Interface Elements of an Online Classroom Platform for Students with Visual Perceptual Disabilities

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Abstract: For a significant amount of time, due to the pandemic of Covid-19, most classes were conducted online through online classroom platforms where students and teachers did not need to physically attend classes. The wide use of online classroom platforms involved all levels of students from preschool to higher education level. These included students with disabilities as well. Most issues arise due to most online classroom platforms not focusing on different types of students, especially students with special needs. Preliminary findings show that most of the platforms designed do not meet the needs of students with disabilities. For this study, the focus is given to students with visual perceptual disabilities. Previous research proved that students with visual perceptual disabilities mostly faced issues that deal with interface elements that include the selection of color, font, size, and design. These issues make their learning process challenging. Hence this study has been carried out with two objectives which are to identify the visibility issues for students with visual perceptual disabilities with the current interface of online learning platforms and to identify the interface elements that suit their needs. Findings from this study can be used as a guideline in developing the interface of an online learning platform for visual perceptual disabilities students. This study will bring a positive change in the life of students with visual perceptual disabilities as they will be able to use the online classroom with ease.
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Keywords: Online classroom, online learning, interface element, visual perceptual disabilities student

INTRODUCTION

In Malaysia, the National Centre on Education Statistics (2020) estimates that up to 11% of students have been diagnosed as learners with disabilities and these numbers keep increasing year by year. Disabilities can vary from hundreds of types. One of the most common disabilities or physical impairments among students is visual or auditive impairment. Visual or auditive impairment is the condition where biological processing issues that impair an individual's ability to handle certain types of information can lead to these disabilities. Visual perceptual disabilities are defined as the disability to recognize, differentiate, and give meaning to visual stimuli, and relating these to previous experiences and inputs to learn new concepts. For students with visual perceptual difficulties, learning to read and write is very challenging, even with it being conducted face to face within a physical classroom setting.

At the time when the Covid-19 pandemic was at an all time high, most learning sessions were conducted through online classrooms using online learning platforms. However, to cater to different needs from different types of users is not an easy task. The needs of students with visual perceptual disabilities, greatly differ from that of other students' (Muktamath et al., 2021). The use of online classrooms has led to another issue for these groups of students. Besides dealing with difficulties that arose from face to face learning, they are now also faced with issues in dealing with the interface of online learning platforms due to their disability, as the interface design does not meet their needs and capability.

A preliminary study conducted among visual perceptual disabilities students found that students with disabilities are facing difficulties dealing with current interfaces. The difficulties lead to the ineffectiveness of teaching and learning among them. The difficulties that they face are mainly due to the selection of color, font, size, and design, which makes their learning process more challenging. This study further explored the interface elements that

suit the needs of these groups of students based on the selection of color, font, style, design and etc. Data for this study were gathered using a set of questionnaires to be answered by visual perceptual students, regarding the selection of interface elements according to their needs.

ONLINE CLASSROOM

Nowadays, modern technologies have influenced all aspects of human life including both the learning and teaching processes (Lepičnik-Vodopivec et al., 2020). One of the most acknowledged today is the usage of online classrooms in teaching and learning processes for all levels of students from preschool to higher education. An online classroom is an environment created by means of a learning management system that allows students and teachers to connect synchronously. This can be done in real-time, with teachers and students meeting simultaneously or asynchronously, with recurrent interactions between the teacher and students (Jeffrey et al, 2022; Tomasz & Katarzyna, 2022; Xu Du et al, 2022).

There are advantages and disadvantages in using an online classroom. Some of the advantages are self-paced study, time and space flexibility, time-saving (no commute between home and school), and the fact that an online learning course often costs less. Disadvantages include a sense of isolation, the struggle with staying motivated, lack of face-to-face interaction, difficulty in getting immediate feedback, the need for constant and reliable access to technology, and occasionally some difficulty with accreditation ((Fidalgo et al, 2020; De Paepe, Zhu, & Depryck, 2018; Lei & Gupta, 2010; Venter, 2003; Zuhairi, Wahyono, & Suratinah, 2006).

An online classroom is like a physical classroom in several respects. In a traditional classroom, students must be able to see and hear the instructor, as well as see and hear the other students, the whiteboard, and their own learning materials. A student in an online classroom can see and hear the instructor via a video/audio stream. Teachers will use the online whiteboard to visually illustrate concepts and collaborate on activities. An online classroom tends to have the important features of a video conferencing tool but with additional features important for teachers. Almost all online

classroom platforms offer equitable use because they can be accessed at home, in a hospital, or elsewhere for students who are unable to physically attend class. Some online classroom platform has gone the extra mile for students with low vision, reading difficulties, or other auditory preferences by allowing access to speech-to-text capabilities.

Due to the wide use of online classrooms in teaching and learning processes nowadays, a proper and appropriate online classroom platform should be developed and provided for these students with visual perceptual disabilities. This to ensure that they are not left behind in the learning process.

VIRTUAL PERCEPTUAL DISABILITIES

Visual perceptual is the brain's ability to make sense of what the eyes see (A Valarmathi et al., 2022; Duke et al, 2022). It is required for daily tasks such as dressing, eating, writing, and playing. Visual perceptual skills are classified into seven categories as shown in Figure 1.0.

Visual perceptual skill	Symptoms
Visual Discrimination	Difficulty processing details
	Confusing similar words or objects
Visual Memory	Difficulty remembering people
	Poor reading comprehension
	Difficulty visualizing from memory
Visual-Spatial Relations	Confusion of left/right
	Disorientation in space, getting lost
	Poor visual organization
Visual Sequential Memory	Difficulty remembering words, spelling
	Confusing sequence of tasks or directions
	Difficulty remembering phone numbers or addresses
Visual Figure Ground	Difficulty locating objects in crowded environment
	Overwhelmed with busy environment
Visual Closure	Substituting one word for another
	Difficulty completing tasks
Visual-Motor Integration	Difficulty with writing
	Poor coordination

Fig. 1 Visual Perceptual Skill (Ripley & Politzer, 2010)

The first visual category is visual-spatial relations. Visual-spatial relations are the ability to determine one form or part of a form that is turned in a different direction than the others (Ripley & Politzer, 2010). Therefore, some

people have difficulty distinguishing between b and d or p and q. They do not realize that just because the letter is rotated, it is a different letter. They also struggle to distinguish between in and out, over and under, and left and right because these are spatial skills concepts.

Next, sequential memory where the ability to remember a series of forms and find it among other forms (Ripley & Politzer, 2010). If the student is having difficulty sequencing the alphabet or copying from one location to another, students may be suffering from a problem with sequential memory. Even older elementary students will occasionally skip words when copying sentences from the board. When a student copies a sentence, they copy one letter at a time. Students with these disabilities do not see it as a whole word to write, but rather as individual letters. This is a problem with sequential memory.

Third, visual discrimination where the ability to differentiate between objects and forms. This includes abilities such as the ability to identify money and sort coins or other objects (Ripley & Politzer, 2010). They will have difficulty distinguishing between n and m, b and d, and p and q if students are unable to discriminate the differences or similarities between objects or pictures.
Fourth, form constancy is the ability to see and locate a form among others, even if it is sized differently or rotated (Ripley & Politzer, 2010). Again, this will be one of the reasons why some students will struggle to recognize letters and numbers. For example, recognizing that 6 and 9 are two different numbers.

Next is visual memory. This is not the same as visual sequential memory. The ability to store visual details in short-term memory, such as recalling a phone number, is referred to as visual memory (Ripley & Politzer, 2010). When one's visual memory is impaired, one's reading comprehension suffers. Consider showing someone a photograph, then taking it away and asking them questions about it. A student with poor visual memory will have difficulty remembering details about the picture.

The ability to fill in the missing details in an incomplete shape is referred to as visual closure (Ripley & Politzer, 2010). This necessitates the solution of abstract problems. Working on puzzles is a good example of this; being

able to mentally put a picture together and correctly piece it together. This will also cause issues with writing and spelling. When it comes to spelling, students with visual closure deficits will not be able to tell the difference between the ends of the word and the middle of the word. A child with visual closure deficits will not be able to tell if a word is complete when writing. Ground for visual figures. This is the ability to attend to one object without being distracted by an irrelevant background object. For instance, ask a student to locate the blue crayon in their pencil box. Visual figure-ground is the ability to filter out all the other crayons to find that blue crayon (Ripley & Politzer, 2010).

Academic performance is a major problem for students with visual perceptual disabilities. Students are not able to complete academic work easily (A Valarmathi et al, 2022; Zahida et al, 2021; Maria et al, 2021). The use of online classrooms nowadays has made the learning process more challenging for them. Hence, providing a suitable online classroom platform that satisfies their needs are very crucial in order to help them.

METHODS

As stated in the previous section, the purpose of this study is to identify the visibility issues for students with visual perceptual disabilities using current online classroom platforms and to identify the interface elements that suit their needs. A quantitative approach has the potential to provide enough understanding for this study. The selection of this method is due to the reason that the quantitative approach is commonly used when the purpose is to test hypotheses and generalize the results (Hair et al., 2015). Quantitative methods are generally concerned with quantifiable data, usually expressed in numbers and statistics, and associated with large samples, high concern for representativeness, and highly structured methods for data collection (Hair et al., 2015). The research approach components involve three phases as shown in Table 1.0 below.

Table 1.0. The research approach adopted for this study

Research Objectives	**1. To identify the visibility issues for students with visual perceptual disabilities using the current online classroom platforms.**	**2. To identify the interface elements of the online classroom platform for students with visual perceptual disabilities.**
Research Approaches	• Theoretical study • Empirical Study	
Research Method	• Literature • Survey questionnaire to students with visual perceptual disabilities (20students)	

In a theoretical study, the main role of the literature review is to show the underlying assumptions behind the research questions, demonstrate the researcher's knowledge within the area, show that the proposed study will fill a gap in previous research, and refine and redefine the research questions by embedding them in larger empirical traditions. The literature review that was performed in this study is based upon literature related to this study topic. Subsequently, relevant articles were acquired, reference lists were inspected, and additional relevant articles were acquired. A thorough review of the literature yielded descriptions of past studies in online classrooms, and visual perceptual disabilities.
In terms of research, the lack of empirical research in this topic especially in Malaysia, renders an exploratory investigation as the most suitable approach to be conducted. Initial understanding of online classroom, and visual perceptual disabilities are synthesized from the literature to provide an initial research approach.

Taking into consideration those guidelines and to fulfill the study needs, the survey questions are divided into two sections, which are section A and section B. In section A, there are 4 questions related to students' demographics and experience in using online classrooms. Section B contains 12 questions about identifying the appropriate interface elements that suit the students' needs and preferences. In this section, the questions are divided into 6 main categories and each category comprises of subcategories. The main category are color, font, button, navigation, icon and background. The questions developed for this study are based on the conceptual framework presented in Figure 2.0.

Fig. 2.0 Conceptual Framework adopted for this study

Interface elements	**Color**	Background	Cold	
			Hot	
		Text	Cold	
			Hot	
		Title	Cold	
			Hot	
	Font	Type	Serif	
			Sans Serif	
		Size	Title	Above 30 point
				Below 30 point
			Text	Above 14 points
				Below 14 points
		Style (effect)	With style	
			Without Style	
	Button	Type	Radius button	
			Rounded button	
			Squared button	
		Effect	With effect	
			Without effect	
	Navigation	Horizontal		
		Vertical		
	Icon	Size	Large	
			Small	
		Color	Color	
			Black and white	
	Background	Plain color		
		With image		

At the end of the questions, there is open-ended section that asks students' opinions on the current online classroom platforms. This section requires students to answer based on their experience in using current online classroom platforms. The questions were distributed to 20 students with visual perceptual disabilities in selected schools that offer Pendidikan Khas (Special Needs' Education).

RESULT AND DISCUSSION

Based on the data collected, the results have been thoroughly analyzed. As mentioned in the previous section, 20 respondents were involved in the study. Those respondents are prudently selected in order to ensure the data collected are precise and represent the idea of the study. Figure 3.0 represents the gender of students that answer the survey questionnaire. The graph shows that 65% of the respondents are female students and 35% are male students.

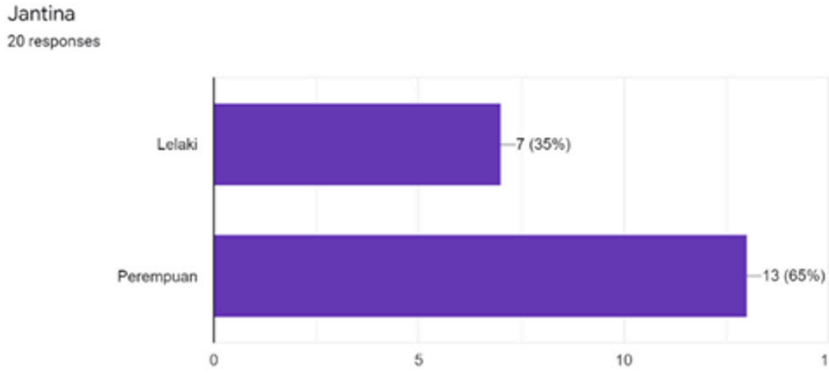

Fig. 3.0 Gender of students

This question was addressed to a group of students from year 4, year 5, and year 6. According to the responses, 15% are students from year three, 45% in year five, and 40% in year six. Figure 4.0 shows the students' year of study.

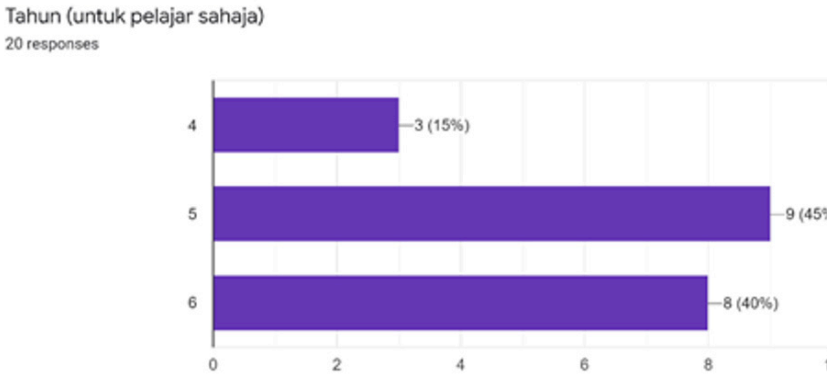

Fig. 4.0 Year of students

This question asked students regarding the application or platform that has been used as their online classrooms. Figure 5.0 shows that 10.5% of students use Webex, 15.8% using Microsoft Teams, 57.9% use Google Meet and 68. 4% use Telegram.

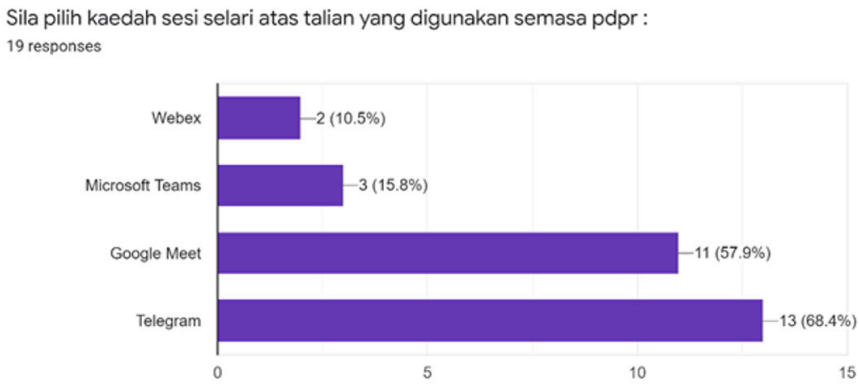

Fig. 5.0 Application or platform that has been used as online classrooms

The next question is an open-ended question that asks students' opinions on online classroom platforms based on their experience. Figure 6.0 shows the answer form filled by students.

Pandangan terhadap tentang *online classroom* yang pernah digunakan:
Tak tahu nak tekan mana sebab tak jumpa button
Gambar belakang bergerak-gerak ganggu saya nak baca
Susah nak baca kerana terlalu banyak benda
Warna tak menyeronokkan
Tajuk tak menarik warna
Susah nak baca
Tidak tahu mana nak mula kerana banyak nak tekan
Tempat tekan kecil sebab guna tulisan tak ada bentuk
Warna belakang terlalu terang
Saya tak pandai guna
Terlalu banyak perkataan
Tulisan kecil
Corak latar ganggu untuk baca
Banyak sangat fail untuk download
Susah guna aplikasi
Tak pandai belajar online
Banyak sangat tempat nak tekan
Selalu salah tekan
Internet lambat

Fig. 6.0 Students' opinion on online classroom platforms

Findings from the open-ended questions found that difficulties faced by students can be divided into 2 main categories which are process and interfaces. In terms of process, students faced difficulties due to a lack of training and exposure to the way of using those online platforms. In terms of interfaces, findings show that students had difficulties due to the selection

of font type, font size, font color, background color, background design, button design, icon, and image used in the current online platform.
The next section discusses the interface elements that have been selected and chosen by students according to their survey questions. This section discusses six main interface elements which are color, font, button, navigation, icon, and background.

5.1 Color

As discussed in the previous section, color selection is divided into three subcategories which are color for background, color for text, and color for title. The color selection is based on two groups of color which are hot color (sejuk) or cold color (dingin). Students were given examples in the process of selection to ensure that they understand their choice. Table 2.0 shows the tabulation of color selection by students according to subcategories. Based on the selection, the majority of students prefer cold colors for all subcategories: the background, text and title.

Table 2.0. Color selection based on subcategories

Category	**Background**		**Text**		**Title**	
Subcategory	Hot (*panas*)	Cold (*dingin*)	Hot (*panas*)	Cold (*dingin*)	Hot (*panas*)	Cold (*dingin*)
Percentage	40%	60%	30%	70%	35%	65%

5.2 Font

Font selection is divided into three subcategories which are font type, font size, and font style (effect). Font type is divided into two types which are serif and sans serif. For font size, multiple sizes of font were given as examples to students, and for them to choose. Font size is divided into other subcategories which are title and, text. And lastly, for style (effect), students were given a choice between texts with effects and texts without. Style (effect) includes shadow, reflection and other types of effect. Students were given examples in the process of selection to ensure they understood their choice. Table 3.0 shows that students prefer to use serif font type in an online classroom platform. In terms of font size, a majority of the students chose above 30 point for title and above 14 point for text. For style, students prefer fonts without style.

Table 3.0. Font selection based on subcategories

Category	Type		Size (minimum size)				Style	
			Title		Text			
Subcategory	Serif	Sans serifs	Below 30 point	Above 30 point	Below 14 point	Above 14 point	With style	Without style
Percentage	90%	10%	30%	70%	25%	75%	20%	80%

5.3 Button

Button selection is divided into two subcategories which are shape and effect. For button shape, students were given three types of button shapes which are radius button (butang jejari), rounded button (butang bulat), and squared button (butang segi empat). Button effects include shadow, reflection, and other types of effect. Students were given choices to choose whether they wanted the button with effect or without effect. Students were given examples in the process of selection to ensure they understood their choice. Based on table 4.0, 45% chose the squared button as button shape, 35% chose the rounded button and 20% chose the radius button. For button effects, 65% chose buttons with effect and 35% chose buttons without effect.

Table 4.0. Button selection based on subcategories

Category	Shape			Effect	
Subcategory	Radius button (*butang jejari*)	Rounded button (*butang bulat*)	Squared button (*butang segi empat*)	With effect	Without effect
Percentage	20%	35%	45%	65%	35%

5.4 Navigation

Navigation selection is based on two selections which are vertical and horizontal navigation menus. Students were given examples in the process of selection to ensure students understood their choice. Based on table 5.0, 90% of students chose horizontal and 10% chose vertical as navigation style.

Table 5.0. Navigation selection

Category	Navigation	
Subcategory	Horizontal	Vertical
Percentage	90%	10%

5.5 Icon

Icon is divided into two subcategories which are icon size and icon color. For icon size, students were given choices between large or small sizes. For colour, students were given a choice between the colours black and white. Students were given examples in the process of selection to ensure students understood their choice. Based on table 6.0, 85% chose large size as for icon size. For icon color, 70% chose a color icon and 30% chose black and white.

Table 6.0. Icon selection based on subcategories

Category	Size		Color	
Subcategory	Large	Small	Color	Black and white
Percentage	85%	15%	70%	30%

5.6 Background

Background selection is based on two selections which are plain color background or image as background. Students were given examples in the process of selection to ensure students understand their choice. Based on table 7.0, 85% of students chose the plain color background and 15% chose an image as background.

Table 7.0. Background selection

Category	Background	
Subcategory	Plain color	Image as background
Percentage	85%	15%

CONCLUSION

This study is carried out with two main objectives which are to identify the visibility issues for students with visual perceptual disabilities with the current interface of online learning platforms and to identify the interface elements that suit their needs. The study was carried out by distributing survey questions to 20 students diagnosed with visual perceptual disabilities. For this study, students selected are from primary school from years 4 to 6. Survey questions were constructed using a conceptual framework that was designed specifically for this study. The conceptual framework consists of six interface elements which are color, font, button, navigation, icon, and

background. Each question had undergone detailed analysis and had been discussed in the findings and discussion section. Findings from this study can be used as a guideline in developing the interface of an online learning platform for visual perceptual disabilities students. This is very crucial in ensuring that this group of students are not left behind in their studies. This study will bring positive change in the life of students with visual perceptual disabilities as they will be able to use the online classroom with ease.

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