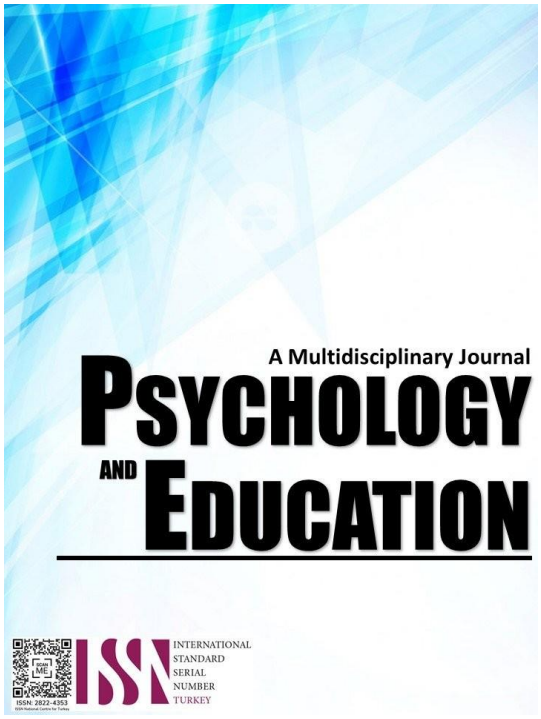
THE EFFECTS OF SELECTIVE AND DIVIDED ATTENTION ON VISUAL PERCEPTION AMONG COLLEGE STUDENTS IN LIPA CITY



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Research Article

The Effects of Selective and Divided Attention on Visual Perception among College Students in Lipa City

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Abstract

Selective and divided attention have significant impacts on visual perception. Several studies have explored how these attention types influence visual processing. However, more extensive research is needed to explore how environmental factors, like stimulus difficulty, impact selective and divided attention in educational settings. Thus, this study aimed to investigate the effects of attention on the visual perception of college students using single-factor experimental approach involving 60 participants. Results indicated that visual perception was higher under selective attention (Mn = 24.7; SD = 4.71) than divided attention (Mn = 21.7; SD = 4.79), with a mean difference of 3.76 points. Moreover, there is a very significant difference between the experimental and the control group, with a p-value of 0.002. The analysis yielded a Cohen's d of 0.863, indicating that both selective and divided attention have a large effect size on student's visual perception. Therefore, researchers recommend creating quiet study spaces to minimize distractions within the institution. Teachers could use visual aids and educate the students about the possible consequences of multitasking. Students can improve visual perception by highlighting key information, color-coding materials, and practicing visual exercises like board games and puzzles. Further studies could examine attention effects across different age groups and genders.

Keywords: *selective attention, divided attention, visual perception, cognitive processing, educational environment, stimulus difficulty, multitasking, experimental study, college students, attention span*

Introduction

Attention is a mental process in which an individual directs their focus on a specific stimulus and the conscious state that lets an individual respond to stimuli (American Psychological Association, 2018; Oberauer, 2019). Selective attention (SA) is a type of attention that lets the brain prioritize crucial information while filtering distractions (Pagnotta et al., 2022). Divided attention (DA), also known as multitasking, pertains to the spread of attention among different tasks and responding to multiple stimuli all at once (Cheng & Kibbe, 2022). While selective attention concentrates on a particular stimulus, divided attention strives to attend to various stimuli concurrently.

Visual perception is the ability of the human mind to organize, interpret, and identify visual information from the environment (Yang, 2020). The visual system (eyes and the neural pathways connected to the brain) encodes the visual stimuli from the environment to be analyzed and interpreted by the brain (Gupta et al., 2022; National Eye Institute, 2020). One significant factor influencing this mechanism is attention.

Selective and divided attention have significant impacts on visual perception. Several studies have explored how these attention types influence visual processing (Harrison et al, 2022; Lappin et al., 2020; Sharp, 2019). However, more research is needed to investigate how environmental factors (e.g., difficulty of the stimuli) affects the efficiency of selective and divided attention in real-life scenarios, specifically in educational settings.

This research aims to address this gap by applying Donald Broadbent's Filter Theory of Attention (1958), modified by Anne Treisman in 1964, and Daniel Kahneman's Divided Attention Theory (1973). The Filter Theory of Attention states that a sensory buffer filters stimuli perceived by an individual, and is therefore interpreted by the brain (Broadbent, 1958; Treisman, 1964, as cited in Bater & Jordan, 2019). In contrast, the Divided Attention Theory argues that tasks done simultaneously can be manageable with a minimum cognitive load. Only then will the process slow down when demanding tasks overload the system (Kahneman, 1973, as cited in Wickens, 2021).

In accordance with these theories, the study aims to explore a private institution for college students in Lipa City, Batangas to assess the effects of attention on visual perception. This research will make use of single-factor experimental design where selective and divided attention will be controlled to determine the visual perception of the students. Furthermore, this study aims to address the lack of existing experimental studies on this topic within the institution and locality. The empirical evidence from this study will present a cause-and-effect relationship between types of attention and visual perception, aiding academic institutions in creating strategies to enhance concentration in educational environments. It will also shed light on how distractions impact students' focus and learning effectiveness, enabling teachers to recognize students' challenges with attention. Additionally, it will contribute to the design of learning activities directed at improving focus.

Research Questions

This study aimed to identify the levels of visual perception and to measure the relationship among selective/divided attention

and visual perception. Specifically, the study sought to answer the following questions:

1. What are the levels of visual perception of:
   1.1 control group; and
   1.2 experimental group?
2. Is there a significant difference in the levels of visual perception between the experimental group and control group?
3. What are the effects of selective and divided attention on the visual perception of college students from Lipa City?
4. Based on the findings, what recommendation can be proposed to improve visual perception among college students?

Literature Review

Selective Attention

Selective attention is a type of attention in which individuals put their focus on one or fewer sensory stimuli, ignoring unimportant ones. This behavioral process sorts out essential information and is significant for almost all cognitive activities (Fiebelkorn & Kasner, 2019; McLeod, 2018; Murphy et al., 2016, as cited in Bater & Jordan, 2019). Research emphasized the complex underpinnings of selective attention (Guan et al., 2023; Faßbender et al., 2023) and its irregularity throughout different ages and conditions (Dahl et al., 2020).

This mechanism enables people to enhance their perception and interaction with their environment (Carrasco, 2011, as cited in Lev-Ari et al., 2022; Moerel et al., 2021), emphasizing its role in cognitive processing, particularly on how visual information is connected or distinguished over time (Sharp, 2019). Moreover, studies indicated that when people pay attention to specific details, it significantly affects how stimuli are perceived, possibly increasing clarity while tuning out irrelevant data (Sharp, 2019).

Research have shown that human brain can only attend to a definite amount of information at a time (Rüttgens et al., 2023), making a thorough analysis of each piece of information before proceeding to the next (Treisman et al., 1997, as cited in Okamoto, 2020). This constraint in the human brain supports specific spatial zones at certain times, letting individuals respond effectively to their environment (Zivony & Eimer, 2023).

Divided Attention

Divided attention, or multitasking, is a psychological construct that refers to the capacity of the brain to process various stimuli simultaneously, which is crucial in several contexts, including everyday tasks, educational environments, and technological settings (Różańska & Gruszka, 2020; Uluave, 2024). In addition, divided attention allows the mind to disperse its focus on diverse areas to achieve different objectives rather than simply alternating between tasks (Ji et al., 2021).

Szumowska and Kruglanski (2022) discovered that goal activation is one of the factors why people engage in multitasking. Interestingly, Lui et al. (2022) indicate gender differences in multitasking, suggesting that men may have a higher-level ability for juggling tasks, specifically in dual-task events. This advantage may root from innate cognitive differences between male and females.

Despite the perceived benefits of multitasking, evidence suggests that dividing attention can impede encoding and memory recall, thereby reducing learning performance (Castel & Craik, 2003; Craik et al., 1996; Navah-Benjamin et al., 2000, as cited in Murphy & Castel, 2022). In 2021, Peng and Tullis revealed that dividing one's attention negatively influences memory performance. Regardless, researchers note that this decline did not have an impact on the students' metacognitive monitoring—their awareness and assessment of their learning and recall abilities.

Further studies promote the idea that divided attention can lead to less accurate recognition of objects or events and impair detection of simple visual features. In addition, research suggested that limited cognitive capacity, constraints in post-perceptual processes, and decreased efficiency of information processing may be associated with performance declines (Castro et al., 2019; Lappin et al., 2020; Harrison et al., 2022).

Visual Perception

Visual perception is the cognitive process of organizing, identifying, and interpreting visual information from the environment, leading to increased awareness and understanding (Yang, 2020). It is also the cognitive capacity to visually perceive certain inputs before the retinal process relies on what information these inputs hold (Fodor, 1983, as cited in Enge et al., 2023). These sensory organs select what to emphasize among the visual contents presented to an individual (Koutras, 2022).

Visual process starts when visual inputs are received by the optic nerve, activating different brain structures (Wei et al., 2021). It also involves an interaction of multiple physical systems which includes bodily movements, optical images, external surfaces, muscular responses, and electrochemical activity in neural networks, linking each of their individual functions with one another to form visual concepts (Lappin & Bell, 2021), followed by the visual interpretation, where physical signals become percepts, eventually producing behaviors in response, allowing individuals to sense, detect, and recognize various content (Hofheimer, 2020; Pirinen, 2021; Roussy et al., 2021). This system not only converts optical impulses into comprehensible information but often does so at an unconscious level.

However, the capability to accurately recognize objects or events can be hindered under specific conditions that require focus, resulting

in slower processing (Lappin et al., 2020). Notably, when faced with various sources of input, visual information usually takes priority, serving as the main avenue through which individuals understand their surroundings (Cole and Balcetis, 2021).

Selective and Divided Attention on Visual Perception

A central discussion revolves around the role of attention in visual perception. Research on non-human primates concluded that attention controls visual processing, underscoring its essential role in iconic memory, which indicates a proxy for conscious visual perception (Persuh & Suero, 2020). Studies have shown that selective attention increases sensitivity in discriminating subtle stimulus changes during matching tasks, while divided attention activates different brain regions for each attribute (Corbetta et al., 1991, as cited in Liang & Scolari, 2020). Specifically, selective attention enhances visual perception, whereas divided attention primarily impairs it. Divided attention tends to adversely affect post-perceptual processing, resulting in poorer detection of simple visual features than focused attention (Harrison et al., 2022). It aligns with findings from another study indicating that selective attention outperforms divided attention in visual perception (Guan et al., 2023).

Additionally, split attention effects are influenced more by the intrinsic characteristics of objects rather than their spatial arrangement, refining the understanding of attentional mechanisms in visual perception (Moore et al., 2022), while divided and selective attention significantly influences the integration of audiovisual information in adolescents (Yang et al., 2020).

In contrast, some studies proved that expectation effects on visual perception occur independently of attention, suggesting no significant relationship between the two (Zivony & Eimer, 2023). Moreover, evidence indicates that divided attention does not impair the detection of changes in simple visual features (Moreland et al., 2020). Research has shown that divided attention during the encoding phase does not significantly hinder the perceptual priming of unfamiliar visual stimuli (Soldan et al., 2008, as cited in Castellà et al., 2020), suggesting that visual perception remains robust even under conditions of divided attention. Furthermore, research suggested that selective attention is unnecessary for integrating fundamental features of visual stimuli (Evans, 2020). Additionally, a study on driving performance found that selective and divided attention are significantly more predictive of driving fitness than visual acuity, visual field extent, or contrast sensitivity (Grundler & Strasburger, 2020). These findings challenge the meaningful relationship between selective and divided attention and visual perception.

Methodology

Research Design

This study used a single-factor experimental design, incorporating both experimental and control groups to examine the effects of independent variables on dependent variables (DeCarlo et al., 2020). The independent variable, which pertains to a type of attention, was manipulated in the experimental group through a treatment condition to determine its effect. In contrast, the control group remained unchanged providing a sound basis for statistical comparison (Zavadil et al., 2023). Random assignment was employed to ensure that participants had an equal chance of being placed to either the control or experimental group. This approach reduced extraneous variables, enabling the researchers to focus on the effects of selective and divided attention on visual perception.

Participants

The researchers utilized a simple random technique in the study to select the 60 participants, keeping the results unbiased and representative (Noor et al., 2022). Additionally, they used convenience sampling technique to accommodate the participants' availability at their most convenient times while considering their willingness to participate (Golzar et al., 2022; Stratton 2021). The sample size is consistent with recommendations from previous studies, ensuring it is adequate (Westfall, 2014, as cited in Bürki & Vasishth, 2024). Participants involved in a private institution in Lipa City came from various academic departments and are evenly divided of males and females. This approach guarantees the generalizability of the findings by ensuring each program in the institution has proper representatives. Participants consist of 12 students from the College of International Tourism and Hospitality Management (CITHM), College of Criminal Justice Education (CCJE), College of Business and Accountancy (CBA), College of Nursing (CON), and College of Computing and Technology Engineering (CCTE). The researchers made use of random assignment to eliminate bias in grouping the participants to either control or experimental group. Moreover, to ensure that the experimental process would not be subject to systematic errors, 7 participants from the department of College of Education and Liberal Arts (CELA) took part in a pilot experiment.

Instrument

Researchers were able to gather the necessary data with the use of various research instruments. These included demographic profile forms, illustration boards, A4 vellum boards, high-resolution printed images, plastic covers, red whiteboard markers, erasers, yellow curtains, an air conditioner, and a digital timer.

During the experiment, participants were asked to complete demographic questionnaires including crucial information necessary to determine their capacity to participate. Participants' age, sex, academic department, English fluency, visual acuity, auditory capability, their previous involvement in similar research, and potential health concerns were known due to these being potential factors that can shape the interpretation of research findings (Hammer, 2011, as cited in Ash et al., 2023). High-definition imagery was also employed in order to look into the impacts of selective and divided attention on visual perception. The use of high-resolution visuals allowed the

participants to fulfill tasks accordingly (Wang et al., 2020), as they were able to recognize images precisely, improving the participant's perceptual accuracy while minimizing the likelihood of perceived errors during the procedure.

In addition, participants made use of red whiteboard markers during visual search tasks to mark the differences. This technique aligns with the study of Pashler suggesting that the red color is salient (Pashler 1988, as cited in Mayer et al., 2021). Utilizing bright colors like red enables participants to effectively have a close attention on certain differences or details compared with less noticeable color tone. This strategy may result in better analyzing complex information which ensures clarity and accuracy.

Research utilized yellow curtains in the laboratory to improve lighting through blocking natural light. It corresponds to the lighting effect on perceptual processes as found in the study of Chao et al. (2020). Further research of Liu et al. (2022) supports the idea of enhancing the learning outcomes by using warm colors, for instance, yellow and red. Thus, yellow curtains were utilized to encourage participants to have a sense of positivity during the experimental tasks and participate actively.

The thermal condition of the laboratory was regulated to approximately 25°C, given that moderate temperature can enhance performance by up to 35% when compared to unbearable extreme temperatures (Chen & Yang, 2020). By ensuring a more comfortable, stable, and pleasant setting which is efficient for focus and optimal information retention, participants were more likely to feel at ease, thus, boosting attentiveness above the average level.

To facilitate task segment into a more manageable period, researchers made use of digital timer, which is aligned to the findings of Olipas and Luciano (2020), suggesting that countdown timers can notably increase performance outcomes. This usage promoted effective task prioritization and a sustained engagement from the participants towards the experimental task, enabling them to maximize their capacity to perform.

The researchers have selected these strategies thoroughly to create an ideal environment suitable for experiment among college students in determining the effects of selective and divided attention on visual perception.

Procedure

Phase 1: Approval Documents

Essential documents including approval and invitation letters, informed consent forms, and the data gathering procedure were arranged by the researchers to conduct the experiment accordingly. Subject Matter Experts [SMEs] ensured the appropriateness of the methodology and ethical validity before the approval. The informed consent forms and research methodology were also presented to the assigned institutional Subject Matter Experts for an extensive review and evaluation of the potential physical, mental, societal, legal, and financial risks corresponding to the study's method. The approved documents were then submitted to the Research and Creative Works Office of the institution for the concluding affirmation to conduct the study. Subsequently, researchers presented the approval sheet and invitation letters to the department heads and deans of the institution to inform them before the experimental proper.

Phase 2: Preparation for the Experiment

Phase 2a: Pilot Experiment

Researchers ran a pilot experiment to ensure that the materials and set conditions functioned properly, and to minimize confounding variables by addressing any inconsistencies. The room was set with specific conditions: a temp erature of 25°C, covered windows, fluorescent lighting, and chairs spaced a seat apart. Seven students from the College of Education and Liberal Arts participated. They completed a demographic profile form to identify any potential health conditions that may affect the experiment. Researchers randomly assigned the participants to either the control or experimental group through a draw. The same setup was applied to the actual experiment after ensuring that the pilot conditions were safe and effective.

Phase 2b: Actual Experiment

Researchers invited twelve randomly selected participants from each five departments through a formal letter of invitation. The experiment was scheduled at a convenient time in the psychology laboratory after the participants agreed to partake. Like in the pilot experiment, participants also completed a demographic profile form and were randomly assigned to either the control or experimental group through a draw.

Phase 3: Conduct of the Experiment

On the first day, six participants under the control group entered the room one by one and were directed to their seats. The researchers briefly introduced themselves and used deception to conceal the true purpose of the experiment, aiming to observe genuine participant behavior. Participants were provided with an informed consent form and cover story about a game to ensure their agreement to participate. They were briefed on the consent form details and allowed to ask questions.

The cognitive task "Spot the Difference" was divided into three levels with corresponding time frames and scoring. For easy level, participants had two minutes to spot differences, with each correct answer worth one point. For the average level, participants had three minutes, with each correct answer worth two points. For the difficult level, participants had five minutes, with each correct answer worth

five points.

The experimental group performed the same task under treatment conditions, with verbal instructions given to split their attention. Researchers recorded the points accumulated to measure visual perception. Afterward, participants were debriefed, and the true purpose of the study was revealed. Participants were informed of their rights to withdraw without any repercussions, and their data was handled confidentially.

Data Analysis

Jamovi was used for data organization, including data entry, adjustments, and variable computation (Şahin & Aybek, 2020). The researchers employed the Independent-Samples t-test to compare the means between the two groups. This statistical procedure assumes the following:

- Samples should be independent.
- The independent variable should be categorical.
- The dependent variable should be continuous.
- Normal distribution, tested with the Shapiro-Wilk statistic for samples between and 50 (Field, 2024).
- Populations should have equal variances, verified using Levene's test (Field, 2024).

Ethical Considerations

Ethical standards were ensured by having participants signed informed consent forms and thoroughly explaining the study's purpose and methodology. The study was approved by the institution's ethics committee. Individuals with visual or hearing impairments, attention problems, or those on medications affecting cognitive function were excluded. However, those with corrected vision or hearing received appropriate accommodation.

To ensure authentic results, a level of deception was used by informing participants they were part of a game. After participation, the true purpose of the study was revealed in a debriefing session. Confidentiality was a top priority, with participants' data limited to the researchers. Participants' identities were anonymized using pseudonyms, and data was securely stored and disposed of, in compliance with the Data Privacy Act of 2012.

Results and Discussion

Table 1. *Level of Visual Perceptions*

Group	*Mean*	*SD*	*Interpretation*
Control	24.7	4.71	High visual perception
Experimental	21.7	4.79	Moderate visual perception

Table 1 presents the level of visual perception of the control and experimental group. The data shows that the control group has a high visual perception (M = 24.7, SD = 4.71), while the experimental group has a moderate level of visual perception (M = 21.7, SD = 4.79). The mean difference of 3.00 between the groups highlights a distinction in visual perception levels, with the control group exhibiting a higher visual perception than the experimental group.

Ozsu and Ürgen (2024) indicated that perceptual load is crucial in managing attentional resources during visual tasks. A study found that attending to multiple stimuli increases the workload compared to focusing on a single stimulus (Agmon et al., 2022). Research of Ersin et al. (2021) implied that the capacity to sustain attention in dual-task conditions is influenced by high perceptual load. These findings correspond with the perceived performance in the experimental group. This suggests that the intervention or condition (verbal instructions) administered to the group result in moderate level of visual perception. In addition, Sharp (2019) discovered that concentrating on a particular detail significantly enhances stimuli perception, which aligned with the presented high level of visual perception of the control group. Furthermore, selective attention is fundamental in the procedure to improve perception of selected stimuli, concurrently controlling distractor stimuli in complex situations (Bonacci et al., 2020). Hence, treatment conditions exclusion may positively influence visual perception in the control group.

Table 2. *The significant difference between the control and experimental group*

Variable	*Statistic*	*df*	*p*	*Mean Difference*	*Interpretation*
Visual Perception	Student's t	3.29	56.0	0.002	3.76

Table 2 illustrates the significant difference between the control and experimental group. An Independent samples T-test was conducted, and the results indicate no violation of the assumption of normality (W = 0.947, p = 0.238), confirming that the distribution of scores in each group is normal. Additionally, the assumption of homogeneity of variances was not violated (F = 1.12, p = 0.295), suggesting that the variances in the two groups are similar. The results provide compelling evidence to reject the null hypothesis, which posits no difference between the groups. The t-test revealed a significant outcome, with a p-value of 0.002, indicating a very significant difference between the two groups. The control group exhibited notably superior visual perception scores to the experimental group, with a

substantial mean difference of 3.76 points. This finding suggests that the intervention applied to the experimental group had a considerable effect on visual perception, The study presents strong evidence than the control group outperformed the experimental group in visual perception.

Table 3. *The effect of selective and divided attention*

Variable	*Statistic*	*df*	*p*	*Effect Size*	*Interpretation*
Visual Perception	Student's t	3.29	56.0	Cohen's d = 0.863	Large effect size

Table 3 illustrates the impact of selective and divided attention on visual perception in both the control and experimental groups. The results show a statistic of 3.29, df of 56.0, a p-value of 0.002, and an effect size of 0.863, indicating a significant effect for both types of attention. In practical terms, participants in the control group would be expected to score, on average, 0.863 standard deviations higher than those in the experimental. This level of effect size is generally seen as evidence that the results are not only statistically significant but also of practical importance.

Selective attention enhances visual perception by making target objects stand out, improving the processing of relevant information while distorting visual features, resulting in accurate responses to sensory stimuli through specific brain mechanisms (Hamed & Kerkoerle, 2024). When neural structures are aligned, differences between images become distinct, aiding participants in task completion (Chapman et al., 2023). Conversely, divided attention also significantly impacts visual perception but allows the processing of multiple features simultaneously, even in complex scenes. According to Adersen and Hillyard (2024), selective attention (feature-based attention) enhances processing across the visual field, but this enhancement declines under divided attention (split attention). Moreover, divided attention can impair early-stage control and accuracy, particularly at higher speeds, reducing attentional tracking accuracy (Chen & Li, 2022). Similarly, Popovkina et al. (2021) found that divided attention diminishes accuracy in differentiating objects simultaneously. These studies support the current findings suggesting that, while selective attention can improve visual perception, it may take time to prioritize and select relevant features when multiple stimuli compete for attention, like in divided attention, reducing performance quality.

Conclusions

This study found that attention significantly affects visual perception. The results suggest that selective attention enhances visual perception by prioritizing stimuli, whereas divided attention can impair it due to high perceptual load. This highlights the importance of fostering environments and strategies that support focused attention, particularly in educational settings. However, the study sample was limited to college students from a single institution, which may affect the generalizability of the findings. It also did not explore how factors such as age and gender may influence visual perception.

Based on these findings, it is recommended that educational institutions create quiet, distraction-free study spaces to help students improve their selective attention and information processing. Teachers can enhance students' visual perception through the use of visual aids, highlighting, and color-coding of learning materials. Additionally, educators should inform students about the cognitive drawbacks of multitasking and encourage sequential, focused studying. Engaging in visual exercises like board games and puzzles may further strengthen visual processing skills.

For future research, it is suggested to investigate interventions that assess the impact of selective and divided attention on visual perception and student responses to stimuli. Further studies should also examine the effectiveness of combining verbal and visual learning strategies, and explore how demographic variables such as age and gender influence visual perception outcomes.

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