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DEVELOPMENT AND ASSESSMENT OF THE USABILITY OF MATHEMATICAL TEACHING MODULE FOR VISUALLY IMPAIRED FOURTH YEAR STUDENTS

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Abstract: *This article reports the development process and evaluation of the usability of mathematical teaching modules for visually impaired fourth year students. The development process involved three phases namely, analysis of teaching needs; preparation of materials and experts' review on content of module; and usability assessments of module based on teacher's retrospection. Teaching needs analysis was conducted with 10 mathematic teachers selected from purposive sampling through semi-structured interviews. Next, the preparation and review of the content module involved five experts from different fields. Some suggestions were identified and improvements were made based on the recommendations provided. The module was refined and its usability was evaluated based on a retrospection of 15 reviewers, consisting of mathematics teachers who taught visually impaired fourth year students in Malaysia. Qualitative data was collected using semi structures interviews while quantitative data was gathered using questionnaire and the mathematical teaching module developed. Qualitative data was analysed thematically while quantitative data were analysed using descriptive statistic involving frequency and percentage. The findings show that the analysis of the need for teaching Visually Impaired Students required a wide range of teaching aids, strategies and teaching approaches that are appropriate their issues, as well as four methods of modifications that can be applied to mathematical subjects. The findings of quantitative studies indicated high level of approval from experts and teachers on the evaluation of the module in terms of four main aspects, namely presentation, pedagogy, content and theoretical relationship with the teaching module. Hence, this teaching module caters the needs of visually impaired fourth year students. The findings of the study suggest that the mathematical teaching module was able to make the teaching of teachers more effective and the learning of Visually Impaired Students more meaningful and interesting.*
Keywords: *Development of Modules, Teaching of Mathematics, Visually Impaired Students*

Introduction

The mathematics curriculum executed in Malaysian education system is for all types of students including the special need students i.e. Visually Impaired Students. However, unlike typical students, the Visually Impaired Students has eye sight problems which impede their acquisition of visual information hence limits their knowledge development, experience and learning opportunities (Salleh 2009; Friend 2008). In addition, eye-sight problems also prevent them from receiving information directly from the environment (Zainal & Salleh 2009; Sack & Silberman 2010). Belson (2002) asserts that Visually Impaired Students may be successful in education if given the right and appropriate support and facilities. Therefore, these students need distinctive modifications or specialised curriculum that can cater their learning needs based on their level and type of visual impairment (Ashman & Elkin 2004; Koga & Hall 2009; King-Sears 2001, 2008; Bigge, Stump, Spagna & Silberman 1999).

According to Belson (2002), there are two main types of vision problems; blindness and low vision. Friend (2008) explains that in the context of teaching, it is important to understand that each Visually Impaired Student learn and function in different ways even though they have been diagnosed with the same vision problem. The differences may exist in various aspects such as learning aid, type and size of writing, the required correction lens type, the teaching strategy and approach, and the modifications of teaching.

Hence, special education programs need to be implemented to ensure that Visually Impaired Students will attain the same benefits with typical students in the national curriculum. The problem of pupils in mastering Mathematics needs to be addressed. Therefore, planning of specialised teaching and learning lesson which include design and modify approaches of teaching, teaching materials, and educational goals are vital in order to meet the specific needs of Visually Impaired Students according to their level and ability to receive the lessons. This will help the Visually Impaired Students to use optimise their ability and visual learning experience through other learning medium such as hearing and touch (Salleh & Zainal 2010).

Statement of problem

Visual problems faced by Visually Impaired Students are the major challenge in the implementation of quality and effective curriculum for Mathematic subject. It is important to produce students that mastered the knowledge and understanding in Mathematics in order to enable them to apply the concepts, principles and processes of Mathematics learned in daily life (Ministry of Education, Malaysia 2013a). Visually Impaired Students face difficulties in mastering Mathematics because the ways mathematical notations are being represented and coded are entirely based on visual discipline (Kapperman & Sticken 2010). In fact, Visually Impaired Students face difficulties to combine some information to create an overall conclusion as required in learning Mathematics (Kapperman, Heinze & Sticken 2010). Spindler (2006) in opinion that mathematical concept is easier to understand through visualization, which is not a privilege of Visually Impaired Students. They require more complex cognitive process to understand the concepts. This becomes the biggest hurdle for Visually Impaired Students in solving mathematical problems (Ministry of Education, Malaysia 2013b; Kapperman & Sticken 2010; Barmby, Harries, Higgins & Suggate 2009; Kapperman, Heinze & Sticken 2010). In Malaysia, mathematics subject is taught and presented in the same way to all students including those who have visual abilities. According

to Powell and Fuchs (2012), Mathematics requires visual sense as the main senses to understand the concepts and procedures in solving mathematical problems.

On top of that, the teachers are not trained to teach the subject hence make the teaching and learning process more difficult (Kapperman, Heinze & Sticken 2010). Most teachers only have general academic qualifications in the teaching of special needs students rather than specially trained for the teaching of Visually Impaired Students (Kapperman & Sticken 2010). The teachers' limited knowledge in terms of teaching pedagogy especially for Mathematics subjects makes it difficult for them to provide teaching aids, supporting materials and teaching strategies that are appropriate for needs of the Visually Impaired Students (Drake & Sherin 2006; Kapperman, Heinze & Sticken 2010). Therefore, teachers' professional knowledge is considered as the most important feature in the teaching and learning process. Shulman (1987) explains that a teacher needs to master four types of pedagogical content knowledge, namely; knowledge of subject contents, knowledge of student characteristics, pedagogical knowledge and curriculum knowledge. The level of teacher's pedagogical content knowledge will affect the level of student achievement (Abell 2007; Ball, Thames & Phelph 2008).

The teaching of Mathematics subject requires teachers to make a lot of modifications to the mainstream curriculum to meet the unique needs of teaching Visually Impaired Students (Education Regulations (Special Education) 2013; Sack & Silberman 2010; Friend 2008; Ferrell 2006; Salleh 2009; Zainal & Salleh 2009; Frederickson & Cline 2009; Hallahan & Kauffman 2009; Hardman, Drew & Egan 2008) which also includes the modifications on methods and instructional tools and learning (Holbrook & Koenig 2010; Najafi, Malkhalifeh & Amiripour 2011). In relation to this, Holbrook and Koenig (2010) argue that it is necessary to implement a special teaching module which is developed to help teachers to deliver more effective teaching approach to Visually Impaired Students in order to meet their unique and different learning needs compared to normal students. Ludikova and Finkova (2012) assert than a special form of teaching that comprises of teaching objectives, content, teaching aids, methods and teaching strategies specifically tailored for Visually Impaired Students should be created. Therefore, systematically developed teaching materials need to be developed to deliver effective teaching in line with the needs of Visually Impaired Students.

Purpose and objectives of study

This study aims to develop and evaluate the usability of the Mathematics teaching module for the Fourth Year Visually Impaired Students. The objectives of the study are:

1. To obtain information on the needs of the Mathematics Teaching Module for Visually Impaired Fourth Year Students.
2. To design and develop the Mathematical Teaching Module for Visually Impaired Fourth Year Students.
3. To evaluate the usability of the Mathematical Teaching Module for Visually Impaired Fourth Year Students.

Literature Review

The teaching and learning needs of Visually Impaired Students varies according to the category of vision disability ie blindness and low vision (Carney et al 2003). These special needs cover three main aspects: (i) modifications to teaching strategies and approaches; (ii) modifications and provision of teaching aids; and (iii) special equipment for Visually Impaired Students (blindness and low vision). There are various strategies and teaching approaches that can be implemented for Visually Impaired Students as typical students, but they need to modify and supplementary those teaching practices based on the needs and differences of Individuals with visually impaired (King-Sears 2001, 2008; Koga & Hall 2009; Dursin 2012). Additional curriculum to teaching Mathematics for Visually Impaired Students (blindness) is Braille Nemeth's knowledge and skills (Ministry of Education, Malaysia 2013c). Visually Impaired Students need to know the writing of Braille Nemeth before the Mathematical teaching process can be implemented. Teacher-centered, student-centered, material-centered and activity-centered strategies and approaches are the same as those of typical students. However, according to Hecht and Vagi (2010); Siegler, Thompson and Schneider (2011); Siegler and Booth (2004); Bailey, Hoard, Nugent and Geary (2012) all the strategies and approaches taught to typical students need to be modified according to the needs of Visually Impaired Students.

Modifications to teaching aids are important elements in helping to make the teaching process more effective (Igune 2009). According to Marshall and Swan (2008), teaching aids can be classified into two, namely concrete manipulative and virtual manipulative materials. Visually Impaired Students (blindness) need concrete manipulative materials such as concrete materials, natural materials, modified equipment, mathematical models, embossed diagrams, and braille writing materials in addition to virtual manipulative materials such as audio recording (Marshal & Swan 2008; Chang 2008; Boggan, Harper & Whitmire 2010; Seefeldt & Wasik 2006; Smith 2009). Whereas, Visually Impaired Students (low vision) require printed materials that vary in size depending on the extent of their field of vision (Carney et al. 2003). Therefore, the teacher needs to identify the size of the writing to ensure that the materials provide maximum input to each student (Bigge et al. 1999; Madungwe 2013).

The third aspect is the provision of special equipment to expedite the teaching and learning process of Visually Impaired Students. Visually Impaired Students (blindness) need a braille machine as the main tools, besides slides and stylus, Talking Calculator, Braillewriter, Duxbury, MegaDots, JAWS and Window-eyes software (Carney et al. 2003; Ferrell 2006; Madungwe 2013). Meanwhile, Visually Impaired Students (low vision) requires Close-Circuit Television (CCTV), Magnifier, telescope, and some other magnifying devices that use lenses or prism placed between eyes and objects viewed to enhance visual function (Belson 2002; Carney et al. 2003; Corn & Lusk 2010).

The difference in the needs of Visually Impaired Students with typical students in mathematics teaching causes the development of mathematical teaching modules to meet their unique needs (Spindler 2006; Curry & Hatlen 2007; Madungwe 2013). Visually Impaired Students are entitled to receive the same teaching and learning as typical students according to their age in accordance with the development of the skills required as individuals with visual impairments. Curry and Hatlen (2007) explain to meet the needs and goals of this Visually Impaired education; a special curriculum needs to be creating for them. Based on previous studies, the teaching needs of Visually Impaired Students are very limited studies in Malaysia.

Assuming that cognitive capacity of Visually Impaired Students equivalent to typical students cognitive development, the need to provide teaching material that is appropriate to the needs of visual disabilities is often overlooked. Hence, the development of mathematical teaching module is expected to be the beginning of a study of specific teaching needs for Visually Impaired Students.

Methodology

The process of module development, which refers to the design and development model, involves three main phases (Richey & Klein 2007). The Richey and Klein models (2007) are pragmatic studies as this model provides space for researchers to test the theory and validate practical practice based on procedures, techniques and tools based on specific cases. Based on Richey and Klein (2007), the design of this study is Type 1 development study which is contextual product development. This model is best suited for a study that requires product testing in a small focus group such as Visually Impaired Students and Special Education Teachers in Malaysia. The Richey and Klein models (2007) propose a sample of the study based on the needs of the study phase. The first phase involved needs analysis carried out with the aim to identify teaching needs and user's characteristics. This phase involved 10 mathematic teachers who were selected using purposive sampling. Creswell (2014) explains that although the number of samples is small, it allows researchers to investigate what has been studied more profoundly because the samples have in-depth information and know the progress of the study phenomenon. Data were collected using semi structured interview methods and analysed thematic.

Subsequently, in the second phase, design and development of teaching module were done based on findings of needs analysis, theory, literature review, and curriculum review. This phase involved five experts who reviewed and confirmed the contents of the module. Formative assessment of five field specialists was gathered to determine the validity of the content and to obtain suggestions for improvements. In order to ensure that the evaluation of teaching module designs can be done effectively, the selection of experts is based on the criteria set out as having a high knowledge and extensive experience in the field of represented. Tessmer (1993) explains that diversity of expertise is more important than the number of experts as the number of experts who are in the same field can interfere with the assessment because of unproductive contradictions and comments. Therefore, Tessmer (1993) recommends that one or two experts representing a field be sufficient and sufficient to evaluate. Data collection using questionnaire and analysed descriptively using frequency and percentage.

The third phase is the evaluation of the usability of the teaching material or product that is produced. The researcher chooses to conduct usability evaluation using a questionnaire instrument as a measurement method involving the user as the sample of the study. Users in the context of this study are 15 purposefully selected fourth year mathematics teachers. This selection is based on the classification of formative assessment involving users by Morrison et al. (2011) which explains usability assessments must involve individuals who are directly involved in carrying out the teaching. Data collection was done by using set of questionnaire and the mathematical teaching module that has been developed. Assessment of the validity of module contents by field experts and usability assessments employed a five point Likert scale answer; (1) strongly disagree, (2) disagree, (3) not sure, (4) agree, and (5) strongly agree. The data was analysed using the category calculation method proposed by Yusri, Nik Yusof, and

Mohd Shah (2010). This method indicated total value that exceeds 61 percent is considered that the module have a good content and obtained high level of achievement.

Results of the Study

The findings of the study are described in three main phases based on three main objectives of the study. The findings of the first phase which is the needs analysis phase which answers the first objective of the study are summarized in Table 1 below.

Table 1: Summary of the findings for Needs Analysis Phase

Teaching Aid Materials	Teaching Strategies and Approaches	Modification Methods
1. Concrete manipulative: • Existing Materials, • Natural Materials, • The correct tools / materials, • Embossed Figures, • Embossed Tables, • Diagram, • Photographs, • Tables, • Special equipment (magnifying glass / braille machine / CCTV) • Worksheets with regular prints. • Worksheets with Braille prints.	1. Approaches: • Inductive • Deductive 2. Strategy: • Teacher-centred • Student-centred • Activity-centred Content-centred 3. Method: • Collaborative, • Simulation, • Lecture, • Demonstration • Brainstorming 4. Technique: • Groups, pairs, • Explanatory, • Acting, • Role Play, • Demonstration, • Questions and Answers, • Discussion, • Quiz.	1. Customization of period: (Adjustments) • Additional periods in the Daily Teaching Plan or • Annual Teaching Design. 2. Customization of Approaches & Teaching Strategy: (Adjustments & Adaptation) • Based on student situation, • Topic relevance, • Classroom conditions, • Type of visual problem. 3. Customization of Teaching Aid Materials: (Adjustments & Adaptation) • Normal Printing ↔ Braille Printing, • Photography ↔ Sentence statement, • diagram/table ↔ embossed diagram • Small font size ↔ big font size. 4. Modification of Level of Skills: (Parallel Curriculum & Overlapping Curriculum) • Lessen or increase the number of training, • Lower or raise the level of difficulty of the questions, • Diversify the level of skills

Table 1 shows three main themes that have been determined by the researcher based on literature review. The themes represent three main needs of teaching; teaching aid materials, strategy and teaching approach, and modifications made to the mathematical curriculum to enable Visually Impaired Students to learn successfully. Summary of findings shows the need

for teaching aids; and the teaching strategies and approaches to Visually Impaired Students are the same as typical students. However, modifications to teaching materials and strategies need to be done by teachers to enable (i) the materials used to serve as a medium that facilitates the delivery of teaching; and (ii) the strategies and teaching approaches implemented in accordance with the student's visual abilities. Meanwhile, the four modifications proposed should be adapted based on students' cognitive levels, type of visual impairment and classroom situation.

The second phase of the study involved a development of module based on the findings of needs analysis, theory, literature review, and curriculum reviews. Analytical information is important to produce a module that teachers need. The second phase is divided into two parts; (i) development of module designs (ii) evaluation of module contents by experts. The development of module design involves seven planning components based on the teaching design model introduced by Morrison, Ross, Kalman and Kemp (2011). The components comprise of analysing tasks or contents; determining teaching objectives; designing sequence of teaching; designing teaching strategies; designing teaching messages; building learning materials and planning teaching methods; and build instructional assessment instruments. Planning of teaching organizations in the module has taken into account the needs of teaching requirements from the needs analysis phase. This teaching design is developed specifically to meet the needs of Visually Impaired Students (Blind and Low Vision).
The developed module was later revised by five different field experts. The formative assessment of the experts on the module content developed includes four main constructs; module presentations; module content; pedagogy; and the teaching theoretical relationship which has a total of 107 items. The validity assessment of module contents is as presented in Table 2.

Table 2: The value for the computation of the module content validity

Assessor/Expert	Percentage (%)	Level
1	79.0	High
2	77.0	High
3	72.0	High
4	95.0	High
5	83.0	High
Cumulative Average	**81.20**	**High**

The results for the computation of module content validity level by five field experts showed a percentage value of more than 61.00 per cent i.e. 81.20 per cent. The findings indicated that the module has a high level of validity and meets the target of a module expert. Table 3 shows the formative evaluation of experts on the four main constructs of the Mathematics Teaching Module for Visually Impaired Fourth Year Students.

Table 3: Analysis on the level of Expert Approval on the four main modules of the Mathematics Teaching Module for Visually Impaired Fourth Year Students

Construct	N Item	Average Percentage (%)	Level
Presentation of Modules	16	88.00	High
Contents of Modules	34	81.00	High
Pedagogy	38	83.00	High
Theoretical Relation	19	76.00	High
Cumulative Average	**107**	**82.00**	**High**

Based on Table 3, the score value for all constructs was at a high level ranging from 76.0 per cent to 88.00 per cent. The overall score of the test reveals that the experts agreed that the design and development of this teaching module was at a high level, can be improved and used to conduct the study on the usability of the Mathematics Teaching Module for Visually Impaired Fourth Year Students.

Next is the third phase of usability module evaluation. Formative assessment findings collected from teachers on the usability of the Mathematics Teaching Module for Fourth Year Visually Impaired Students are shown in Table 4 below:

Table 4: Formative Assessment by Teachers on the Usability of Mathematics Teaching Module for Fourth Year Visually Impaired Students

Construct	N Item	Average Percentage (%)	Level
Presentation of Modules	16	96.30	High
Contents of Modules	34	97.90	High
Pedagogy	38	98.10	High
Theoretical Relation	19	98.30	High
Cumulative Average	**107**	**97.65**	**High**

Table 4 shows the average score given by 15 teachers on each construct evaluated for Mathematics Teaching Module for Visually Impaired Fourth Year Students. Overall, the module's usability ratings by teachers for each construct demonstrate high level of achievement with average percentage score ranging from 96.30 per cent to 98.30 per cent. This indicates that the teachers are in agreement that the module developed is feasible and can be used in the teaching of Mathematics for Visually Impaired Fourth Year Students.

Discussion

The design of this module based on needs analysis, theory, literature review and curriculum review which has produced a comprehensive module. The development process of this module involved the evaluation process of module contents by both experts and users (teachers). All information gathered has contributed to the creation of a more practical knowledge-based module. In general, this study concludes that:

1. Needs analysis information is important to produce a module that can be used by teachers.
2. The development process of the module should take into account the combination of theories to produce a comprehensive knowledge-based module.
3. The literature review provides important information to produce appropriate learning activities with Visually Impaired Students.
4. Curriculum Review is important for producing teaching and learning activities that can meet curriculum goals.
5. The results of reviews by experts from different fields have provided rich information both theoretically and practically.

6. Evaluation of the modules by both experts and teachers (users) is important to produce a module that not only meets the areas studied but also usable.

In the context of this study, the discussion is described in three parts. The first part concerns the teaching needs of Visually Impaired Students which includes (i) teaching aids, (ii) teaching strategies and approaches, and (iii) modification of methods. This study demonstrates the use of teaching aids to allow students to learn through the touch and hearing senses besides experience (Burns & Hamm 2011; Madungwe 2013). Educational research shows that most effective learning takes place when students are actively constructing their own mathematical understanding through the use of manipulative materials (Seefeldt & Wasik 2006; Ferrell 2006; Marshal & Swan 2008). The importance of teaching aids in transmitting knowledge is supported by Piaget's (1952) cognitive theory, Bruner (1966) and Skemp (1987) which state that mathematical concepts are developed through physical objects into representations and abstract thinking. However, the materials used should be in line with the student development stage (Smith 2009), and in accordance with the objectives of learning and student characteristics (Ma 1999; Shulman 1986, 1987). In addition, the study shows that the use of teaching aids in teaching and learning help students to understand Mathematics more easily and improve students' achievement (Burns & Hamm 2011; Chang 200; Kelly 2006; Boggan, Harper & Whitmire 2010).

The second aspect is the appropriate teaching approach and strategy to be implemented in teaching of Visually Impaired Students. Inductive and deductive approaches have been suggested by teachers based on the fact that each student is different in terms of cognition, interest, efficiency and creativity. This approach can be customized based on categories and cognitive level of Visually Impaired Students (Gale & Cronin 2005; Billingsley, Scheuemann & Webber 2009). Furthermore, this approach helps students to improve their understanding of concepts before applying it in the activities provided by teachers (Billingsley, Scheuemann & Webber 2009; Rowlett 2010; Akpan & Beard 2014). Teachers also proposed four forms of teaching strategies, namely; (i) teacher-centred, (ii) student-centred, (iii) activity-based, and (iv) material-based. Material-based teaching strategies are object-oriented thinking skills which have been applied in education field (Shepherd 2001). Materials used as interactive mediums allow students master the content of the subject learned (O'Brien & Hodgins 2000). Implementation of approaches, strategies, methods and techniques should be diversified to meet diverged needs of students (Fitriana 2011; Billingsley, Scheuermann, & Webber 2009; Gale & Cronin 2005; Rowlett 2010). In addition, teachers should be able to determine which methods or specific techniques that is suitable for the students depending on their development and ability (Ismail & Atan 2011). The appropriate teaching approaches and strategies for Visually Impaired Students have the potential to not only to stimulate students to learn actively, but also to produce meaningful and effective learning.

The third aspect is the methods of modifications carried out based on the regulations for modifications in the Education Regulations (Special Education) 2013. Modifications can be implemented in the teaching of Visually Impaired Students, including modifications in terms of (i) time; (ii) strategies and approaches; (iii) teaching aids; and (iv) the level of skills. Texas Education Agency (2014) explains that time modifications can be implemented by increasing outside school time or teaching time of the year. In the context of this study, the timing changes are consistent with the guidelines set out in the Education Regulations (Special Education) 2013, in other words, changes or additional time during the examination, and the expected teaching period in the Annual Teaching Plan, whereas, modifications to teaching

approaches and strategies depend on the type of eyesight problem, student situation, topic relevance, and classroom conditions. Previous studies showed that students' achievements were much better in schools which implement the adaptations of curriculum based on student's ability compared to schools that practice one curriculum for all students (King-Sears 2001, 2008; Begeny & Martens 2007; Hardman, Smith & Wall 2005). Next, by modifying the teaching aids, Visually Impaired Students can participate in teaching and learning activities through the transformation of physical environments, curriculum modifications and modifications of teaching aids as well as the provision of specialized equipment (Igune 2009; King-Sears 2001, 2008; Texas Education Agency 2014). In addition, adjustment of the skill level is necessary if the student experiences a delay in cognitive development compared to their peers (Bigge et al 1999; King-Sears 2001, 2008; Hardman, Smith & Wall 2005; Koga & Hall 2009). The modification enables Visually Impaired Students to attend the same subject as normal students in the classroom. It is also important on the development of appropriate individual programs, as well as contributes positive impact on the education of Visually Impaired Students in the future.

The discussion on the second phase of the module design and development is divided into two parts. Firstly, to answer the question "How is the Mathematics Teaching Module for Visually Impaired Students being designed based on the aspects, teaching model; Learning theory; And the appropriate modifications? "This module incorporates two teaching models: the effective teaching model of Morrison et al (2011) and the 5E Teaching Model by Bybee and Landes (1990). Meanwhile, the theory of learning refers to the theory of cognitivism by Piaget and Bruner. Besides that, active learning is considered when preparing students' activities and training. Bloom's Taxonomy is the basis for determining the level of student's skill level while modifications are based on the scope of modifications allowed in the Regulations of Education (Special Education) 2013.

Furthermore, Effective Teaching Model introduced by Morrison et al (2011) acts as organization model for module design. The module developed for this study was developed and designed according to structure proposed in model by Morrison et al (2011). There are nine main elements in the design framework of this module, namely: analysis of teaching problems; analysis of user characteristics; analyse tasks or content; determine teaching objectives; designing the arrangement of teaching; designing teaching strategies; designing teaching messages; building learning materials and planning teaching methods; and building instructional assessment instruments. Meanwhile, Teaching Model 5E is a model that acts as the organizational structure of teaching which is a five-step teaching arrangement of involvement; exploration; explanation; expansion/processing; and evaluation. Theories, models and modifications are combined to build a specific teaching module for Visually Impaired Students. Material-based teaching provided specifically for Visually Impaired Students can create meaningful and quality teaching and learning atmosphere, and is able to connect students and teachers (Nordin, Embi, & Yunus 2010; Ismail 2015). Therefore, special teaching modules for Visually Impaired Students that caters to their learning needs and vision problems are vital to be produced (Sanchez & Flores 2004; Madungwe 2013; Ferrell 2006; Curry & Hatlen 2007; Spindler 2006; Ali & Mahamod 2015).

The following is the second part of the second phase which answers the question of the study, "What is the expert assessment of the design of the Mathematics Teaching Module for Visually Impaired Fourth Year Students in terms of presentation and clarity of modules; module content; pedagogy of teaching modules; and modules with learning theories?" The

findings of the four main constructs evaluated by experts, the overall average of the constructs provide a value greater than 61.0 per cent which is 82.0 per cent. This high percentage shows that the developed module has a high content validity. The findings summarize that experts agreed that the developed Mathematics Teaching Module for Mathematics Teaching Module for Visually Impaired Fourth Year Students is feasible to be used and continued on user usability tests. The module developed can fulfil the teaching needs of Visually Impaired Students covering teaching objectives, learning outcomes, pedagogical approach, application of learning theory, teaching strategy, learning environment, management, support resources and so on. This module has successfully incorporated teaching and learning theories, appropriate teaching strategies and the application of information that achieves teaching objectives. Researchers have taken into account the important aspects in producing a module that can achieve the objectives of the module development as well as the teaching objectives achieved in line with the learning standard.

The findings from the third phase of the module usability assessment by teachers as users also show high score of consensus score of 97.65 percent. This shows that the teacher agrees that this module is suitable and can be used in teaching Mathematics to Visually Impaired fourth year students. The developed teaching modules took into account the four-year cognitive structure of the students and utilized their readiness to affect the development of new knowledge. The process of teaching and learning works smoothly if the material is in line with the student's cognitive structure (Siegler, Thompson, & Schneider 2011). The module is structured with the theory of Bruner (1960) which says that effective teaching materials are compiled in the order of difficulty from a simple topic to more complex ones. Teachers provide suggestions for improvements aimed at producing more organized and effective modules.

Implications and Contributions of the Study

Based on a combination of theoretical and empirical data, the product of this research is hoped to provide an impact on existing teacher practices and pedagogy. The development of knowledge in the new pedagogical form produced in this teaching module is expected to be able to alter the existing practice of teachers in facing the challenges of education of the Visually Impaired Students. The results of this study can be used as a reference for the parties involved in the planning, development and implementation of the curriculum to improve the existing curriculum, especially in the aspects of teaching aids, strategies and teaching approaches, curriculum modification methods and the implementation of active learning, especially for students in primary schools. The method of teaching and learning in this module can be used as an example and guidance for all teachers at primary level to produce more effective and meaningful teaching for Visually Impaired Students.

Conclusion

Overall, the development of teaching module for Visually Impaired Students has highlighted a new idea in meeting the educational needs of Visually Impaired Students in Malaysia. This study also provides exposure and information to the education policy maker regarding the unique teaching and learning needs of Visually Impaired Students. In addition, this study also provides general knowledge of the various categories of Visually Impaired Students and these differences require a teaching approach that is different from typical students. The initial effort in developing a dedicated teaching module for Visually Impaired Students opens a vast

opportunity for such future efforts. In this regard, the Mathematical Teaching Module for Fourth Year Visually Impaired Students has made a great contribution as an inspiration for teachers' ideas and creativity in diversifying teaching and learning support materials to primary school pupils. Additionally, the researcher's proposals in the module include teaching strategies, teaching aids and special equipment, teaching and learning activities, modifications, and preparation of worksheets and tests, to directly assist and develop teachers' knowledge in diversifying Mathematics teaching approaches specifically for Visually Impaired Students.

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