

Mindfulness, Visual Attention, and Image-Based Perception of Architectural Spaces: A Correlational Study Among Deaf and Hard-of-Hearing Adolescents

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Abstract

The current study aimed to reveal the nature of the relationship between mental alertness and both visual attention and image-based visual perception among deaf and hard-of-hearing students enrolled in educational integration programs in Najran region of Saudi Arabia. It also sought to test the ability of mental alertness to predict levels of visual attention and visual perception in this group, within a cognitive psychological perspective that focuses on attentional regulation. The study relied on a descriptive correlational approach, and the study sample consisted of 114 deaf and hard-of-hearing students. The Children and Adolescents Mindfulness Scale (CAMP) was applied, along with the Visual Attention Scale and the Picture-Based Visual Perception Scale. Statistical analyses were performed using arithmetic means and standard deviations, Pearson's correlation coefficient, and simple linear regression analysis. The results showed that levels of mental alertness, visual attention, and picture-based visual perception were moderate to high. They also revealed statistically significant positive correlations between mental alertness and both visual attention and picture-based visual perception. The regression analysis results indicated that mental alertness contributes significantly to predicting both visual attention and visual perception, explaining a considerable proportion of the variance in these two variables. The study concludes that mental alertness is a regulatory psychological mechanism related to how deaf and hard-of-hearing students direct their attention and process visual information, and emphasizes the importance of viewing visual perception as a cognitive process influenced by the state of consciousness and attentional regulation, rather than merely a direct sensory response.

Keywords: *Mental alertness, visual attention, visual perception, deaf and hard-of-hearing, integration programs.*

Introduction

Adolescence is a crucial developmental stage in human life, marked by fundamental cognitive, emotional, and social changes. During this period, there is an increased demand for self-regulation skills, attention control, and adaptation to growing academic and social demands. The importance of this stage is compounded when it comes to adolescents with disabilities, who face additional challenges resulting from sensory or communication limitations that may affect their psychological and cognitive development (Al Harthy et al, 2024). Among these groups, deaf and hard-of-hearing adolescents occupy a special place in psychological research, as their perceptual and cognitive experiences are shaped by the absence or limitation of auditory input and the resulting increased reliance on visual channels for perceiving and interacting with their environment (Hammad , 2023; Knoors & Marschark, 2014).

From a cognitive psychology perspective, hearing impairment is not viewed solely as the loss of a particular sense, but as a factor that may contribute to the reorganization of certain cognitive and attentional processes (Awed, & Hammad, 2022). Numerous studies have indicated that early auditory deprivation may lead to changes in how attentional resources are distributed, particularly within the visual domain, where vision becomes the primary source of environmental and social information (Bavelier, Dye, & Hauser, 2006). In this context, visual attention and image-based perception become

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central elements in the lives of deaf individuals, whether in learning, communicating, or interacting with different environments (Hammad, 2017).

Psychological literature has addressed visual attention in deaf individuals from multiple angles, with some studies suggesting a relative superiority in peripheral attention as a compensatory mechanism for the absence of auditory cues (Neville & Lawson, 1987). However, subsequent research has presented a more complex picture, showing that this superiority is not universal or absolute, and that some components of visual attention, such as selective or executive attention, may not necessarily differ from those of hearing individuals (Hauser et al., 2007). A study by Dye, Hauser, and Bavelier (2009) using useful field of view tasks also showed that patterns of visual attention distribution in deaf individuals depend largely on the nature of the task and the perceptual context.

These findings confirm that visual perception in deaf individuals cannot be understood as a direct sensory process, but rather as the product of a complex interaction between visual input and higher cognitive processes, such as attention, self-regulation, and perceptual interpretation (Hammad, & Awed, 2023). Perception theories in psychology suggest that individuals do not passively receive visual images and scenes, but rather process them through selective mechanisms influenced by prior experience, motivation, and psychological state (Goldstein, 2014). Therefore, any attempt to understand image-based cognition in deaf and hard-of-hearing adolescents requires consideration of the psychological variables that regulate attention and direct awareness.

In this context, mindfulness has emerged as one of the fundamental concepts in contemporary psychology, due to its close connection to attention, self-regulation, and awareness of the present experience (Hammad, & Shalhoub, 2024). Mindfulness is defined as deliberately directing attention to the present moment in a conscious and non-judgmental manner, accepting internal and external experiences as they are (Kabat-Zinn, 2003). This concept has evolved from its meditative roots to become a psychological construct that can be measured and studied experimentally, both as a personality trait and as a skill that can be developed.

Numerous studies have supported the relationship between mindfulness and basic cognitive functions. Brown and Ryan (2003) noted that individuals with high levels of mindfulness tend to show greater awareness of ongoing experiences and a higher ability to control attention and regulate behavior. A study by Jha, Krompinger, and Baime (2007) also showed that mindfulness training contributes to the modulation of various attention systems, including sustained attention and executive attention. These findings support the view that mindfulness is a cognitive mechanism that improves the efficiency of attentional resource allocation (Alqarni, & Hammad, 2021).

Other experimental studies have also shown that mental mindfulness may be associated with improved visual perceptual discrimination and reduced distractibility and attentional disruptions. MacLean and colleagues (2010) found that intensive meditation training improved the ability to discriminate between visual stimuli and increased attentional stability. These findings suggest that mindfulness not only affects emotional states, but also extends to basic cognitive and attentional processes.

The study of mindfulness is particularly relevant during adolescence, a period characterized by incomplete maturation of executive functions and heightened sensitivity to environmental and emotional stimuli (Steinberg, 2014). Post-hoc analyses have shown that mindfulness programs implemented with adolescents are associated with improvements in self-regulation and reductions in stress levels, although the magnitudes of effect vary depending on methodological design and implementation context (Zoogman et al., 2015; Felver et al., 2016; Hammad, & Shalhoub, 2024). These findings underscore the importance of mindfulness as a psychological variable that may contribute to supporting adaptation during this sensitive period (Alqarni, & Hammad, 2021).

Given the perceptual characteristics of deaf and hard-of-hearing adolescents, the role of mental alertness may be even more important, given their heavy reliance on visual processing in interacting with their environment (Hammad, & Shalhoub, 2024). Visual environments rich in images and scenes may impose high attentional demands, requiring a high capacity for directing attention and filtering out distractions. In this context, mental alertness may contribute to improving how individuals process visual stimuli by enhancing awareness of the perceptual experience and regulating attention during the processing of images and scenes (Alqarni, & Hammad, 2021).

The concept of image-based perception is one that allows for a deeper understanding of the relationship between attention and the visual environment. In environmental and cognitive psychology,

numerous studies indicate that the characteristics of visual scenes can influence cognitive and emotional responses, such as attention, preference, and feelings of comfort or stress (Kaplan & Kaplan, 1989). Ulrich (1984) also showed that exposure to certain visual scenes can influence physiological and emotional indicators, reflecting the profound psychological role of images and visual scenes.

From this perspective, the study of image-based visual perception is not a departure from psychology, but rather a natural extension of it, where images are understood as perceptual stimuli subject to processes of attention, interpretation, and cognitive organization. This approach is particularly important when studying groups that rely heavily on visual input, such as deaf and hard-of-hearing adolescents.

Although there is extensive literature on both mental alertness and visual attention, studies combining these two variables in deaf and hard-of-hearing adolescents remain limited. Furthermore, many previous studies have addressed visual attention or mindfulness separately, without exploring the correlational relationships between them in image-based cognitive contexts. This gap in the literature points to a knowledge gap that warrants further research, especially in light of the increasing importance of visual environments in education and social interaction.

The problem addressed by the current study is the limited psychological understanding of the relationship between mental alertness, attention, and image-based visual perception in deaf and hard-of-hearing adolescents. The absence of this understanding limits the development of comprehensive theoretical models that explain how attention is organized under high visual dependence and reduces the ability to use psychological research findings to improve educational and cognitive environments for this population.

Based on this problem, the current study seeks to explore the relationships between mental alertness, attention, and image-based visual perception in deaf and hard-of-hearing adolescents within a cognitive psychological framework that focuses on self-regulation and attention as two central processes in psychological adaptation. The study seeks to answer the following research questions:

1. What is the nature of the relationship between mental alertness and visual attention in deaf and hard-of-hearing adolescents?
2. To what extent is mental alertness related to image-based visual perception in this group?
3. Do patterns of attention and visual perception differ according to levels of mental alertness in deaf and hard-of-hearing adolescents?

By addressing these questions, the study hopes to contribute to the cognitive psychology literature on perception and attention in people with hearing impairments and to advance the theoretical understanding of the relationship between mental alertness and visual processing in adolescence.

Methodology

Study Approach

The current study relied on the descriptive correlational approach, as it is appropriate for the nature of the study's objectives, which seek to reveal the nature of the relationships between mental alertness and both attention and image-based visual perception in deaf and hard-of-hearing adolescents, without interfering with or manipulating the variables. This approach is one of the most commonly used in cognitive psychological studies that aim to understand the relationships between psychological variables in their natural contexts.

Study population

The study population consisted of deaf and hard-of-hearing students enrolled in educational integration programs in schools in Najran region of Saudi Arabia. These programs include students with hearing impairments who receive their education in regular classrooms or attached classrooms, with specialized educational support services provided in accordance with the policies approved by the Ministry of Education in the Kingdom.

The selection of this community is appropriate for the objectives of the study, given that students enrolled in integration programs rely heavily on visual channels for learning and interaction within educational environments, making them a suitable group for studying variables such as mental alertness, attention, and visual perception.

Study sample

The study sample consisted of 114 deaf and hard-of-hearing students, selected from among students enrolled in educational integration programs in Najran region of Saudi Arabia, using the available sample, given the specificity of the community and the difficulty of accessing all its members. The following criteria were taken into account when selecting the sample. The student must be deaf or hard of hearing according to reports approved by the school. The student must be actively enrolled in an educational integration program. The student must be an adolescent, in line with the objectives of the study. The ability to understand the instructions of the study tools, either directly or through sign language interpretation when needed. This sample is statistically appropriate for conducting correlational analyses and is consistent with the sample sizes used in previous psychological studies that addressed cognitive variables in people with hearing impairments.

Study Tools

The current study relied on a set of standardized psychological tools to measure the study variables, as follows:

First: Child and Adolescent Mindfulness Measure (CAMM)

The current study relied on the Child and Adolescent Mindfulness Measure (CAMM) developed by Greco, Baer, and Smith (2011), which is one of the most widely used measures of mindfulness in young and middle age groups, including adolescents. The CAMM consists of 10 items that measure the level of mindfulness as a psychological trait, focusing on: Awareness of the present experience. The ability to observe thoughts and feelings without involvement or judgment. Acceptance of unwanted internal experiences. The items on the scale are answered on a five-point Likert scale, ranging from (1 = does not apply to me at all) to (5 = applies to me completely). Original and subsequent studies have shown that the CAMM scale has good reliability and validity. Greco and colleagues (2011) reported that Cronbach's Alpha was 0.80, and the scale showed good construct validity through its negative correlation with indicators of anxiety and emotional avoidance and its positive correlation with indicators of psychological adjustment. The scale has also been used in a large number of subsequent studies on adolescent samples in different cultural and educational contexts and has proven its validity in measuring mental alertness as a cognitive and emotional construct related to attention and self-regulation (Zoogman et al., 2015). In this study, the Child and Adolescent Mindfulness Measure showed a high level of reliability, with a Cronbach's alpha coefficient of 0.85. The CAMM scale was chosen for several reasons: Its suitability for the age group of the study sample (adolescents). Its focus on the cognitive and attentional aspects of mental alertness. The simplicity of its wording, which makes it suitable for use with deaf and hard-of-hearing students, with the possibility of adapting the wording or supporting it with sign language when necessary.

Second: Visual Attention Scale (VAS)

To measure visual attention, the study used the Visual Attention Scale (VAS) derived from the work of Derryberry and Reed (2002), which was developed to measure individual differences in the ability to focus and control attention while processing visual stimuli. The scale measures the level of visual attention through a set of items that focus on: The ability to focus attention on a specific visual stimulus, Resistance to distraction from peripheral visual stimuli, and Maintaining attention while performing visual tasks. The items on the scale are answered using a five-point Likert scale, reflecting the degree of frequency of the behavior or feeling associated with visual attention. Studies using this scale or derivatives thereof have reported acceptable stability coefficients ranging from 0.70 to 0.85. The scale has also demonstrated convergent validity through its correlation with measures of attentional control and performance on visual tasks (Derryberry & Reed, 2002). In this study, the Visual Attention Scale showed a high level of reliability, with a Cronbach's alpha coefficient of 0.83. This measure is suitable for use with deaf and hard-of-hearing students, as it relies on self-assessment of attentional abilities in visual situations, without the need for auditory stimuli. It is also consistent with the nature of the visual learning environments with which the sample individuals interact in inclusion programs.

Visual Perception and Image-Based Processing Scale

To measure image-based visual perception, a scale based on the literature of visual perception and scene processing in cognitive and environmental psychology was used, as reported in the works of Kaplan and Kaplan (1989) and Ulrich (1984), which addressed how individuals respond to scenes and images in terms of attention, interpretation, and cognitive engagement. (1989) and Ulrich (1984), which addressed how individuals respond to scenes and images in terms of attention, interpretation,

and cognitive engagement. The scale focuses on measuring: the clarity of the image and its ease of cognitive interpretation, the ability to make sense of visual scenes, and the degree of engagement and attention while viewing images or scenes. The scale items are answered using a five-point Likert scale, reflecting the degree of agreement with descriptive statements related to visual perception. Previous studies using similar scales in the field of environmental and visual perception have shown adequate stability and reliability coefficients, and have supported construct validity through the association of visual perception with indicators of attention and cognitive engagement (Kaplan & Kaplan, 1989; Ulrich, 1984). In this study, the Visual Perception and Image-Based Processing Scales showed a high level of reliability, with a Cronbach's alpha coefficient of 0.87. This scale was chosen because it is: consistent with the theoretical framework of the study; based on visual and pictorial stimuli, which is appropriate for the nature of the study sample.

Study Procedures

The study procedures were implemented in accordance with the ethical standards adopted in scientific research, after obtaining the necessary official approvals from the relevant educational authorities in Najran region of the Kingdom of Saudi Arabia. Coordination took place with the administrations of schools that implement educational integration programs to facilitate the implementation procedures.

The study tools were applied in appropriate classroom environments within schools, taking into account the communicative and cognitive characteristics of deaf and hard-of-hearing students. The application was carried out with the assistance of special education teachers and teachers responsible for teaching deaf and hard-of-hearing students, whose role was limited to clarifying instructions and explaining the response mechanism in sign language or an appropriate communication method when necessary, without interfering with or directing the content of the answers.

The study tools were applied collectively and in the same order to all members of the sample, with sufficient time allowed to answer the scale items. Understanding of the response options was ensured before the application began, with clarification limited to the wording only. After completion, the questionnaires were collected and checked for completeness and suitability for statistical analysis, with full commitment to data confidentiality and voluntary participation.

Statistical methods

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) by: Calculating arithmetic means and standard deviations to describe the study variables. Verifying the validity and reliability of the study tools using correlation coefficients and Cronbach's alpha coefficient. Using Pearson's correlation coefficient to reveal the nature of the relationships between the study variables. Applying appropriate statistical analyses to answer the study questions in light of the approved level of statistical significance.

Results

Descriptive results of study variables

The arithmetic means and standard deviations of the study variables were calculated to identify the level of each variable among the sample individuals.

Table 1. Arithmetic means and standard deviations of study variables (n = 114)

Variable	mean	Standard deviation
Mindfulness	3.41	0.47
Visual Attention	3.56	0.52
Visual Perception and Image	3.62	0.49

The results in Table (1) indicate that the averages of the study variables were moderate to high, with image-based visual perception achieving the highest arithmetic mean, followed by visual attention, then mental alertness. This reflects the sample's significant reliance on visual processing, which is consistent with the characteristics of deaf and hard-of-hearing students.

Pearson's correlation coefficient was used to answer the study questions related to the relationships between the variables.

Table 2. Matrix of Pearson's correlation coefficients between the study variables

Variable	Mindfulness	Visual Attention	Visual Perception and Image
Mindfulness	1		
Visual Attention	0.46**	1	
Visual Perception and Image	0.52**	0.49**	1

Note:** Statistically significant at the 0.01 level.

The results show statistically significant positive correlations between all study variables. Mental alertness was positively correlated with both visual attention and image-based visual perception, and a positive correlation was also found between visual attention and visual perception. These results indicate a close relationship between attentional regulation, mental alertness, and visual processing in the sample.

Results of simple linear regression analysis

1. Predicting visual attention through mental alertness

A simple linear regression analysis was performed to verify the ability of mental alertness to predict visual attention.

Table 3. Regression analysis results for predicting visual attention through mental alertness

Independent variable	β	R ²	F	Level of significance
Mindfulness	0.46	0.21	29.14	0.001

The results in Table 3 indicate that mental alertness is a statistically significant predictor of visual attention, explaining approximately 21% of the variance in visual attention scores among the sample, which is considered an average and acceptable amount of explanation in correlational psychological studies.

Predicting image-based visual perception through mental alertness

Another simple linear regression analysis was performed to predict image-based visual perception through mental alertness.

Table 4. Regression analysis results for predicting image-based visual perception through mental alertness

Independent variable	β	R ²	F	Level of significance
Mindfulness	0.52	0.27	40.87	0.001

The results show that mental alertness contributes statistically significantly to predicting image-based visual perception, explaining approximately 27% of the variance in this variable, which indicates a stronger predictive relationship compared to visual attention.

Discussion

The results of this study open a quiet but profound window into a psychological world that is often viewed only from the outside. The positive relationship between mental alertness and both visual attention and image-based visual perception in deaf and hard-of-hearing students does not seem surprising, but rather logical when viewed from within the experience, rather than from the margins. We are not talking here about an additional skill or cosmetic feature in psychological makeup, but rather an internal regulatory mechanism similar to the knob used to refocus the lens when the image becomes too crowded.

The correlations revealed by the results indicate that mental alertness is associated with a higher ability to stabilize visual attention and with clearer and more consistent interaction with scenes and images. This pattern is consistent with Brown and Ryan (2003), who presented mindfulness as a state

of awareness that keeps an individual present with what they see and do, rather than drifting away with internal noise that steals attention without leaving a trace. In the case of deaf students, this “noise” is mostly visual: overlapping images, signs, movements, and endless stimuli. Mindfulness here does not calm the world, but it teaches the individual how to stand within it without being fragmented.

What is striking about the results is not only the existence of a relationship between mindfulness and visual attention, but the magnitude of that relationship. It is neither overwhelming nor marginal. It falls squarely in the middle ground that researchers know well: the zone that indicates a real effect but does not claim absolute dominance. This balance is consistent with the findings of Jha, Krompinger, and Baime (2007), who showed that mental alertness does not completely reshape attention, but rather redistributes its resources, as if the mind learns to breathe deeply instead of panting.

When we turn to image-based visual perception, the picture becomes clearer—yet more complex. The relatively stronger relationship between mindfulness and visual perception suggests that mindfulness operates not only at the level of “how much” attention, but also at the level of “what kind” of attention. The image is not just seen, but read. The scene is not captured, but understood. This is what MacLean and colleagues (2010) hinted at when they found that meditative training not only improves sustained attention, but also increases the accuracy of perceptual discrimination itself. It is as if mindfulness gives the eye an extra mind, or gives the mind more patience with what the eye sees.

These findings take on particular weight when placed in the context of the literature on hearing impairment. Classic research in this field, such as the work of Bavelier, Dye, and Hauser (2006), has often focused on the idea of “sensory compensation,” as if the visual perception of deaf people works with extra energy simply because of the absence of hearing. However, the current results do not support this simplistic picture. What emerges here is not an automatic visual advantage, but rather a psychocognitive interaction that depends on how attention is organized, not just on its capacity. This intersects with what Dye, Hauser, and Bavelier (2009) proposed: that patterns of visual attention in deaf people vary depending on the task and context, not just on auditory deprivation alone.

From another perspective, this overlap between mindfulness and visual perception raises an important question about the role of the visual learning environment. Images, scenes, and spaces are not psychologically neutral. Decades ago, Kaplan and Kaplan (1989) pointed out that visual scenes influence attention, preference, and feelings of immersion. When a student is deaf, these scenes are not a silent backdrop but rather a primary text that the mind is constantly reading. Mental alertness, in this context, may act as a musical interlude between one image and another, preventing overlap and enabling understanding.

Regression analysis adds another layer of understanding. The fact that mental alertness explains a significant proportion of the variance in visual attention and visual perception does not mean that it is the only factor, nor should the results be interpreted in this way. However, it does suggest that alertness is not merely a concomitant variable, but an active element within a complex network of psychological and cognitive factors. This is consistent with recent longitudinal analyses of mindfulness in adolescents, which have indicated that its effects are often moderate in size but stable in direction (Zoogman et al., 2015; Felver et al., 2016).

It may be tempting to interpret these results in directly interventionist terms: “Mindfulness improves attention, so we should teach it immediately.” But such a quick conclusion impoverishes rather than enriches the meaning. What the results quietly suggest is that mental mindfulness may represent a different way of being within the visual world, not a tool for taming it. This proposition is consistent with Kabat-Zinn’s (2003), who emphasized that mindfulness is not a technique for achieving a goal, but rather a practice for reconnecting with experience itself.

It is noteworthy that these results came from a homogeneous sample of males only. Rather than being a limitation, this homogeneity allowed for a clearer view of the relationships studied without the confounding of additional demographic variables. However, the question remains open as to whether these patterns would appear in the same way in deaf and hard-of-hearing females, or in different cultural and educational contexts. This question does not weaken the findings, but rather places them in their proper context as a beginning, not an end.

Ultimately, this study does not offer loud answers. It does not claim revolutionary discoveries, nor does it promise magical solutions. But it does paint a more accurate psychological map of a region that is often reduced to general headlines. Mental alertness, visual attention, and image-based perception are not separate entities, but threads in a single fabric. In deaf and hard-of-hearing students, this fabric

appears to be denser, more sensitive, and in greater need of careful reading—reading that does not rush to judgment and does not shy away from complexity.

Study limitations

Like any serious attempt to understand a psychological phenomenon within a complex human context, this study was surrounded by limitations that cannot be ignored, but these limitations are more like riverbanks than walls; they shaped the course, they did not stop it.

The first of these limitations relates to the nature of the sample itself. The study was limited to male students who are deaf or hard of hearing and enrolled in educational integration programs in Najran region of Saudi Arabia. This limitation was not a theoretical choice so much as a reflection of the educational and organizational reality in which the study was conducted. Although this homogeneity contributed to reducing unwanted variation, it limits the generalizability of the results outside this geographical and cultural context, or to female deaf and hard-of-hearing students whose cognitive and psychological experiences may be shaped within different contexts. The problem here is not the small sample size, but rather the breadth of questions it raises.

Another limitation relates to the correlational nature of the study. The results, however consistent they may appear with previous literature, do not allow us to speak of definitive causal relationships between mental alertness and both visual attention and image-based visual perception. What we see is a meaningful correlation, not a closed causal chain. This coincidence may be a reflection of interdependent effects that are difficult to separate: does mindfulness enhance attention, or does the ability to regulate attention predispose the mind to mindfulness? Questions like these are not so much a gap in the study as a reminder that the human mind does not operate in a linear fashion.

Some of the limitations are also related to the nature of the measurement tools used. The study relied on self-report measures, which are known for their ability to capture internal experience, but at the same time remain hostage to the examinee's self-awareness and ability to express it. In the case of deaf and hard-of-hearing students, cognitive experience overlaps with linguistic and communicative characteristics, which may affect how they understand or respond to certain passages, despite the procedural adaptations that were taken into account during the application. This does not diminish the value of the data, but it calls for reading it as a representation of perceived experience, not a direct measurement of neural or behavioral processes.

In addition, the study did not include experimental performance tasks or direct behavioral measures of attention or visual perception, but focused on self-assessment of these processes. Although this choice is consistent with the study's objective and psychological scope, incorporating performance tools into subsequent studies may add another layer of understanding, especially in a field where perception intersects with action.

Another limitation worth considering is that the study treated mindfulness as a psychological trait rather than a training intervention or practice extended over time. This means that the results reflect the participants' current state, not their capacity for change or development. The picture might be different if mindfulness were reconsidered as a dynamic process shaped by training and experience, rather than a static level measured at a single moment.

Finally, it cannot be overlooked that the educational context itself—inclusion programs, classroom dynamics, visual stimulus density—forms a silent backdrop to everything that was measured. This context was not included as an independent variable, but it was present in every response, in every attempt to focus, and in every image that was understood or ignored. This invisible presence is perhaps one of the most important determinants of the study, because it reminds us that psychological processes do not occur in a vacuum, but within environments that are both constraining and containing.

In light of these determinants, the results of the study are not presented as the final word, but as a clearly defined segment of a longer scientific dialogue. A dialogue that does not seek quick certainty, but rather a deeper and more humble understanding of what it means for a person to see the world with alert eyes, when hearing is absent and image is the primary language.

Conclusion

This study offers a careful psychological reading of the relationship between mental alertness and both visual attention and image-based visual perception in deaf and hard-of-hearing students, without claiming to provide definitive answers or closed explanatory models. The results showed that mental alertness is positively associated with both visual attention and visual perception, and that it contributes

significantly to predicting these two variables, which is consistent with the theoretical proposition that views alertness as an attentional regulatory mechanism that influences how sensory experience is processed.

In this context, mental alertness can be understood as a state of consciousness that regulates how attention is directed within complex visual environments, not as a tool for controlling stimuli, but as a pattern of cognitive presence that reduces distraction and enhances perceptual clarity. This finding is particularly relevant when considering a population that relies heavily on visual processing for learning and interaction, where attention regulation becomes a central factor in how surrounding images and scenes are understood.

These findings contribute to the expansion of the cognitive psychology literature on hearing impairment, shifting from the traditional focus on concepts of sensory compensation or perceptual differences to a focus on the regulatory processes that shape the perceptual experience itself. Rather than assuming that visual perception in deaf individuals operates in isolation from psychological factors, the study's findings suggest that states of consciousness and attention play an important role in how visual information is processed and interpreted.

The study also adds a complementary dimension to the mindfulness literature, which has often addressed this concept in emotional or therapeutic contexts, by highlighting its relationship to basic cognitive processes in a developmental and educational context. This suggests that mindfulness has effects that extend beyond stress reduction or well-being enhancement to the way individuals interact with sensory and cognitive stimuli in their everyday environments.

At the theoretical-applied level, the findings highlight the importance of considering the attentional and psychological characteristics of deaf students when designing visual learning environments or developing image- and scene-based teaching practices. However, this reference should not be understood as a direct recommendation, but rather as a logical extension of a deeper understanding of the relationship between psychological organization and visual perception.

At the same time, the findings of this study should be viewed in light of its methodological limitations, particularly its correlational nature and focus on a specific sample. These findings represent a step in a broader research trajectory, not an end point. There remains a need for future studies that address these relationships from longitudinal or experimental perspectives and test them in diverse educational and cultural contexts.

In conclusion, this study contributes to enhancing the psychological understanding of the relationship between mental alertness, attention, and visual perception in deaf and hard-of-hearing students, and confirms that perception is not a purely sensory process, but rather a cognitive experience shaped by how an individual mentally attends to what they see. From this perspective, the presented results represent a balanced cognitive addition to contemporary psychological literature and open the door to further research that treats perception as a complex human process, not merely a direct sensory response.

Recommendations

In light of the study's findings and the significant correlations it revealed between mental alertness and both visual attention and image-based visual perception in deaf and hard-of-hearing students, a set of recommendations can be proposed based on the study's cognitive psychological framework, without exceeding its methodological limits.

The results point to the importance of attention as a central regulatory process in the cognitive experience of deaf students. The study therefore recommends that this psychological dimension be taken into account when planning visual learning environments and inclusion programs. Instead of focusing exclusively on the density or diversity of visual content, it may be useful to direct attention to how visual stimuli are organized in a way that supports attention and reduces distraction, especially in classrooms that rely on images and scenes as a primary teaching tool.

The study also recommends that concepts related to mindfulness and conscious attention be incorporated into psychological or counseling programs offered to deaf and hard-of-hearing students, in a manner appropriate to their developmental and communicative characteristics. This does not mean adopting ready-made training programs, but rather utilizing the basic principles of mindfulness, such as awareness of the present moment and attention regulation, as psychological frameworks that can be employed to support cognitive and attentional adaptation.

The results also highlight the importance of preparing teachers and staff working in inclusion programs to deal with the psychological and attentional aspects of visual perception in deaf students. Dealing with images and scenes in the classroom should not be viewed as merely a technical or educational issue, but rather as a psychological process that is influenced by the student's mental state and ability to regulate their attention. The study therefore recommends that teacher training programs include content that focuses on understanding the attentional and cognitive processes of this group.

At the level of scientific research, the study recommends conducting further studies on the relationship between mental alertness, attention, and visual perception using different methodological designs, such as longitudinal or quasi-experimental studies, to allow for a deeper understanding of the nature and direction of these relationships over time. It is also advisable to expand the sample size to include females and different geographical areas to verify the consistency of the results in diverse cultural and educational contexts.

The study also recommends incorporating multiple measurement tools into future research, combining self-report measures with performance tasks or behavioral indicators, thereby contributing to a more comprehensive picture of the attention and visual perception processes of deaf and hard-of-hearing students and reducing reliance on a single source of measurement.

Finally, the study recommends that visual perception in deaf students be viewed as a complex psychological process involving sensory, cognitive, and organizational factors, rather than as a separate ability or an automatic compensation for the absence of hearing. This perspective provides a basis for developing educational research and practices that are more consistent with the actual psychological experience of this population.

Author contributions

Author Contributions: Conceptualization: N.A and H.A. Data Collection: N.A and H.A.. Data Analysis: N.A and H.A. Resources: N.A and H.A. Writing—Original Draft Preparation: N.A and H.A. Writing—Review & Editing: N.A and H.A. Funding Acquisition: H.A.

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Institutional Review Board Statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. In addition, the protocol for the study was approved by Research Ethics Committee at Najran University.

Data availability

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

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