

AN EXPLORATION OF DIVIDED ATTENTION IN YOUNG ADULTS DURING READING WITH MULTITASKING ACTIVITIES: A SCIENCE PERSPECTIVE

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Abstract: Multitasking activities, such as listening to liked and disliked songs and eating snacks, have an impact on young adults' focus while reading. Focusing on graduate students who engage in more activities, this study addresses the effects of multitasking on academic performance. In the digital age, prevalent multitasking behaviors can negatively impact work quality and mental health. This qualitative, experimental design study involved eight graduate students, aged 24-28 years old, from a university in Bandung. The participants were selected through purposive sampling, participating in two simulated sessions involving a reading task with multitasking activities. Data were collected through self-reported journals and analyzed descriptively. Findings showed that memorable songs were more distracting than disliked songs, while snacking also affected focus but to a lesser extent. These results support the theory that attention is a limited resource that must be managed efficiently. This research discusses the single pool and multiple pool models that explain how emotional and sensory distractions affect multitasking ability. Therefore, it is necessary to understand distraction factors in educational and professional contexts. Future research could involve in-depth interviews to gain deeper insights into strategies to maintain focus, improving our understanding of divided attention and multitasking, particularly in education.

Keywords: Attentional processes, divided attention, multitasking, young adults.

INTRODUCTION

Multitasking is an important topic in cognitive psychology and neuroscience. Advances in technology have contributed to multitasking behavior. For example, social media and productivity apps allow people to multitask. Surprisingly, out of 22.6 million internet users in Indonesia, 170 million active social media users spend 99.1% of their time on smartphones (Gunawan & Ratmono, 2021). About 62.3%

of students admitted to doing other activities while using the internet to search for references, such as browsing Facebook and playing online games, with about 37.7% of respondents admitting to using Facebook while searching for references on the internet (Afiandini, 2016). An increasingly busy lifestyle affects individual habits and behaviors in daily life, including among graduate students as young adults.

According to Richard Davidson, a neuroscientist from the University of Wisconsin, focus is one of the important abilities in our lives, each of which is supported by a different nervous system, to help us deal with various feelings, relationships, and problems that arise in everyday life (Goleman, 2009). The nervous system consists of millions of nerve cells often called neurons (nerve cell bodies, dendrites, and axons) that conduct and transmit messages (impulses) in the form of stimuli or responses (Deny, 2018). Safira, A., Minasa, R., Kahby, I. A., & Artinah (2023) states that the structure of the central nervous system consists of the brain which includes the cerebrum and cerebellum and the spinal cord. The peripheral nervous system consists of the conscious system (somatic) and the unconscious nervous system (autonomic nervous system), where the conscious system controls activities regulated by the brain, such as body movements, while the autonomic system controls activities that cannot be regulated by the brain, such as heart rate, digestive tract movements, and sweating, and the conscious system is composed of brain nerves (cranial nerves) and spinal cord nerves (Meutia et al., 2021).

Graduate students usually engage in in-depth research to produce quality academic work because they are considered to have more mature academic experience. Academic demands on students often make them perform various activities simultaneously (multitasking behavior), including when they read or work on other tasks. This is in line with what Arini (2020) revealed that individuals often work on tasks while snacking or eating lunch and listening to music. Multitasking activities include reading while consuming snacks such as chips or others. Schalkwyk (2011) explains that multitasking is the capacity to perform two or more tasks simultaneously, each requiring attention and additional cognitive functions. In other words, multitasking refers to the practice of completing multiple tasks with different goals simultaneously (Sanbonmatsu et al., 2013). Junco (2012) defines multitasking as managing multiple tasks simultaneously, dividing attention, and switching between tasks that have no predetermined order.

But is multitasking really effective in improving work quality? Or is multitasking actually detrimental to work quality and mental health? Several studies have shown that multitasking can improve work quality and time efficiency, but it can also impair work quality and even, if excessive, increase the risk of chronic stress, depression and social anxiety. This is consistent with theories that continuously limited central cognitive selection constraints and decision-making capacity impair performance in multiple tasks (Schumacher et al., 2001). The study by Schumacher et al. (1999) showed overlapping response times in response selection for two tasks performed simultaneously and raised the question of whether

there are fixed response selection constraints. Applying metacognitive strategies can reduce multitasking interference, according to Salvucci et al. (2009) in their Unified Theory of Multitasking Continuum.

Attention is part of the ability to focus attention on a task that plays an important role in processing and understanding information. According to Robiansyah (2019) that human attention has a range, namely the increase or decrease of human focus in an activity. Goleman (2009) emphasizes that focus is essential for maintaining control of attention, fighting internal and external distractions that can interfere with cognitive processes. Divided attention is a key phenomenon involved in multitasking. Kahneman (1973) points out that dividing attention across modalities becomes difficult when a task involves storage. Sternberg & Sternberg (2012) explain that divided attention is our ability to perform more than one task at a time, and we shift our attentional resources to allocate them wisely, as needed. Early research on divided attention showed difficulties in monitoring two activities at once (Neisser & Becklen, 1975). However, practice can improve performance in divided attention, as shown in research (Spelke et al., 1976).

The fundamental question of the influence of multitasking on work quality and its impact on mental health is still an important topic of discussion. Some studies show that multitasking can improve time efficiency, but it can also lead to a decrease in work quality and increase the risk of chronic stress, depression, and social anxiety. For example, research by Larry D. et al. (2011) showed that the group that was actively texting experienced a significant decrease in scores (10.6% lower) compared to the group that was rarely or not distracted by text messages. Cognitive factors, such as attention and cognitive control, play an important role in multitasking and can affect multitasking performance (Braisby & Gellatly, 2012; Sternberg & Sternberg, 2012). Attention is a process that not only brings together the elements that make up a stimulus, but also brings the outcome into consciousness (Braisby & Gellatly, 2012).

In daily life, cognitive factors (knowledge, expectations, and goals) that act as Top-Down controllers and sensory stimuli that act as Bottom-Up controllers interact dynamically to control visual attention (Corbetta & Shulman, 2002). The ability to control and regulate cognitive and behavioral processes to achieve goals is the ability of effective functioning (Guranto et al., 2023). Background noise and other minor distractions can inhibit the development of declarative memory, which is necessary for efficient learning, according to research by Foerde et al. (2006). Attention causes us to actively process only a small portion of the vast amount of information available to us through our senses, stored memories, and other cognitive information processes (Nadel, 2003). In addition, since we are more likely to remember information we focus on than information we ignore, increased attention also aids in memory processes (Sternberg & Sternberg, 2012). According to Sternberg & Sternberg (2012), attention has four main purposes, namely observational attention (focusing on specific stimuli while ignoring others), search

(finding signals amidst noise), deep attention (allocating attentional resources to coordinate performance on multiple tasks simultaneously), and signal detection and alertness (detecting the occurrence of specific stimuli).

In everyday life, understanding divided attention and multitasking performance has significant implications for managing complex information and tasks. Therefore, this study aims to explore divided attention in young adults while reading with multitasking activities, with a focus on work quality and mental health.

METHOD

This study used a qualitative approach with an experimental design through two simulations, to explore young adults' divided attention while reading with multitasking activities. Each participant participated in both simulations, which consisted of a series of reading tasks while performing additional activities. The study involved eight participants consisting of four females and four males ranging in age from 24-28 years old. All participants were postgraduate students of a university in Bandung city, who were selected by purposive sampling to ensure appropriate representation of the desired age group and educational status. The study was conducted in two simulation sessions, each lasting 9 minutes, with the following stages.

Table 1. Simulation stage, implemented by researchers from the theory of Sternberg & Sternberg (2012)

Time	Simulation 1	Simulation 2
Minutes 0-3	Participants read their favorite book or passage without doing any other activity.	Participants read their favorite books or readings without doing any other activities.
Minutes 3-4	Participants continue reading while listening to memorable songs.	Participants continue to read while listening to unfavorable songs.
Minutes 4-6	The participant reads while listening to memorable songs and records the essence of the reading.	The participant reads while listening to unfavorable songs and records the gist of the passage.
Minutes 6-9	The participant reads while listening to memorable songs and eats chips/ crackers (without taking notes).	The participant reads while listening to disliked songs and eats chips/ crackers (without taking notes).
Minutes 9	The participant stops reading.	The participant stops reading.

Favorite books, memorable songs and disliked songs were selected by each participant to ensure their interest and engagement in reading and songs were selected based on the individual preferences of the participants to ensure emotional

impact. Data collection in this study was conducted by journaling method through self-report technique, meaning that the recording was done individually regarding the details of the simulation experience conducted by each participant. The data collected in this study were then processed using descriptive analysis techniques, which focused on exploring the divided attention of young adults while reading a favorite book by multitasking listening to memorable and disliked songs, and eating chips.

RESULTS AND DISCUSSION

The results of the two simulations of reading a favorite book while doing multitasking activities carried out by the eight participants who were graduate school students with an age range of 24-28 years old. Papalia et al. (2009), mentioned that the age limit of young adults is from 20 years old to 40 years old. showed various responses presented in the following table.

Table 2. Participants' experiences from the simulation conducted

Subject	Simulation	Minutes 0-3	Minutes 3-4	Minutes 4-6	Minutes 6-9	Ability to Maintain Focus (Cognitive Processes)
Subject 1, 26 years old	1	Imagining the story in the novel (focused on reading), distracted by sound	Calmed down after hearing a song, but forgot the last part of the previous reading	Multitasking to record the essence, difficult to focus	Eating crackers, feeling embarrassed in front of husband, focus split	Focus split by many distractions, difficulty maintaining attention when multitasking
	2	Reading quietly Focus	Distracted by egg martabak, regained focus after hearing disliked song	Difficulty taking notes while reading	Eating crackers, not distracted by songs	Easier to maintain focus without songs, distraction from disliked songs less influential than memorable songs
Subject 2, 24 years old, Female	1	Focused on reading and trying to understand the reading	Favorite song played, stayed focused	Writing a digest, focus shifted to writing	Eating snacks, reading comprehension lost	Distraction from snacks reduced comprehension, but songs did

						not affect focus too much
	2	Difficulty correlating title and introduction	Started to understand after further reading and stayed focused even with disliked song	Difficulty multitasking with notes, but easier to write when disliked song	Distracted by snack, focus decreased	Disliked song easier to ignore, but still had difficulty multitasking
Subject 3, 28 years old, Female	1	Interested in reading content (reading focus), distracted by noise	Preferred song, focus split	Multitasking with note-taking, memory recall	Multitasking with eating, snack focus	Distraction from songs and memories greatly affects, difficulty multitasking with eating
	2	Difficult to focus because of friend (who helped set timer)	Difficult to focus because of disliked song	Multitasking with note taking, difficult to focus	Multitasking with eating, distracted by mouse noise	Friends and ambient sounds are more distracting than disliked song, multitasking remains difficult
Subject 4, 24 years old, Female	1	Focused on speed reading and comprehending the content	Songs are disliked, focus is split on songs and difficulty comprehending reading	Multitasking by writing the essence after reading	Reading fast enough, comprehending the reading, more focused, not distracted by songs	Difficulty multitasking with songs and taking notes, but eating has less influence
	2	Focus with fast reading, comprehend reading content	Unfavorable song, focus remains	Multitasking with note-taking, difficulty writing	Not distracted by song, more distracted by sound of chips, focus split	Unfavorable song easier to ignore, still difficulty multitasking
Subject 5, 26 years old, male	1	Trying to focus on reading, distracted by fan noise and soreness	Distracted by song lyrics and cell phone sound, forgetting what I'm reading	Focus distracted by various sounds, focusing on the taste of chips	Eating chips, focusing on the taste, difficulty remembering what I'm reading	Distraction of sounds and preferred songs affect focus, difficulty multitasking with eating
	2	Distracted by friends coming over, focused	Disliked song, focused on trying to digest	Multitasking with note taking,	Eating chips, focused on food but	Disliked music is easier to ignore,

		on the clock showing 1:00 am in the morning	sentences in reading	distracted by music	slightly improved and tried to understand reading	multitasking difficulties persist
Subject 6, 25 years old, male	1	Focus on reading	Focus decreased, tried to keep reading	Multitasked with notes, focus split	Multitasked with eating, felt messy, hard to focus	Unpreferred songs easier to ignore, multitasking with eating very distracting
	2	Focus on reading	Disliked song, focus decreased, distracted	Multitasking with note-taking, difficult to focus	Multitasking with eating, focus split, lost focus due to phone distraction	Disliked music remained distracting, multitasking remained difficult and distracted by the phone
Subject 7, 25 years old, male	1	Focus on reading	Preferred song, focus is split, affected by the emotion of the song, can still read	Multitasking with note taking, writing although distracted by the emotion of the song	Multitasking with eating, focus is split due to more complex activities	Preferred song is motivating but also distracting, multitasking with eating is very distracting
	2	Focus on reading	Disliked song, focus remains	Multitasking with note taking, difficult to focus, negatively affected by song, difficult to write digest	Very distracted by song and food, focus is split	Disliked music remains distracting, multitasking remains difficult
Subject 8, 27 years old, male	1	Reading focus	Preferred song, focus distracted by memories from song	Multitasking with note taking, focus on important things	Multitasking with eating, focus returns slightly, but not as good as without song	Preferred song brings memories, very distracting, multitasking with eating better

2	Focus on reading	Disliked song, focus remains	Multitasking with notes, difficulty writing, distracted by fast tempo music	Focus better with sweets, music distracted less	Disliked music easier to ignore, multitasking remains difficult
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This study focuses on exploring the split attention of young adults while reading a favorite book with the multitasking activities of listening to songs and eating chips. Based on the results of the two simulations that have been conducted, there are several findings related to the effect of multitasking activities on reading ability while listening to memorable and disliked songs, and eating chips.

Table 3. Results of simulation 1 (reading favorite books accompanied by memorable songs)

Time	Result
Minutes 0-3	Participants read their favorite book or passage without any other activity. At this stage, all participants reported high levels of concentration and no significant distractions.
Minutes 3-4	Participants continued reading while listening to memorable songs. Most participants reported interruptions in concentration as the songs triggered strong memories and emotions.
Minutes 4-6	Participants read while listening to memorable songs and recorded the gist of the reading. At this stage, the difficulty level increases as multitasking between listening to the songs and taking notes requires more attention.
Minutes 6-9	The participant reads while listening to memorable songs and eats chips/ crackers (without taking notes). The eating activity is considered an additional distraction that makes the participant's attention even more divided.

Table 4. Results of simulation 2 (reading favorite book accompanied by disliked song)

Time	Result
Minutes 0-3	Participants read their favorite books or readings without doing any other activities. The results were the same as in the first simulation, with high levels of concentration.
Minutes 3-4	Participants continued to read while listening to unfavorable songs. Most participants reported that the disliked songs were easier to ignore, so the interruption to concentration was lower compared to the memorable songs.

Minutes 4-6	Participants read while listening to disliked songs and took notes on the gist of the reading. Participants found it easier to stay focused than when listening to memorable songs.
Minutes 6-9	Participants read while listening to disliked songs and ate chips/crackers (without taking notes). Although there was some distraction from the eating activity, the effect was lower than with memorable songs.

Attention is the process by which individuals direct their mental resources to specific tasks. Attention allows us to allocate mental resources wisely by reducing external and internal distractions, allowing us to focus on stimuli that interest us (Sternberg & Sternberg, 2012). By dimming the lights on irrelevant sensations and thoughts, we can improve our ability to respond quickly and accurately to stimuli that matter, increasing the efficiency and quality of our responses (Sternberg & Sternberg, 2012, 2017).

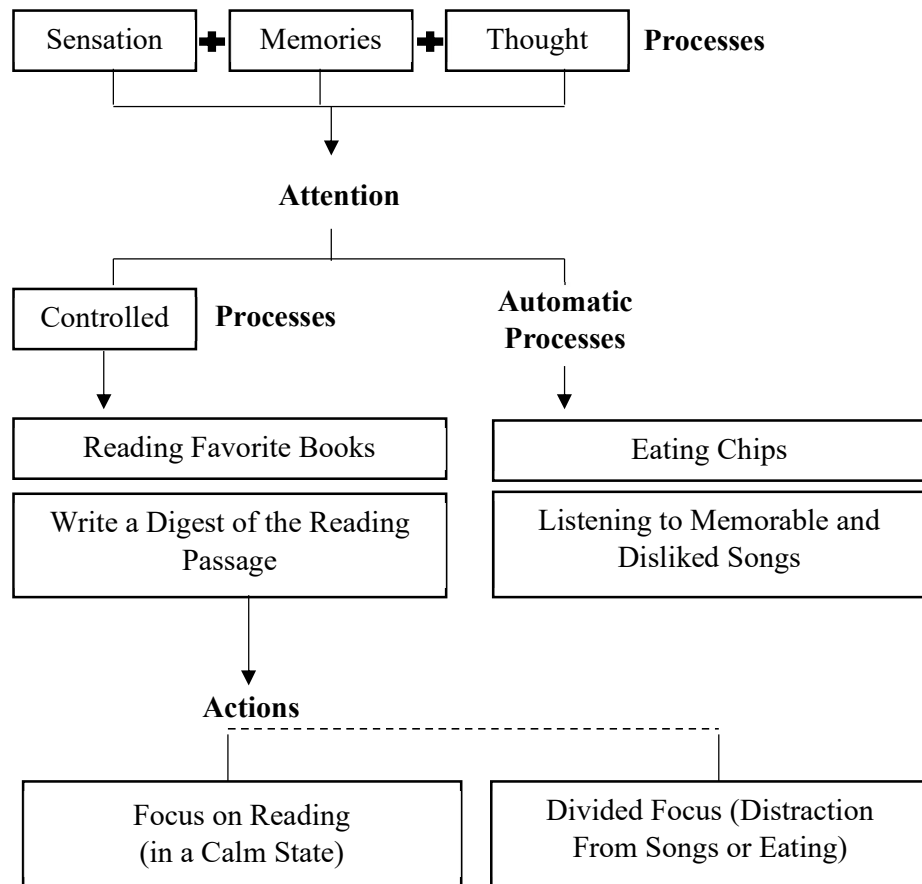


Figure 1. Attentional Process in Multitasking Activities

Participants in this situation receive a variety of sensory inputs from reading, listening to songs and eating. Memories can be triggered by memorable songs, distracting attention and disrupting focus. Conversely, unfavorable songs are less likely to trigger the same memories, allowing attention to remain on the main task. During the reading and note-taking process, participants had to actively manage their thoughts and concentration. Participants' attention was then divided between different activities, with memorable songs more likely to distract due to their emotional component. Unfavorable songs were easier to ignore, allowing attention to remain focused on the main task. Activities such as reading while listening to a song or writing a digest require full attention and awareness, especially when multitasking with other activities. Eating activities, although more automatic, still interfere with attention because they involve physical and sensory coordination. Participants tend to focus on the activity of eating chips because of the sensation and preferred taste, resulting in low attention to reading a book. In line with that perception is the process by which sensory neurons organize and assess the stimuli they receive, and sensation is the result (Dania & Novziransyah, 2021).

Furthermore, scientifically, the process of control when reading and writing the essence of reading, as well as the automatic process of eating chips and listening to songs, is closely related to the functioning of the nervous system in the brain. Meutia et al. (2021), mentioned that the peripheral nervous system consists of the conscious system (somatic) and the unconscious nervous system (autonomic nervous system). The conscious system controls activities regulated by the brain, such as body movements, while the autonomic system controls activities that cannot be directly regulated by the brain, such as heart rate, gastrointestinal movements, and sweating.

Attention is a selective process that is necessary due to the limited capacity to process visual information (Attwell & Laughlin, 2001). According to Petersen & Posner (2012), the selection process is controlled by three distinct and interrelated networks in the brain system: alerting, orienting, and executive. Attention acts as an observation center that increases awareness of limited environmental stimuli (Gardiner & Parkin, 1990). This simulation shows that focusing attention on a task can enhance the processing of information related to the task. In this simulation, the subject had difficulty focusing on reading a book due to the distraction of eating chips. The sensation and sound of the chips drew their attention, resulting in distracted processing of information related to the reading content and low comprehension.

Meanwhile, an unfavorable song can become a background that is easier to ignore, becoming an automatic process without much distraction. As a result, when there are no distractions or only minimal distractions, such as an unfavorable song, participants can maintain focus on reading. However, distractions from memorable

songs or eating activities can cause attention to be split, interfering with participants' ability to stay focused on reading and note-taking tasks.

The results showed that participants' attention was more easily divided when there was emotional distraction from memorable songs compared to disliked songs. Multitasking activities such as eating and note-taking also interfered with the reading process, with eating being a more automatic but still significant distraction. In line with the theory that multitasking can inhibit knowledge acquisition by increasing cognitive load and reducing the capacity of individual cognitive resources (Mayer & Moreno, 2010). The results showed that when multitasking with activities such as listening to songs or eating chips, individuals' cognitive resources become divided and work efficiency decreases. Simulation results also show that not only eating chips, but also other factors such as environmental sounds, laptop mouse sounds, and disliked songs can become distractions that affect participants' attention and understanding of reading a favorite book.

Attention is a process that not only brings together the elements that make up a stimulus, but also brings the outcome into consciousness (Braisby & Gellatly, 2012). In attentional theory, these results support the concept that attention is a limited resource that must be divided among various tasks. When additional tasks have a strong emotional or sensory component, they are more likely to distract attention and reduce the effectiveness of the primary task. In line with that attention causes us to actively process only a small portion of the vast amount of information available to us through our senses, stored memories, and other cognitive information processes (Nadel, 2003). Moreover, since we are more likely to remember information that we focus on than information that we ignore, increased attention also aids in memory processes (Sternberg & Sternberg, 2012). Thus, this study confirms that multitasking, especially with emotional distraction, can affect an individual's ability to focus and complete tasks well.

This research shows that selective attention has limitations, and when subjects are multitasking, their attention is divided and distributed among the tasks being performed (Sternberg & Sternberg, 2012). Divided attention occurs when attention must be allocated between multiple activities simultaneously (Sternberg & Sternberg, 2017). In this study, the activities of reading, listening to songs, and eating chips are tasks that require different attention. As explained by Sternberg & Sternberg (2012) that attention allows us to direct our mental resources to specific tasks, which allows us to focus on stimuli that interest us. Based on the theory of "allocation of attentional resources", there are two models namely "single pool of resources" and "multiple pools of resources", shown in figure 2.

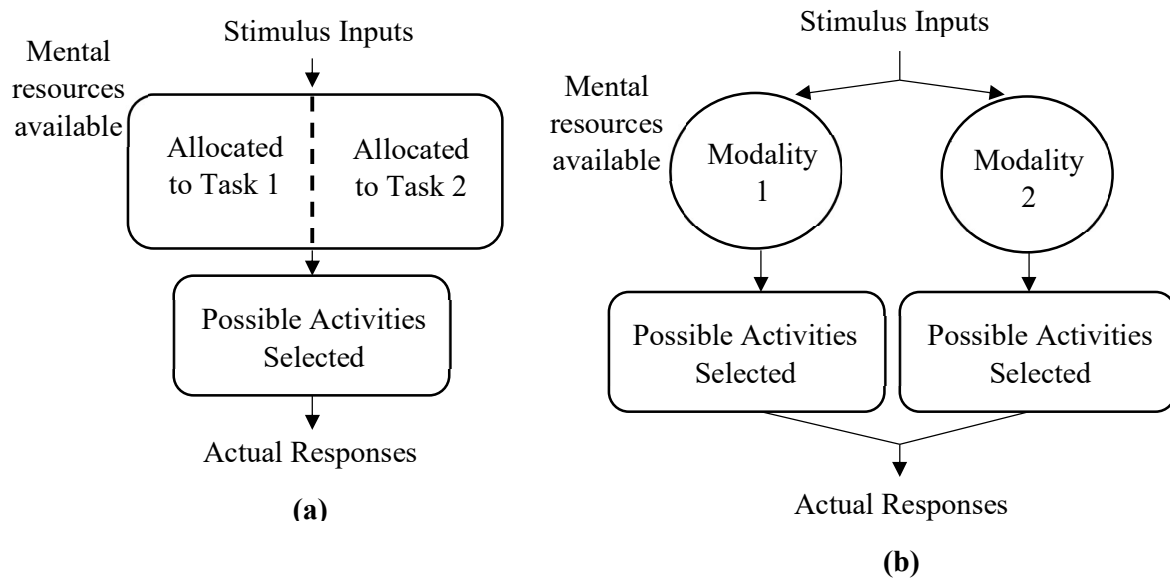


Figure 2. Allocation of Attentional Resources (Sternberg & Sternberg, 2017)

In the figure above, model (a) is the “single pool of resources” by Kahneman (1973), that this model assumes that individuals have one pool of attentional resources that can be divided among several tasks. While model (b) is “multiple pools of resources” by Navon & Gopher (1979), that this model assumes that there are several pools of resources that are specific to each modality, for example verbal and visual modalities.

Two models, the single pool model and the multiple pools model, were used to understand the effects of memorable and disliked songs, as well as eating activities, on multitasking ability in reading and note-taking. In the single pool model, memorable songs consume more attentional resources as they are associated with emotional associations, which reduces the resources available for reading and note-taking. Something similar happens with eating activities, where consuming food consumes the same attentional resources as reading, causing a decrease in effectiveness in reading comprehension. Meanwhile, in the multiple pools model, memorable songs more strongly affect the verbal modality (reading and note-taking) as they activate the emotional and memory modalities simultaneously. The activity of eating, although it may involve a different motor modality, still interferes with attention as it requires additional management of the physical activity along with reading. Regarding note-taking multitasking, in both the single pool model and the multiple pools model, the note-taking task requires the same attentional resources as reading, so multitasking can lead to decreased performance on both tasks. In the Multiple Pools Model, interference occurs due to competing resources in the same modality, namely verbal. Therefore, the two models provide different

understandings of how memorable songs, disliked songs, and eating activities affect multitasking ability in reading and note-taking. The results showed that both memorable songs and the activity of eating chips consumed the same attentional resources as the reading task, causing a decrease in effectiveness in reading comprehension.

The effect of songs on young adults' ability to focus on reading books is that memorable songs have a strong emotional component, triggering memories and emotions that interfere with concentration. This suggests that attention was diverted more to the song than to the reading and note-taking activities. Meanwhile, non-memorable songs were more easily ignored by participants, resulting in lower distraction. This allowed participants to focus more on reading and note-taking. This is consistent with the concept that emotional factors in multitasking can drain limited attention resources. Sternberg & Sternberg (2017), state that in the Multiple Pools of Resources model, distraction occurs due to competing resources within the same modality, as occurs when songs with strong emotional components influence the verbal modality. In addition, there was no clear pattern of gender differences in responses to multitasking and distraction. Both men and women experienced similar difficulties in maintaining focus when multitasking with additional activities.

Multitasking with additional activities of writing digests and eating chips or crackers. Digest writing, which requires higher controlled attention, causes more distraction when done in conjunction with listening to a song. Meanwhile, eating chips/ crackers, this activity is more automatic but still affects attention due to sensory and physical distractions. This is in line with the theoretical concept that activities that require more attention will interfere more with the main task. Sternberg & Sternberg (2012), emphasize that attention should be allocated judiciously, by dimming the lights on irrelevant sensations and thoughts.

This research confirms that multitasking activities, especially those involving emotional components such as listening to memorable songs, can distract attention and reduce the ability to focus on the main task, while disliked songs are more easily ignored. Additional activities such as writing a digest and eating also affect attention, with writing requiring more attentional resources compared to eating. Divided attention can have a significant impact on performance in tasks that require focus and concentration, suggesting that attentional resources are limited and can be affected by the type and intensity of distractions.

CONCLUSION

In this study, focus on exploring the influence of multitasking activities, specifically listening to memorable and disliked songs, as well as eating chips/

crackers, on young adults' focusing ability while reading their favorite books. Our findings showed that memorable songs tended to be more distracting than disliked songs, while eating activities had a significant but lesser influence. These results support the concept that attention is a limited resource that must be managed efficiently among various tasks. The two models, namely the single pool model and the multiple pools model, provide different understandings of how distractions, both emotional and sensory, affect multitasking ability in reading and note-taking. The implications of this study highlight the importance of understanding distraction factors in understanding attention and performance, especially in educational and professional contexts. Furthermore, follow-up research could involve in-depth interviews with subjects to gain deeper insights into the strategies used to maintain focus, so as to further enrich our understanding of divided attention and multitasking in everyday life, especially in educational settings.

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