same laptop-based tasks while the other participants utilized a paper and pencil note-taking method. The paper and pencil group participants were then randomly assigned to either be in the view of their multi-tasking classmates or not (Sana et al 27). The participants for the second experiment then completed the same assessment as the first experiment (Sana et al 27).

The results of this second experiment showed results similar to that of the first experiment. Those participants that were in the view of their multi-tasking peers scored significantly lower on the comprehension exam than the participants who were not in the view of multi-tasking classmates (Sana et al 29). The study found that "those in view of a multitasking peer scored 17% lower on a post-lecture comprehension test" (Sana et al 29). The results of this experiment not only prove my thesis true, but provide an interesting argument. This experiment suggests that multitasking within the classroom impacts all students who are subjected to it, both

directly and indirectly. The prominence of laptop and other technology usage within the classroom makes this problem more prevalent. The negative impact that multitasking can have on a wide range of students as demonstrated in this study is something for educators to be aware of and attempt to prevent in their classrooms. This is particularly critical, especially when it has been found that intelligence cannot mitigate against the negative affects of multitasking.

Multitasking and Intelligence

Individual intelligence is not capable of preventing the negative impacts of media multitasking. Although it could be assumed more intelligent students could work through the distractions, this is not the case. Significantly, Susan Ravizza and her fellow researchers discovered that non-academic internet usage was negatively related to classroom learning regardless of a student's intellectual ability (Ravizza et al 109). Although the researchers acknowledged that the use of media devices in the classroom could be positive in a well-controlled classroom, their study sought to "assess the relationship between natural portable device use in the classroom and performance in a real academic setting" (Ravizza et al 109). The researchers hypothesized that student scores would decrease with increased non-academic technology usage within the classroom. They theorized that students who were doing well in a particular class would use technology more, believing that they did not have to pay attention as closely (Ravizza et al 109). This would result in negative outcomes for all students in the classroom, regardless of intellectual ability.

Ravizza's study surveyed 196 students enrolled in an Introductory Psychology course regarding the frequency and duration of their technology usage as well as their perception of the impact this technology usage had on their learning (Ravizza et al 110). Participants were asked to rate each response on a scale from 1-5 at four different times in the semester, approximately one

week before each in-class exam [there were four exams total with the last exam being cumulative, each had 50-51 multiple choice questions] (Ravizza et al 110). It is important to note that technology usage was broken down into four sections; texting, Facebook, email and internet use, all were specified to be non-academic internet usage.

The results of Ravizza's study concluded that students typically utilized texting as their primary source of technology followed by internet usage, email and Facebook (Ravizza et al 111). When student ratings of technology usage were correlated with the scores on the final exam, it was found that all four types of technology use negatively impacted the score of the final exam (Ravizza et al 111). Ravizza's study also discovered that the negative effects of media usage on classroom learning affected all students regardless of their intelligence level. This was found by assessing the ACT scores of the participants in relation to their exam scores during the study. It is important to note that intellectual ability cannot always be measured by a test score, and that utilizing high school ACT scores may not have been the most effective choice for determining the intellectual ability of the participants. Furthermore, participants showed that while they did not originally believe that technology usage impacted their classroom learning, they were more likely to believe that it negatively impacted learning as they came closer to the final exam (Ravizza et al 111). Additionally, it was found that when students did well on the first exam, technology usage for those particular students increased and that the students who had higher ACT scores were more likely to use technology more after the first exam than their lower performing peers (Ravizza et al 112).

The results of Ravizza's study show similar outcomes to the other studies cited in this paper and therefore have some validity. However, the use of ACT scores prevents a fully sound study. Intellectual ability cannot always be determined by test scores, and since this study is

assessing college level students, a high school standardized test may not be the best predictor of intellectual capability. It is appropriate to say that students will typically increase technology usage after they have received a decent test score. Even the most intelligent students will believe that these good scores enable them to concentrate less on their coursework and instead focus their attention on other things such as technology. The participants in this study admitted that technology was detrimental to their learning just prior to their final exam. This demonstrates that although students are unable to perceive the negative impacts of their media-multitasking in the short-term, the long-term multitasking does influence their learning over an entire semester.

Can Interest Level Lessen Multitasking?

From Ravizza's study, it is supported that intellectual ability does not mitigate against the negative effects of technological multitasking in the classroom. Is it possible that interest level within a certain subject would alleviate these negative impacts? Student interest, like intelligence level does very little to mitigate against the negative impacts of media multitasking. An experiment performed by Maureen Conard and Robert Marsh addressed the question of interest level and the influence it could have when paired with multitasking in the classroom. Conard and Marsh's study looks at multitasking from the psychological perspective, attempting to examine the role that individual difference may have in a person's ability to gain information (Conard et al 112). They hypothesized that greater situational interest; interest specific to a topic, would "motivate the activation of more cognitive resources, particularly in working memory, which could allow the individual to better attend to the content being learned in spite of interruptions" (Conard et al 113). In other words, the researchers believed that interest level would promote better attention among students and that the working memory portion of their brain would be activated to contest the multitasking occurring in the classroom.

Their experimental design included 110 participants, all were business students that were assigned to one of two conditions, the interrupted group or the uninterrupted group (Conard et al 114). All participants received course credit for participating in the study. Participants watched a video of a prerecorded business presentation about social networking which was judged by previous individuals to be interesting and new, something that the participants would be likely to pay attention to (Conard et al 114). During the video, the interruption condition received 8 instant messages at specific times of the lecture. The uninterrupted group received no IMs and all participants completed a 22 question multiple choice assessment following the video. The participants were also asked to rate their interest level in the video on a 3 point scale (Conard et al 114).

The results of the Conard and Marsh study found that test performance was better when participants found the video interesting and that students scored more poorly when they were not focused on the video and had additional distractions from media (Conard et al 115). All participants who were uninterested in the video also reported a greater inability to focus on the presentation while participants in the interrupted condition reported that the more interested they were in the video, the more they felt distracted by the instant messages they received (Conard et al 115). This serves to support Conard and Marsh's hypothesis, that the more interested an individual is in the material, the more likely they are to learn more from the material. Although this may seem to be common sense, it is significant when correlated with technological multitasking. The results indicated that the interrupted control group scored lower on the multiple choice exam than did their uninterrupted counterparts with a mean percentage score of 69.5% compared to 74.1% (Conard et al 115). The findings showed that both groups measured similarly when surveyed about their interest in the video, therefore demonstrating that although

interest level would improve learning, it does not prevent the negative effects of media usage on classroom learning.

It is important to note that this study was conducted using a population of all business majors who were asked to watch a video of a prerecorded business conference regarding social media. The college major of the participants may have influenced higher interest levels in the content of the video since it is applicable to these students in their future careers. Although it is shown that heightened interest levels are positively correlated with student learning, it would be interesting to examine if interest levels were still significant in a more diverse population of students. Additionally, all of the participants in this study were offered course credit for their participation, which may or may not have skewed the interest level results. It can be speculated that if students are receiving credit for participating that they would be more interested in the material being presented. However, regardless of interest level, it was found that student scores were negatively impacted by media multitasking. This supports the argument of my paper, that unless mediated by educators, the role of media multitasking in the classroom will result in deficits in student learning.

Multitasking and Pedagogy

Technology can be a beneficial classroom resource, but only when multitasking behaviors are reduced. In the past, single activities requiring the full concentration of an individual were the norm in the classroom. Referred to as the "composition classroom," this educational setting would encourage careful attention to detail during sustained reading in which students were expected to fully comprehend each section they were reading (Keller 100). Arguably, this same form of education is still valued today, especially in the collegiate classroom that promotes lengthy discussion-based lectures. Daniel Keller asks the important question,

"what are teachers leaving out if they see this kind of reading as the only valid one-or simply the best kind of reading? (Keller 100) This question can be applied more generally to the field of education today. Is it possible for students to attend more to their learning if the use of technology is involved? Previous research has indicated that interest level does increase student learning, enabling us to consider that students might gain more from their education if it was conducted through teacher-managed technology use.

The development of technology has both helped and hindered the educational field. It is important to make the distinction between classroom-led technology use and the non-educational media multitasking that students engage in regardless of their expected classroom role. Technology can be a valuable tool in the learning community when it is explicitly tied to educational standards. Utilizing technology as a way to further the learning that is already occurring in the classroom is an effective way for teachers to better connect their course material to the constantly evolving technological world of their students. As Keller suggests, "Corporate America embraced it [media multitasking] as a vague job skill" (Keller 102). Educating students using technology and encouraging them to process information simultaneously using media became integral to the educational field. As teachers, particularly university educators, a main goal of the curriculum is to prepare their learners for the job market they will enter upon graduation. Based on the growing demand for employees who are capable of multitasking using media, it is evident that classroom learning had to make a shift to include technology.

Although Keller indicates that technology is an integral part of 21st century America, he also states that "the connected, option-loaded lives of students have become distracted, overloaded lives" (Keller 102). This statement is essentially the basis of support for my argument; that although technology can be a beneficial tool when paired with directed classroom

instruction, it can also inhibit learning if used unnecessarily by students who attempt to multitask. It has been repeatedly proven that media multitasking has been attributed to poor comprehension skills, delayed processing, as well as poorer test scores. The students who engage in non-academic technology use during class-related activities are more likely to experience negative educational outcomes. The enduring question is, would it be possible to utilize technology effectively in the classroom while mitigating for the negative outcomes of technological multitasking?

Effectively preventing media multitasking in the classroom can be done when students are presented with a media-integrated curriculum. Students who are given the opportunity to use technology in meaningful ways are less likely to use it to multitask in the classroom setting. Enabling students to analyze and present material using technology provides them with a purpose for their technology use. Giving students a planned purpose for their use of technology is an effective method in diminishing media multitasking. The value of technology in the classroom is heightened when it is connected to the academic context (Gebre et al 83). In other words, it is necessary for students to see the connection between their technology use and their coursework in order to avoid media multitasking. Additionally, encouraging students to interact with one another using technological resources is key in mitigating against media multitasking in the classroom. "Learners are increasingly connected and therefore are in a constant state of wanting to know what their peers are saying" (Ng'ambi 652). A major component of technology usage that impacts multitasking is communication. Students are more likely to utilize media multitasking when it involves communicating with others, as seen in the prominent use of text messaging. When students have opportunities to discuss important topics with one another, it diminishes the amount of multitasking when using technology in an academic capacity. These

components are all a part of a student-centered education. Allowing students to work together, using technology to construct their knowledge and share it with others can help to mitigate against media multitasking (Lasry et al 238). However, based on my own experiences in the collegiate classroom, reducing the amount of media multitasking in the classroom is best accomplished with a strict set of rules regarding technology-use policies and frequent monitoring by the teacher. When students recognize that there are written and formal consequences to their media multitasking, they are more likely to obey those rules. Students are less likely to understand the long-term consequences that technological multitasking can have on their academic performance, but they are more likely to respond to immediate repercussions given by the instructor. It can be maintained that this same form of pedagogy would be effective to mitigate technological multitasking in all grade levels and although it is often more applicable to college level students, these strategies can also be applied within the elementary and secondary education classrooms.

The increased use of technology across the education curriculum poses an issue for educators at all grade levels. As technology becomes more widely available, the multitasking that occurs in conjunction with it also increases. As seen in the research described in this paper, media multitasking most often occurs with the use of cell phones and non-academic computer usage. The prevalence of these types of media makes it difficult to reduce the negative impact that media multitasking can have in the classroom environment. It is important to notice that the most detrimental types of multitasking occur due to student initiated technology use in the educational setting. Technology use that is structured by the educator is not an issue connected to media multitasking. The multitasking that does occur as a result of technology has shown many of the same effects across multiple types of technology usage including texting, internet surfing,

instant messaging and video watching. All of these technologies when accompanied with multitasking behaviors demonstrated negative academic impacts. These included decreased reading comprehension, lower test scores, slower reading rate as well as reduced student GPA.

Conclusion

Through the research that was conducted for this paper, it can be concluded that media multitasking is not only detrimental in terms of education, but also in terms of neuroscience and psychology. The brain has not shown to be capable of efficient media multitasking, especially in instances where two different parts of the brain were involved. The brains ability to switch between two different tasks that require separate portions of the brain is not sufficient enough to allow the individual to fully concentrate on both tasks. Therefore, it can be concluded that in instances where any individual is attempting to process two tasks at once; in the case of this paper, an educational task and a media task, they would be unable to fully understand either task.

Although the negative impacts of media multitasking have been fully displayed in the conducted research, it is my argument that with the correct pedagogical approaches, multitasking can be reduced and technology use can be beneficial in the classroom environment. As the world becomes more technologically-based, it is important that educators adapt to the changing job-markets and assist their student in becoming fluent with media. However, it is just as important that they plan for the technological multitasking that can negatively impact their student's abilities. By setting up purposeful activities for students using technology and providing them with formal boundaries regarding media usage, multitasking may be reduced in the classroom. Ultimately, the role of technology in the classroom is a pivotal one. It allows students to access information and become accustomed to the forms of media they will need to use in the workforce. With the role of technology in the classroom being so important, it is imperative for

teachers to mitigate the impact of media multitasking in the classroom. With the correct teacher

supports and the impact of media multitasking being reduced, the use of technology within the

classroom can be a beneficial one.

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