The Development and Content Validation of a Needs Assessment Questionnaire for Visual Attributes Profiling in Students with Visual Impairment

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ABSTRACT

INTRODUCTION: Conducting a needs assessment is imperative to identify gaps in the current data management practices for visually impaired students. This study aims to evaluate the content validity of a needs assessment questionnaire, a critical precursor to developing a systematic visual attributes profile for this student population. By validating the questionnaire, the challenges and needs of visually impaired students can be accurately identified, enabling targeted interventions and informed policy decisions in special education. Ensuring the precision of the questionnaire establishes a foundation for understanding and addressing these students' needs, ultimately contributing to more effective educational environments. **MATERIALS AND METHODS:** The instrument underwent two phases, i.e. item development and a comprehensive assessment of item validity by six experts. The experts evaluated the instrument's relevance and comprehensibility using a four-point Likert scale. Microsoft Excel facilitated the analysis of the Content Validity Index (CVI), Content Validity Ratio (CVR), and modified kappa (K) statistics. **RESULTS:** The item content validity index (I-CVI) ranged from 0.83-1, with a Scale-level Content Validity Index (S-CVI/Ave) of 0.97, indicating acceptability. The Content Validity Ratios (CVR) for most items surpassed 0.7, indicating strong agreement among experts on their relevance with the interpretation of the K analysis of 70% excellent. However, three items in the second and third domains required revision and clarity enhancement. **CONCLUSION:** The content validity analysis showed that all items in the questionnaire were deemed appropriate. This suggests that the questionnaire is suitable for assessing the need to develop a systematic visual attribute profiling for students with visual impairment.

INTRODUCTION

According to the latest report from the Special Education Division, Malaysia, 2616 students are classified as visually impaired, with 289 of them enrolled in special schools.[1] Visual impairment can profoundly impact cognitive and learning process abilities. Previous study has found that the involvement and academic performance of visually impaired students is generally lower compared to their sighted peers in mainstream classrooms.[2] Furthermore, research on teachers' perspectives regarding the academic involvement of visually impaired students is moderate.[3,4] Most teachers agreed that the academic and social challenges faced by these students are due to their visual impairment. Students with severe visual impairment and those enrolled in special education programmes often exhibit low self-assurance and academic achievement.

Visual anomalies can reduce the efficiency of the visual system and consequently reduce the capacity to perform optimally at school.[5] The key attributes related to the visual system that may be affected include visual acuity, visual field, and contrast sensitivity. These visual attributes are vital for diagnosing vision issues and deciding on the

best treatments. Despite the best treatment, eye anomalies can result in difficulty carrying out certain tasks, especially those involving vision. Therefore, it is important to understand the demand on the visual system and relate it to visual ability. Visual demand refers to the visual requirements specific to each task, which vary depending on the nature of the task.[6] Utilizing evidence-based information from medical records and data on the students' visual attributes should guide the teachers to meet students' visual demands in the classroom. Previous studies have primarily focused on management strategies for children with common refractive errors and non-strabismic conditions. However, there remains a limited focus on studying the visual attributes and demands of visually impaired students.[7,8] This gap is particularly significant given the diverse nature of visual impairment of children across different regions.[9] Recent global estimates indicate that approximately 2.2% of children and adolescents experience some form of visual impairment, with refractive errors being a leading cause.[10,11] Nonetheless, a profiling study in Malaysia concerning the causes of visual impairment and the utilization of low-vision aids has revealed congenital cataracts as the primary cause of visual impairment among students.[12] This underscores the importance of genetic consultation and the careful selection of visual aids, based on functionality and the student's visual needs to enhance visual performance. These findings highlight the critical role of detailed visual profiling in formulating tailored rehabilitation strategies.

In parallel with technological advancements, data profiling systems enable continual access to updated algorithms. In the education sector, data management systems are crucial for handling the increasing volume of data and restructuring administrative methods, thus impacting various aspects such as leadership, decision-making, human resources, communication, accountability, and strategic planning in schools.[13] These systems involve collecting, organizing, securing, and storing data for analysis and informed decision-making, replacing the traditional manual methods. In Malaysia, the Ministry of Education (MOE) employs The Educational Management Information System (EMIS) to systematically gather educational data from schools. Despite its intended utility, concerns regarding the quality and accuracy of the collected data have been voiced by high-ranking MOE officials.[14] Inclusive or special education faces additional challenges within this system, as essential details about students' conditions, impairments, and management are often overlooked. This omission poses difficulties for those tasked with tailoring the educational needs of these students, further highlighting the critical need for enhanced data collection practices specifically designed for special education populations.[15] Consequently, conducting a needs assessment is vital before developing tailored software systems to meet the visual needs of visually impaired students.

To date, questionnaires remain a prevalent and widely utilized method for needs assessment across various educational fields, including healthcare and software engineering.[16] Ensuring instrument reliability is crucial, especially in pilot studies, as validity evaluates how accurately an indicator measures the associated constructs.[17] This study aims to evaluate the content validation of a needs assessment questionnaire in the Malay Language, specifically designed for developing systematic visual profiling for visually impaired students. By rigorously assessing the questionnaire's content validity, this study ensures the reliability of tools used in educational planning and provides empirical evidence of its effectiveness in capturing relevant visual attributes and needs. The development of such tools has the potential to significantly enhance the educational experiences of visually impaired students by enabling educators to tailor interventions more effectively, fostering a more conducive learning environment.

MATERIALS & METHODS

Development of the Instrument/ Item generations

The development of the questionnaire items through literature review focused on the involvement of the students' management system. Two questionnaires identified from published articles were selected and modified to contribute to item generation.[18,19] The development process began with identifying the definition of the selected domain and drawing insights from relevant literature related to school database management

information systems and portals. A significant shift occurred as a web-based system replaced the conventional approach. The literature review results guided the formulation of the draft, encompassing four domains: i) current data management, ii) challenges in data management, iii) infrastructure system, and iv) top management support. This was followed by a refinement stage through discussion sessions, which included brainstorming to generate new ideas relevant to visually impaired students' needs and critical evaluation of each item for relevance and clarity. Subsequently, linguistic adaptation was carried out to ensure simplicity and comprehension in the Malay language. The final stage involved a preliminary review by a language expert to verify the clarity and cultural appropriateness of the items. This comprehensive process ensured that the questionnaire items were well-suited to the study's objectives and the target population.

Following the initial development, the lead investigator conducted a discussion session involving two panels; i) a senior lecturer, and ii) an undergraduate student specializing in Mobile Communications Systems, Networking, and Big Data. The aim was to gather information and ideas to refine the questionnaire. Qualitative analysis was applied to the data collected from these discussions, and new questionnaire items were incorporated based on the outcomes. A preliminary set of questionnaire was created to avoid duplication of items. These items were crafted using simple Malay language to ensure comprehension by the participants.

Content Validity Process

The judgment and quantification of the questionnaire were done according to the recommendation by the previous studies which involves forming expert panels, inviting experts for participation, analysing responses through item content validity index (I-CVI), content validity ratio (CVR), and modified kappa ($\varkappa$), and ultimately revising and finalizing measures.[20-23]

The expert selection process was rigorous to ensure a comprehensive evaluation of the questionnaire. The formation of the panel adhered to at least one criterion encompassing three essential conditions: i) active involvement in web-based software planning and development, along with possessing extensive knowledge and substantial experience, ii) expertise in managing and addressing issues associated with visually impaired students, and iii) demonstrated willingness to engage in the content validity process. Experts were identified based on their involvement in the low vision field, special education, and information technology within the past five years to promote diverse representation across disciplines. Table I lists the six expert panels recruited for the content validity examination.

Table I: List of expert panels

NO	POSITION	AFFILIATION
1	Assistant Director	Special Education Rehabilitation Unit, Ministry of Education
2	Associate Professor	Centre for Cyber Security, Faculty of Information Science and Technology, UKM
3	Senior Lecturer	Centre of Education and Community Wellbeing, Faculty of Education, UKM
4	Senior Lecturer	Centre for Information Systems Studies (Intelligent Systems), Universiti Teknologi MARA
5	Optometrist	Vision Care, Kajang Selangor
6	Principal	Sekolah Menengah Pendidikan Khas Setapak

The expert assessed the items of the instrument using item-rating scales recommended from the previous study.[24] These scales consisted of four points: 1=*'not relevant'*, 2=*'somewhat relevant'*, 3=*'quite relevant',* and 4=*'highly relevant'*. The experts were also requested to assess the understanding of the items and provide feedback, especially when they evaluated items 1=*'not relevant'*, and 2=*'somewhat relevant'*; or 1=*'not understood and confusing'*, and 2=*'understood but confusing'*.

The responses from the experts were analysed using I-CVI, CVR, and $\varkappa$. The I-CVI was calculated within a range of 0-1, indicating the proportion of experts awarding a score of 3 or 4 to an item. Items with I-CVI values of 0.79 or higher were deemed relevant, those between 0.70-0.79 required revision, and items with an I-CVI of 0.78 for more than five experts were considered for elimination. The Scale Content Validity Index (S-CVI) was determined using Average (Ave) and Universal Agreement (UA) methodologies, with acceptable values set at 0.8 or greater, emphasizing sensitivity to expert agreement.[19] The substitute for CVI is the $\varkappa$ which tackles the constraints of proportion agreement indices. In modified kappa, an *'excellent'* value is above 0.74, and a

'good' value falls between 0.60-0.74. Items in the questionnaire rated as excellent or good will be included in the research. Table II shows the range values for I-CVI and $\varkappa$. The modified $\varkappa$ is determined by utilizing the probability of chance agreement (Pc) and I-CVI. The values and formula were based on previous literature.[24]

Table II: ICVI and $\varkappa$ range values

Item	Standard Range	Degree of Uniformity
Item Level-Content Validity Index (I-CVI)	<0.70	Eliminate
	0.70-0.79	Need for revision
	≥0.80	Appropriate
Modified Kappa ($\varkappa$)	<0.40	Poor
	0.40-0.59	Fair
	0.60-0.74	Good
	>0.74	Excellent

Meanwhile, the CVR is conducted to evaluate item essentiality, ranging from -1 to +1. The proportion of awarding the score value by the experts was the same as I-CVI. The minimum permissible value of 0.78 for individual item acceptance, or 0.99 for a panel of six experts.

RESULTS

Items Development of Need Assessment Questionnaire

As previously outlined, the need assessment questionnaire preceding the development of the visual profiling system comprises four distinct domains; i) current data management, ii) challenges in data management, iii) data infrastructure, and iv) top management support to form 15 items. The first domain (current data management), encompassing Items 1-3, focused on the tools and systems currently utilized by teachers and administrative staff. Items 1 and 2 evaluated the usage of various tools such as physical paper or files, Microsoft Excel, Google Sheets, or dedicated School Data Management Systems. Meanwhile, Item 3 assessed the effectiveness of the current data handling processes.

The second domain explored the challenges encountered with the existing tools or systems. Items 4 and 5 addressed the specific obstacles, including limited accessibility, support provision difficulties, and communication barriers. The third domain (Items 6 and 7) emphasized the importance of incorporating visual characteristics, including issues related to visual impairment and the utilization of visual aids, within data infrastructures. In the same domain, (Items 8 to 11), were centred on knowledge related to web-based systems, assistive technologies, and software in managing visual profiling. The fourth domain; *top management support* (Items 12-15) highlights the support provided to teachers and staff in managing data information for students with visual impairment. It delved into the importance of collaboration, training, data security measures, and the necessity for specific features in data management systems.

Content Validation of Need Assessment Questionnaire

The content validation process employed statistical measures including Item-Content Validity Index (I-CVI), Content Validity Ratio (CVR), Universal Agreement (UA), and Modified Kappa ($\varkappa$) to assess item relevance and validity across all domains. Table III summarizes these measures. Most of the items (80%) achieved excellent content validity with I-CVI values of 1.00, exceeding the acceptable threshold of 0.78. Items 4, 7, and 10 scored slightly lower with I-CVI values of 0.83. The CVR calculations demonstrated that the same three items scored 0.66, falling slightly below the significant threshold of 0.99 for six experts, suggesting that while these items are relevant, they may benefit from further refinement.

Kappa analysis revealed an *"excellent"* rating for all items in domain 1 (Items 1-3) and domain 4 (Items 12-15) and most in domain 3 (Items 6, 8, 9, and 11). These items were retained. Items 4, 7, and 10 received *"good"* ratings ($\varkappa$=0.60), indicating strong but not unanimous agreement on their relevance and clarity, thus necessitated revisions. The overall Scale-Content Validity Index (S-CVI) for the 15-item questionnaire was calculated at 0.97, surpassing the 0.90 threshold for excellent content validity. Additionally, the S-CVI/UA of 0.85 was obtained, indicating a high universal agreement across all items.

These findings demonstrate the questionnaire's excellent overall content validity, effectively capturing intended constructs across all domains, with only minor revisions needed for three items.

Table III: Summary of Item-Content Validity

Domain	Panel in Agreement	I-CVI	CVR	UA	ϰ	Interpretation	Decision
Data Management							
Item 1: *Data management using physical paper or files and sorting information via Excel or Google Sheets remains practical and relevant.*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Item 2: *The School Data Management System is currently used to handle student profiles and information effectively.*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Item 3: *The current process of managing student data and information in your school is efficient, easily managed, and readily referenced.*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Challenges in Data Management							
Item 4: *The following are primary challenges you encounter when managing data for visually impaired students, including a) limited information accessibility, and b) providing appropriate support.*	5	0.83	0.66	0.00	0.60	Good	Revise
Item 5: *Communicating with visually impaired students, parents, and clinicians presents difficulties in the context of managing students' data*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Data Infrastructure							
Item 6: *Managing the visual needs of the students should be tailored to their visual characteristics and level of visual impairment.*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Item 7: *The existing student management data in your school contain information regarding the visual characteristics of students, issues, visual impairment levels, and visual aids.*	5	0.83	0.66	0.00	0.60	Good	Revise
Item 8: *Web-based data and information handling systems offer numerous advantages, including easy access and updates and reduced reliance on physical storage.*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Item 9: *Assistive technology or software is crucial in effectively managing student profiles and information.*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Item 10: *The following are the assistive technology and software used to manage student profiles and information; School Information Management Systems, E-Portfolios, and Cloud Storage and Collaboration Tools.*	5	0.83	0.66	0.00	0.60	Good	Revise
Item 11: *Parent-teacher communication Apps and Mobile Apps for Classroom Management can facilitate electronic communication between parents, teachers, and students.*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Top Management Support							
Item 12: *Improved accessibility to information and support for alternative materials are essential aspects of a profiling system for visually impaired students*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Item 13: *Electronic records should enable communication with clinicians and parents to enhance the efficient management of visually impaired students' data.*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Item 14: *Collaboration with support staff or other professionals is vital in effectively managing profiling data for visually impaired students*	6	1.00	1.00	1.00	1.00	Excellent	Retained
Item 15: *Training or professional development is necessary to effectively utilize assistive technology or software in managing student profiles and information.*	6	1.00	1.00	1.00	1.00	Excellent	Retained
S-CVI/Ave				0.97			
S-CVI/UA				0.85			

DISCUSSION AND CONCLUSION

The developed items for the need assessment questionnaire will determine the importance and effectiveness of the forthcoming visual profiling system. The proposed system anticipates comprehensive profiling by integrating socio-demographic, medical history, and visual characteristics information. This transition aims to enhance data management strategies, cultivate an improved learning environment, and optimize the use of visual aids by precisely characterizing students with visual impairment, moving away from outdated paper-based records.

In this study, the validation analysis of the need assessment instrument has utilized techniques that are frequently employed in health care and nursing research, as indicated by previous studies.[17,25] This is to ensure that the problematic areas can be identified as well as, minimize language errors, assess appropriateness, and

ensure respondents interpret questions accurately.[26] This approach enhances the reliability and applicability of the questionnaire in educational settings.

To the best of our knowledge, this is the first study to develop a need assessment questionnaire for visually impaired students' data systems. In this study, the authors meticulously designed comprehensive domains to address various aspects and explore topics such as current tools and systems, challenges encountered, knowledge of web-based systems, visual profiling in managing students with visual impairment, and support structures available for teachers and staff in data management. The extensive coverage of these domains offers the groundwork for a detailed study of the visual profiling system's evolution and possible impact on meeting the different needs of the educational context. This holistic approach provides a solid foundation for future research and development in this field.

Furthermore, a team of six panel experts were enlisted to oversee the process of validating, modifying, and enhancing the instrument. The number of experts falls within the range suggested previously.[17,18]

The high content validity scores (I-CVI ranging from 0.83-1.00, S-CVI/Ave of 0.97) indicated that the questionnaire effectively captured the intended constructs. These results suggest that the instrument could be a valuable tool for educators and policymakers in assessing and improving data management practices for visually impaired students. Previous studies recommended a minimum CVI score of 0.83 for six to eight experts.[23] Regarding the overall content validity, the S-CVI/Ave value was 0.97, and the overall agreement S-CVI/UA was 0.85, indicating robust content validity for all items. Literature suggested an acceptable validity with S-CVI values of at least 0.8.[23,25,27] Moreover, the S-CVI for this instrument aligned with congruity levels, as values above 0.74, between 0.6-0.74, and between 0.4-0.59 were considered 'excellent', 'good', and 'fair', respectively. In this context, all items in the instrument were classified as 'excellent'. However, findings from the CVR calculations had identified three items with a score of 0.60, leading to revisions based on expert recommendations and

consensus as high CVR scores indicated consensus on the importance of specific items in the instrument.[28]

Feedback and comments from the expert panels might serve as an additional means of assessment to enhance the content validity indices. In response to feedback and expert input, specific revisions were made to enhance the questionnaire's clarity based on ϰ values. Notably, in domain 2 (Challenges in data management), Item 4 underwent a revision to improve clarity, addressing concerns raised by experts regarding the comprehension of bullet-pointed questions. It has been revised from *"The following are primary challenges you encounter when managing data for visually impaired students, including a) limited information accessibility, and b) providing appropriate support?"* to *"Limited information on accessibility and appropriate support are the main challenges in managing data for visually impaired students"*

Additionally, Items 7 and 10 in the data structure domain were rephrased to enhance readability and to better align with the expert expectations. Notably, Item 7 were revised from *"The existing student's management data in your school contain information regarding visual characteristics of students, issues, visual impairment levels, and visual aids* to *"The existing student's data contains information regarding visual characteristics, level of visual impairment, and recommended visual aids"*

The results of this study demonstrate satisfactory content with construct validities of the questionnaire supporting its suitability for assessing the necessity of developing visual attribute profiling for students with visual impairment.[25] The outcomes of the profiling development represent a strategic initiative in addressing evidence-based visual characteristics and demands. These insights offer valuable guidance for educators, optometrists, and clinical instructors in customizing management strategies for students with visual impairment.

However, the absence of a face validity analysis in this study limits the ability to completely evaluate the questionnaire's initial impression and user-friendliness. Although face validity is not a comprehensive measure of an instrument's effectiveness, it is an important

preliminary assessment to determine the questionnaire's apparent relevance and acceptability for potential users.[26] Incorporating face validity into future studies would improve the evaluation's completeness and provide a more nuanced view of the questionnaire's first impression. Further studies in the future can corroborate the assessment of the instrument's reliability, enhancing the applicability of the assessment tool.

In conclusion, this study contributes significantly to the field by providing a validated instrument for assessing the need for visual attribute profiling in visually impaired students' education. The assessment of content validity through CVI (I-CVI & S-CVI), Modified Kappa, and CVR demonstrated excellent content validity for the items in the instrument, highlighting its suitability and potential as a valuable tool for improving data management practices. This thorough approach to content validity is crucial for Information System (IS) organizations and researchers engaged in developing accurate instruments for both preliminary and major research. This paper describes the specific approach used to create and evaluate instruments, ensuring that the content measurements are carefully examined before implementing the system. The examination of content validity in this study highlights the suitability of the instrument, confirming its capacity to attain a notable degree of validity. This study contributes significantly to establishing confidence in the process of preparing reliable instruments for empirical studies by recognizing content validity as a crucial factor.

As educational systems increasingly rely on data-driven decision-making, this validated questionnaire will be essential in ensuring that the unique needs of visually impaired students are effectively met, ultimately enhancing their educational outcomes.

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ETHICAL APPROVAL

The ethical consideration of this study has been approved by Universiti Kebangsaan Malaysia (JEPUKM_JEP-2023-470). The study adhered to the tenet of the Helsinki Declaration.

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