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Leveraging 3D Printing Technology to Facilitate Quranic Education for the Visually Impaired

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Abstract

As the sacred book of Islam, the Quran is essential for all Muslims to learn and memorize. However, teaching it to individuals with visual impairments presents considerable challenges, particularly due to the complexity of the text and the limitations of current learning tools. The development of the Braille Quran through the Braille Quran code has indeed attracted their interest. However, the embossed Braille Quran paper in a thick book is still an inconvenience. Meanwhile, 3D scoring word board games, which offer engaging and tactile word recognition experiences, have shown potential as alternative learning tools. In this context, the study aimed to apply a gamification approach through word board games by developing a learning module that incorporates 3D-printed Braille tiles of Hijaiyyah (Quranic letters) and a reel-to-reel cassette. These components were designed to offer an interactive and engaging method for visually impaired learners. The module was tested among participants with varying degrees of visual impairment who attended Braille classes. Through structured activities using the 3D-printed tiles and cassette kit, learners were introduced to Hijaiyyah characters in an engaging and tactile manner. Assessments were conducted to evaluate vocabulary improvement and user engagement. The results demonstrated that the activity and implementation successfully introduced and attracted visually impaired individuals to learn Hijaiyyah Braille characters through gamification. Participants demonstrated noticeable progress, particularly beginners, in recognizing and recalling Braille Hijaiyyah letters. It is evidenced by an analysis of the program's efficiency and beginners' performance in each activity applied in the module. In conclusion, the integration of 3D-printed Braille tiles and reel-to-reel cassette into a gamified teaching module presents an effective, low-cost solution for Quranic education among the visually impaired. This alternative learning method has the potential to improve accessibility and motivation in learning the Quran.

Keywords: Additive manufacturing; Braille code; Braille module; Cassette shaped; Visually impaired

1. INTRODUCTION

Al-Quran means recitation, which is a religious text in Islam. As a Muslim, al-Quran is a revelation from Allah to the prophet, Muhammad through over 23 years. It contains teaching and guidance for humanity spiritually and physically. As a result, the nobility of the al-Quran was preserved allowing millions of Muslims around the world to learn and memorize. The increase of Muslims numbers is caused by the study of the Holy Quran, which carries significance. Hence, a significant plan are required to enhance and attract Muslims, precisely among the youthful generations, to learn the al-Quran through the development of nationwide education and acquire an impactful plan via reciting, memorizing, as well as understanding the content of al-Quran (Tengku Puji, et al., 2015).

Although this process can be conceivably accomplished for sighted Muslims, it will be difficult for handicapped people, categorically for visually-impaired people, in studying and memorizing al-Quran who possess a restricted sense of sight (Tengku Puji, et al., 2015). Therefore, many innovative proposals and processes have been fulfilled to meet the needs of visually-impaired people in learning Braille Quran. However, without any competent learning tools, the procedure will be an obstacle for them. As a result of their expert tactile sense, the development of Braille code characters is a perfect solution to their learning problems (Awad, et al., 2020; Bettelani, et al., 2020; Brian et al., 2018; Brik et al. 2021). Nonetheless, the lack of adequate instruments has discouraged them from learning Braille Quran due to the challenge of comprehending the Braille code, which serves as the fundamental concept (Brian et al., 2018; Tengku Puji, et al., 2015).

Despite the widespread use of the Braille Quran among Muslims, more has to be done to encourage visually impaired people and the next generation of Muslims to learn and memorize the Quran. The embossed Braille Quran paper was printed in several volumes and accumulated a large number of Hijaiyah characters in Braille code form. Braille's dot code is susceptible to impairment after prolonged use (Izharruzzahir et al., 2024; Mohd Noor, 2016). Therefore, it is essential for figuring out the Braille elements. Today, advanced learning programs for blind individuals include Qur'anic studies, and research has led to the development of innovative Braille Quran teaching tools, such as electronic devices (Najjar et al., 2021) and vibrating systems that align with the Braille code of the Quran (Abualkoshik & Omar, 2010). These findings highlight a growing demand for Quranic studies tailored to visually impaired individuals. Despite enabling access to the Quran, the Braille version presents several challenges. Its extensive volume requires multiple printed books due to the high number of Braille characters, complicating both learning and teaching. Additionally, the embossed Braille paper is prone to wear and tear over time, making it difficult to distinguish characters clearly (Abualkoshik & Omar, 2010; Qu et al., 2020).

Consequently, one of the essential components of the Industrial Revolution 4.0 (4IR) is 3D printing technology (Ford & Minshall, 2019), which is required to support the industrialised world, including education. The education field for the Muslim ummah must also be in line with the needs of technology to equip beginners with better skills and understanding without spending extra cost via the integration of 3D printing and 4IR into the Braille Quran in a fun way. Children in the 21st century have made enormous strides thanks to the structure of the 3D-printed tape cassette for Braille Quran, which is intended to foster profound conceptual understanding. For the education system, many additive manufacturing technologies have been developed. However, 3D printing is the most economical tool for the making of advanced prototypes and final products (Ford & Minshall, 2019; Hamdan et al., 2024; Kaco et al. 2022; Mohan et al., 2021).

The Word Board Game incorporates a three-dimensional scoring board and various 3D letter and connection-based game pieces, offering players an engaging and immersive word recognition experience (Aung & Iida, 2018; Medina-Merodio, et al., 2024; Sousa & Rocha, 2019). Gamification refers to the integration of game mechanics into non-game contexts to enhance specific skills or

problem-solving abilities (Ofosu-Ampong, 2020; Sikora et al. 2024). This approach has proven to be an effective method for helping beginners and individuals with visual impairments learn Hijaiyyah characters in an enjoyable and interactive way (Gao & Shen, 2024; Manzano-León et al., 2019; Pratama & Setyaningrum, 2018).

2. OBJECTIVES

This research aimed to execute the idea of word board game rules through Braille game tiles embossed with Braille dots of Hijaiyyah characters by referring to the developed learning module. Through the development of a three-dimensional printed reel-to-reel cassette as a kit for teaching device in learning Braille Hijaiyyah and consequently for the Braille Quran, the impact of Braille lesson the visually impaired ability to learning Hijaiyyah Braille characters and the effects of designated Braille word game activities in enhancing the efficiency of memorising Braille in the form of short surah were investigated.

3. METHODOLOGY

3.1 Development of Gamification-based Learning Module

If a gamification-based learning module was developed, which contains different learning stages including introduction, module concept, and learning outcome. The instruction of the activity and the type of activity were embraced by each piece. At the end of the module, an assessment model was used to assess the effectiveness of the module. Consequently, the module developed then was reviewed by a group of experts in the field of study and instructional design. The experts were chosen from a research institute known for developing tools for visually impaired representatives, specifically in Braille, a research and development department for blind association officers, and a representative from the Braille Centre for the visually impaired. They provide an assessment through heuristic evaluation, recommendations, and suggestions on the 3D-printed cassette developed. The expert review was based on: a) the operational instruction for the 3D-printed cassette; b) the evaluation of the functionality of the 3D-printed cassette; c) game assessment for both Game 1 and Game 2; d) the overall evaluation of the module; and e) the study's perception.

3.2 Designing and Printing Hijaiyyah Braille Tiles

According to the size of the word game tiles, the tiles for Hijaiyyah characters were designed. The dimension of the Braille dots was deliberated, with the embossed Braille dots used in the Quran as advocated by the UK Association for Accessible Formats (UKAAF) standards, as the reference (Awad et al., 2020). The designing process used TinkerCAD as a 3D modelling software to convert the characters of the braille Hijaiyyah tiles into a form of 3D model and consequently export them as a stereolithography (.stl) file. The .stl file was sliced using Prusa Slicer Software, which contains the printing settings and the file transform to g-code. Finally, the printing process was executed at a temperature of 210 °C as polylactic acid (PLA) was used as the filament. The process was summarized in Figure 1.

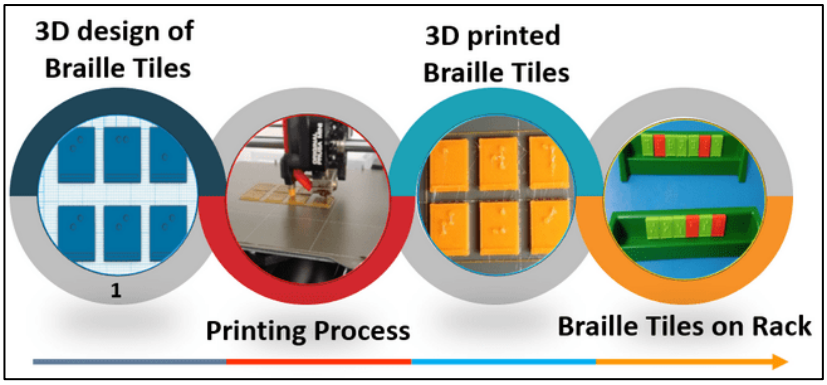


Figure 1: Flow process of developing 3D printed hijaiyyah braille tiles

3.3 Build-up of Reel-to-Reel Braille Cassette

A reel-to-reel Braille cassette was designed and printed using the same method as in designing and printing the characters of Hijaiyyah Braille tiles's section by imitating the design of a conventional tape recorder with modifications. A strip of craft paper with a thickness of 120 gsm was used to manually imprint the Hijaiyyah and short surahs in the form of Braille to be learnt by the visually impaired. Consequently, the strip was rolled into paper and then integrated into the body of the tape cassette to form a Braille Quran 3D-printed tape cassette. The flow process of development 3D printed reel-to-reel cassette was summarized in Figure 2.

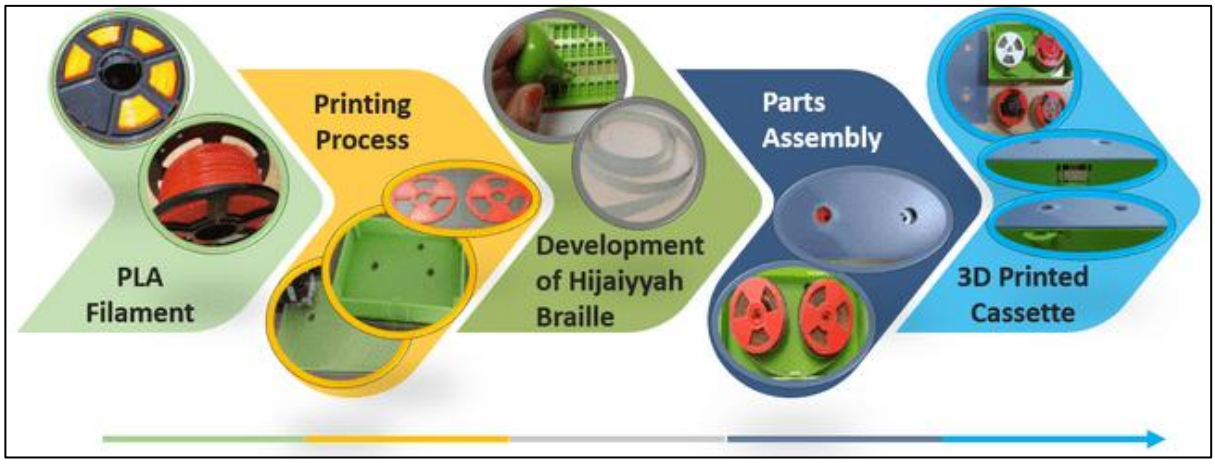


Figure 2: Flow process of developing 3D printed reel-to-reel braille cassette

3.4 Module Employment in Braille Quran Class for the Visually Impaired

The module was made available to visually impaired people who participated in this study, which was a planned research project by the Malaysian Association for the Blind (MAB) and KL Braille Resources. MAB is an organisation that promotes the prevention of blindness while also empowering people with visual impairment by offering them resources and chances for better engagement, involvement, and integration into society. KL Braille Resource is a centre for Braille users to advance their literacy and knowledge in special education for people with vision impairment. Participants consisted of both organisations' own visually impaired staff and consent was obtained from the participant before the program held. Both MAB and KL Braille have approved and given their consent to be the human subjects for their staffs to be in this study.

Three stages of implementation were used, with the first stage consisting of an introduction from educators that included theory and concepts. The execution of the module prototyping concept in the second phase included Game 1 (Spell it Right) using produced 3D-printed Hijaiyyah Braille tiles and Game 2. (Guess the Surah). The effectiveness of the activity was evaluated at the conclusion of the programme using a survey and questionnaire. The assessment step determined whether or not the participant could implement the ideas of 3D-printed tiles and 3D-printed cassettes. Achievement of learning outcomes will also be used to gauge how effective the programme will perform. Formative evaluation was used in this study at each stage of the development cycle.

3.5 Analysis on The Module Effectiveness and Participant's Performance

Qualitative and quantitative analyses were conducted on the set of questionnaires designed for the module's implementation. Figure 3 summarizes the analysis criteria, which include participant information, module effectiveness, program effectiveness, and suggestions for improvement. The analysis utilized the highest percentage Likert scale responses chosen by participants to interpret the data and identify relationships among the items. These insights can help educators refine the module's functionality and enhance the development of related products. Additionally, educators' evaluations were incorporated into the analysis to assess participant engagement and performance in Games 1 and 2.

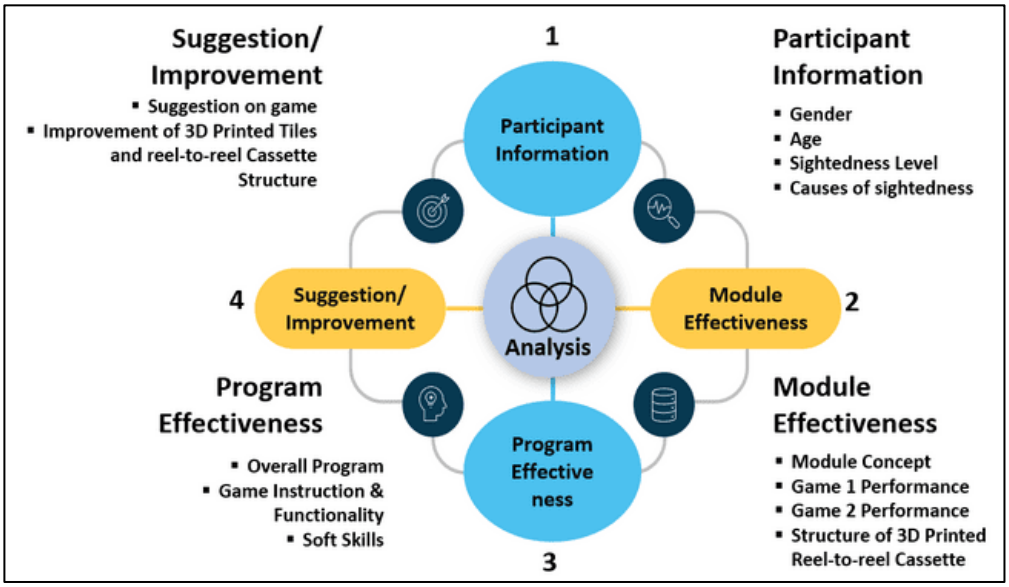


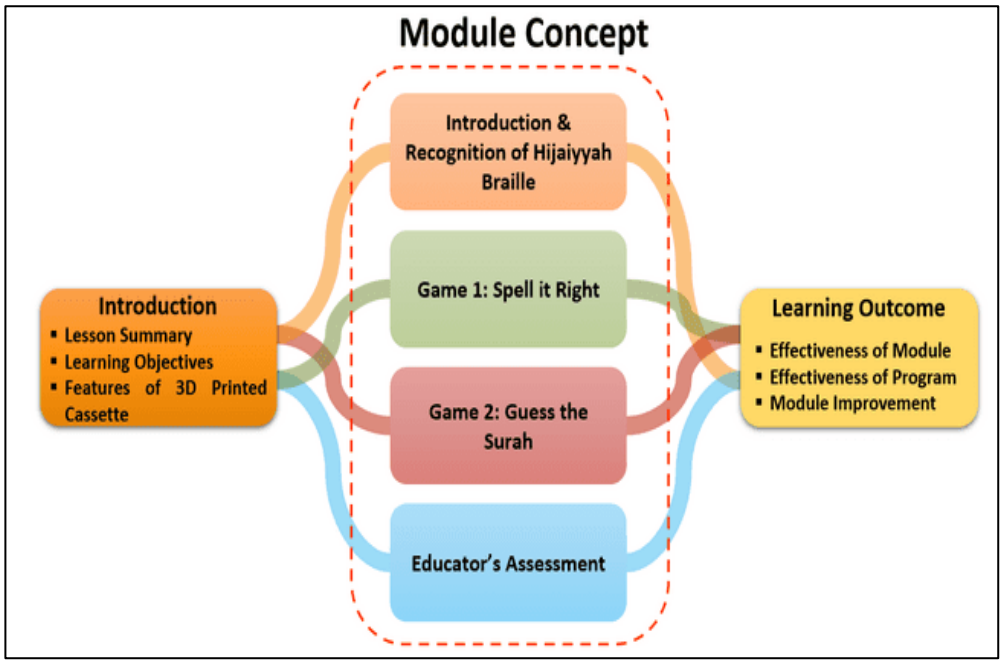
Figure 3: Analysis on questionnaire

4. FINDINGS

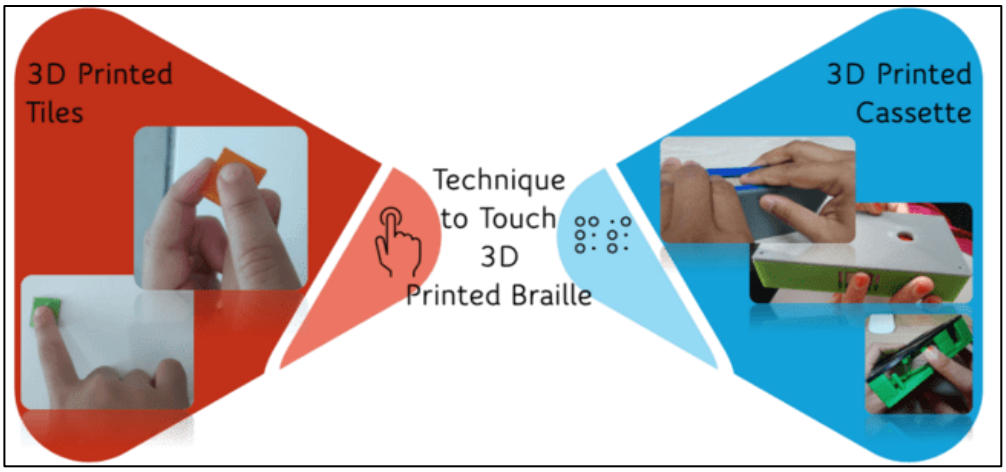
4.1 Expression of Module and Instrument

Figure 4(a) shows the interaction of learning stages in the gamification-based learning module developed. As can be seen, participants were introduced to the lesson summary and learning objectives throughout the module. It was followed by the establishment of the features of 3D-printed Hijaiyyah braille tiles and reel-to-reel cassette. This includes every technique to touch, handle, and read the braille characters on each tile. Meanwhile, for the 3D-printed reel-to-reel cassette, the technique was different due to the different features of the models, as shown in Figure 4(b).

The main content of the module is represented in the module concept, including the inauguration of Hijaiyyah characters in braille form, instruction, functionality, and evaluation of Games 1 and 2. At the edge of the module concept, a valuation by educators was employed. Introduction and module concepts are eventually interconnected to the designed learning outcomes through the assessment of module effectiveness, programme effectiveness, and improvement in module content.



(a)



(b)

Figure 4: (a) Interaction between stages in the development of gamification-based learning module and (b) Technique to touch and read 3D-printed Hijaiyyah braille tiles and reel-to-reel cassette

In this study, Google Forms, surveys, and a teacher's evaluation form were used as various assessment tools. The Google form tool was given to the expert in the first stage for review and evaluation. This form is divided into six sections, each of which has the instrument's item responses organised in sequences on the Likert scale (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, and 5: strongly agree). The professional reviewers were simultaneously given a reel-to-reel cassette and a set of 3D-printed braille tiles so they could examine the kits.

Meanwhile, the second stage was the participant's questionnaire responses, also arranged on a Likert scale, following the standard sequences. The questionnaire is also divided into 6 sections, including module concept, game 1, game 2, the structure of the 3D-printed reel-to-reel cassette, soft skills developed, and game instruction and functionality, respectively.

At the third stage of the educators' sheet, educators involved in the programme were provided with an evaluation sheet for them to assess the participants during the programme, specifically throughout Game 1 (Spell It Right) and Game 2 (Guess the Surah). The sheet contains four evaluation criteria, inclusive of peer assessment, survey, behavior, and a generic component for both games. The summary of the instrument items applied in this study is shown in Figure 5.

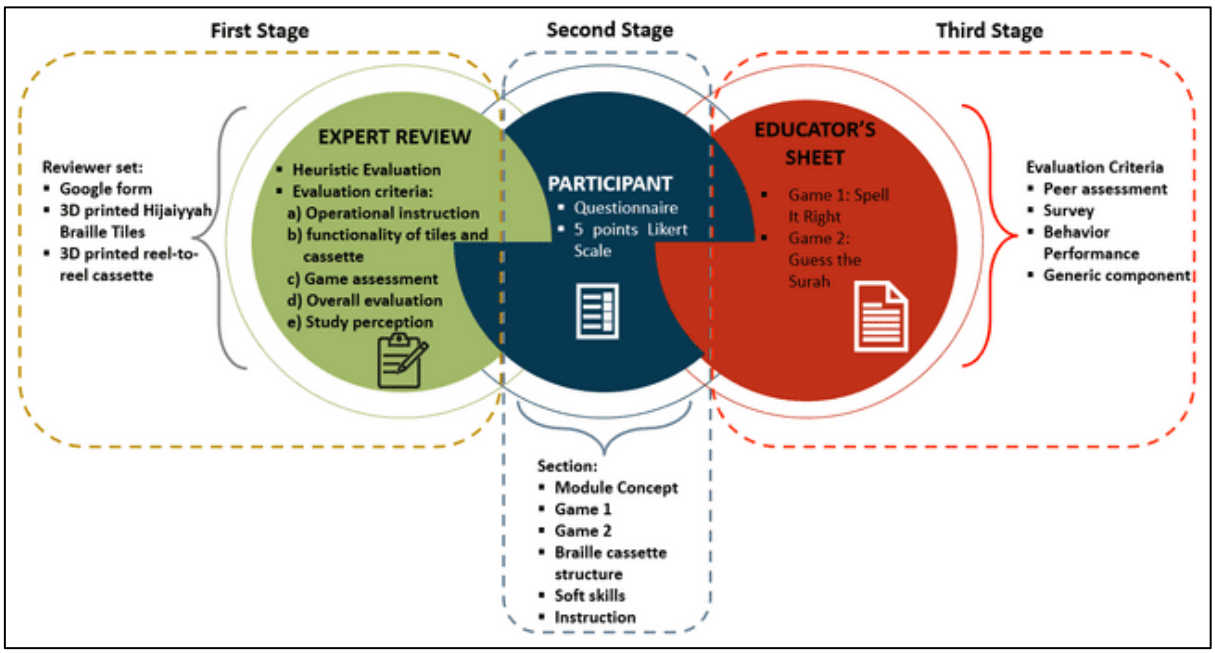


Figure 5: Instruments item developed for 3 stages

4.2 Hijaiyyah Braille Tiles and 3D-printed Tape Cassette Models

Figure 6 shows the 2D sketch of the Braille tiles designed according to the Hijaiyyah Braille characters. The tiles and the tape cassette were sketched and designed in 3D model form by applying TinkerCAD as 3D modelling software to export the stereolithography (.stl) file as shown in Figure 6 respectively. Consequently, the 3D models were sliced using the Prusa Slicer. This process was required to adjust the settings for the 3D models to be printed using a 3D printer. The sliced models were converted into g-code files that contained all of the model's information, including the dimension, position of the models on the 3D printer, and mesh pattern of the solid framework, and the 3D-printed models were printed using the MINI Prusa 3D Printer. The 3D printing process used filament from polymer-based materials, such as polylactic acid (PLA), since it is a thermoplastic polymer where the polymer is soft when hot and becomes hardened when cold (Hamdan et al., 2024; Mohan et al., 2021). As the tiles have 30 Hijaiyyah Braille characters, the tiles were separated into several files. Meanwhile, the tape cassette was divided into components, including the cassette body, top cover, top and bottom reels, and connectors respectively, as shown in Figure 7, where these components were printed separately and assembled accordingly to form a structure of a 3D-printed reel-to-reel cassette.

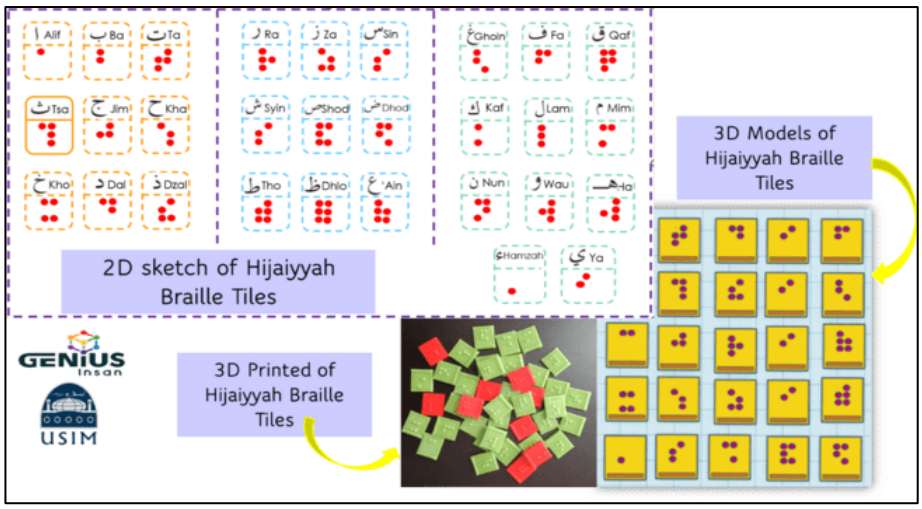


Figure 6: 2D Sketch, 3D models, and the 3D-printed Hijaiyyah braille tiles

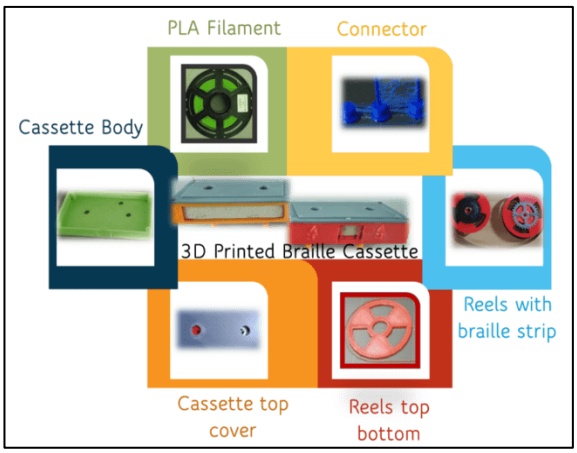


Figure 7: Components and parts of the 3D-printed reel-to-reel cassette

4.3 Interpretation on Participant Information

Table 1 displays the analysis of the data related to the program's participants. Eleven visually impaired people took part in the programme, which was held at the MAB and KL Braille organisations. According to the analysis, there were 4 men and 2 women among the 6 MAB participants who were between the ages of 20 and 29. Four of the participants shared a sightedness level of B1 or B2, with four being in the B1 group (2 male and 2 female). Another two participants, both men, were in the B2 group at the same time. These sight levels are divided into three categories: B1, B2, and B3. B1 describes individuals with visual impairments who are totally blind (cannot see anything) and need tools for daily life. In contrast, B2 had short-sightedness where they could still see light, and while some of them could move around without the right tools, for the most part, they needed them. The B3 level of near-sightedness allowed them to move independently, but most of the time they required glasses. Most of these participants were born blind, and a few had diseases like nerves, glaucoma, and fever that caused them to lose their sight.

Table 1: Analysis on participant information

Gender		Age (years old)			Sightedness level			Cause of sightedness	
Male	Female	20-29	30-39	60-69	B1	B2	B3	Born blind	Disease
5	6	6	3	2	7	3	1	8	3

4.4 Module Employment Analysis

4.4.1 Effectiveness: Module concept

Based on the module concept used in the programme, Figure 8 displays the percentage of responses from the participants. The questions in this section were summarized in Table 2, which focuses on comprehending and using the novel method for teaching braille through gamification to the visually impaired. The approach's ability to pique participants' interest in learning braille is also included in the data. Results for questions b, c, and f indicate that participants were able to comprehend the instructions with ease, were delighted by them, and found them to be a viable alternative. More than half of participants chose "strongly agree" to these questions, with percentages of 64%, 55%, and 55%, respectively. The participants might struggle to understand the module concept and apply it to the cassette braille for questions a and e. On the Likert scale, they frequently select "agree," which has the highest percentage (64% and 54%). This is because of their limitations when teachers use games to apply the module and explain it. In line with the results for questions a and e, the data also showed that 72% of respondents to question d selected "neutral." The employment of this module as gamification education, however, can generally encourage respondents' participation and involvement in growing their interest in learning Braille, which also promotes active learning experiences through gamification while having fun, correlating to the response in A(VII) as a positive way of learning (Manzano-León et al., 2021).

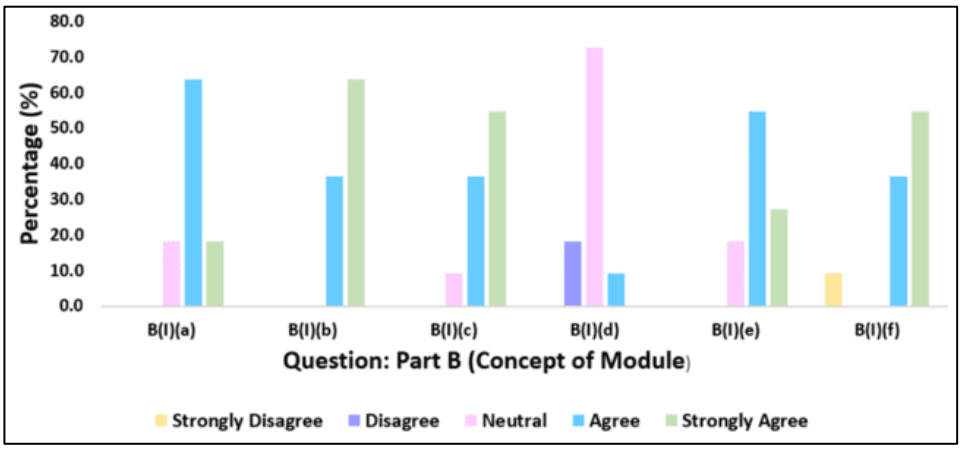


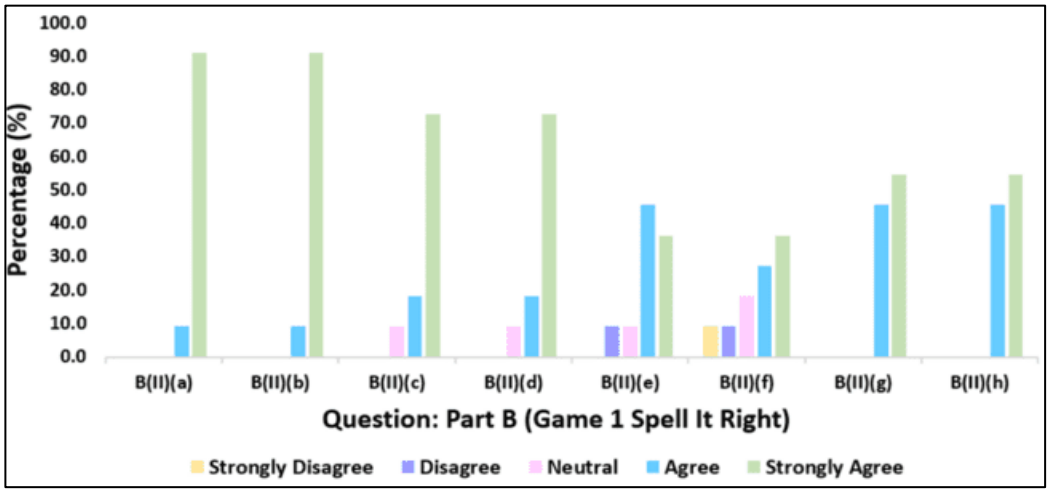
Figure 8: Percentage of Likert scale regarding module effectiveness (module concept)

Table 2: Questions on module concept

Question	Survey Question
B(I)(a)	I can understand the module concept based on Game 1 and Game 2.
B(I)(b)	I am able to follow the instructions arranged in the module.
B(I)(c)	I am happy to learn the module through a game approach.
B(I)(d)	The method and approach in this module make me learn how to use the braille cassette easily.
B(I)(e)	The method and approach in this module attract me to learning and using the braille cassette.
B(I)(f)	This module applies a new approach to learning braille for the visually impaired.

4.4.2 Effectiveness: Game 1 (Spell It Right)

The performance of Spell It Right in the module was also examined, and information was gathered to hasten the development of the game's enhancements. The game Spell It Right, which is used to determine the module's effectiveness, is depicted in Figure 9(a). The largest percentage of "strongly agree" responses was given to seven out of eight questions, indicating positive responses. The questions are designed to test your comprehension of the instructions and questions, as well as your ability to build a vocabulary and correctly spell and arrange letters and words. Participants in this activity were divided into groups, and each group received a set of Hijaiyyah braille tiles. Participants had to correctly spell and arrange the words in the order of increasing difficulty, as seen in Figure 9(b) (beginner, medium, and advanced). The findings indicate that players are able to relate to the game in an entertaining way with ease (Sikora et al. 2024). When participants were asked about learning a new language, just one question (question e) had the highest Likert scale "agree" score. It demonstrates how the game can facilitate the easy arrangement and spelling of Hijaiyyah braille characters using specially produced 3D-printed tiles. The MAB claims that its programme participants' staff members know the fundamentals of braille Hijaiyyah characters, but they are not game savvy. This allows students to study things in a new way, which is advantageous.



(a)

(b)

Figure 9: (a) Percentage of Likert scale and (b) images captured regarding module effectiveness) based on Game 1 (Spell It Right)

4.4.3 Effectiveness: Game 2 (Guess the Surah)

The module effectiveness based on Game 2 (Guess the Surah) was shown in Figure 10. As presented in the figure, the highest percentage of Likert scale for each question based on game 2 shows a moderate response whereby 5 of 7 questions selected "neutral" and "agree" as the highest percentage. These 4 questions were referred to the implementation of the game, including the ability to find Hijaiyyah braille words in the cassette roll, improvement of finger sensitivity, ability to guess the surah correctly, and efficiency in using the braille cassette. This game applied the 3D-printed reel-to-reel cassette in the game. The roll involved three short surahs (Al-Fil, Al-Ma'un, and Al-Masad) with 5, 7, and 5 verses, respectively. The participants were given 2 minutes to find the given verses. As a result, this represented that participant's ability to understand and apply the knowledge in Quran verse. Knowledge and experience gained through the module's examples and exercises expand and refine knowledge and the students' understanding of the material learned.

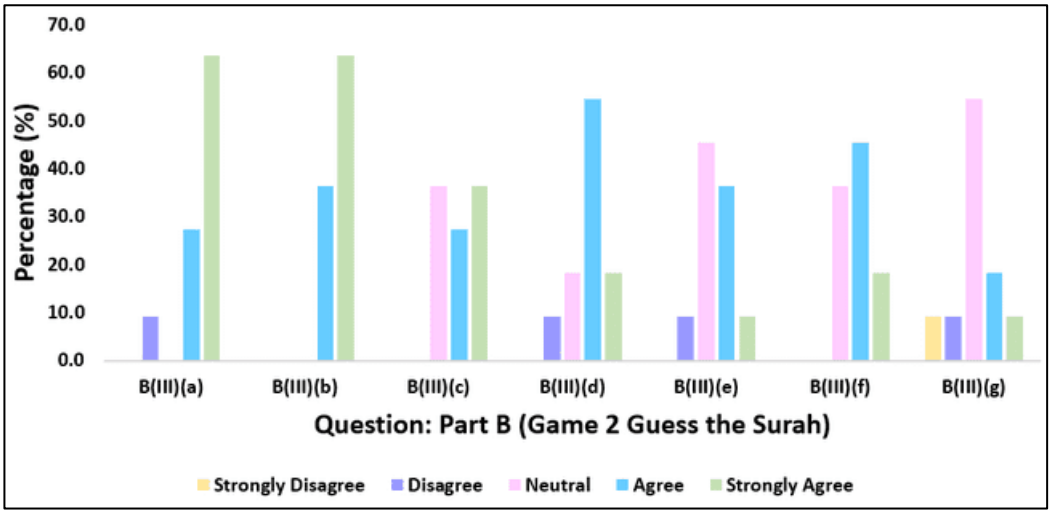


Figure 10: Percentage of Likert scale on module effectiveness based on Game 2 (Guess the Surah)

4.5 Analysis on Programme Implementation

4.5.1 Programme Effectiveness: Instructions, Questions, and Playing Method

An analysis of the effectiveness of instructions, questions, and playing methods is shown in Figure 11. Positive responses are shown as moderate responses whereby 6 of 6 questions have selected "agree" and "strongly agree" as the highest percentage. The questions were about how clear and understandable the instructions given throughout the module were; whether participants were free from spelling and grammar mistakes; whether the questions had an appropriate level of difficulty; and whether the marks for each game corresponded to the activities. The participants could understand easily because of the instructor, who paid attention to every participant and came well prepared, both in terms of the subject matter as well as the know-how to give effective instructions (El Kemma, 2019). Questions have an appropriate level of difficulty, allowing them to reach the solution with fewer questions. (Azzurra Ruggeri, 2021). Overall, all the instructions and questions for the module are easy to understand by the participants.

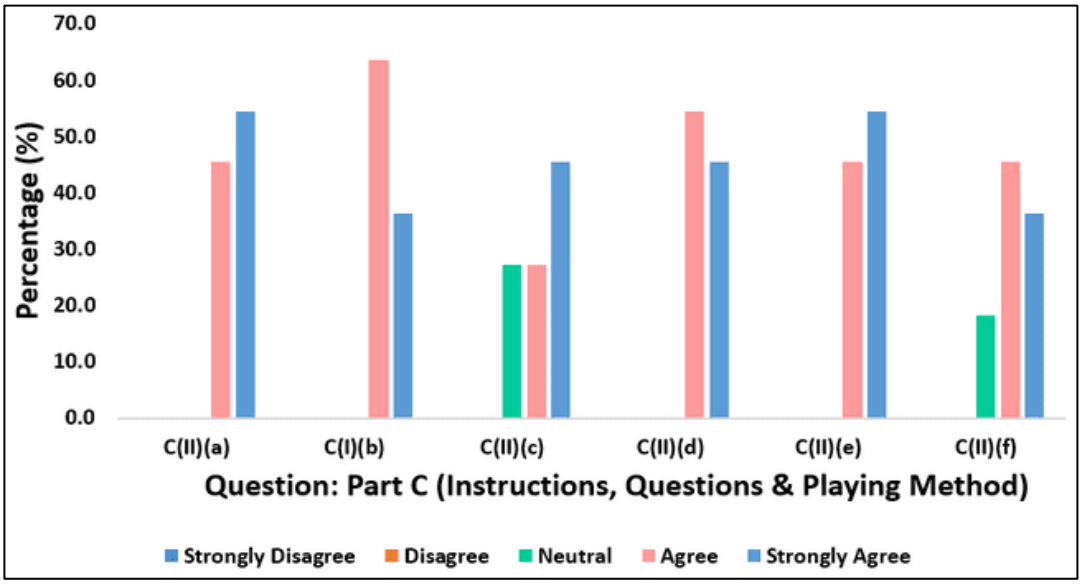


Figure 11: Percentage of Likert scale on programme effectiveness based on instructions, questions and playing method

4.5.2 Programme Effectiveness: Soft Skills

Figure 12 shows the percentage of the Likert scale on programme effectiveness based on soft skills developed. Positive responses were recorded as 5 of 5 questions were selected as "strongly agree" and "agree". The questions ask the participants whether they can solve each game with critical thinking; whether they can develop leadership skills and teamwork skills; whether they are active in solving the problem; and whether they are interested in participating in the game. Participants can solve each game using critical thinking because they can identify questions worth pursuing, pursue their questions through self-directed search and interrogation of knowledge, have a sense that knowledge is contestable, and present evidence to support their arguments (Sappa & Barabasch 2020; Sikora et al. 2024). The games help them develop leadership skills by motivating people to work towards achieving common goals and by making ordinary people display extraordinary performance (Maria, 2019; Sousa & Rocha, 2019). The participants can show their skills for working in a group by interacting with other members during group work, showing cooperation, positive behaviour, and

communication (Forsell, 2019). Therefore, this leads to energising a positive discussion between different viewpoints during a problem-solving game (Sappa & Barabasch 2020).

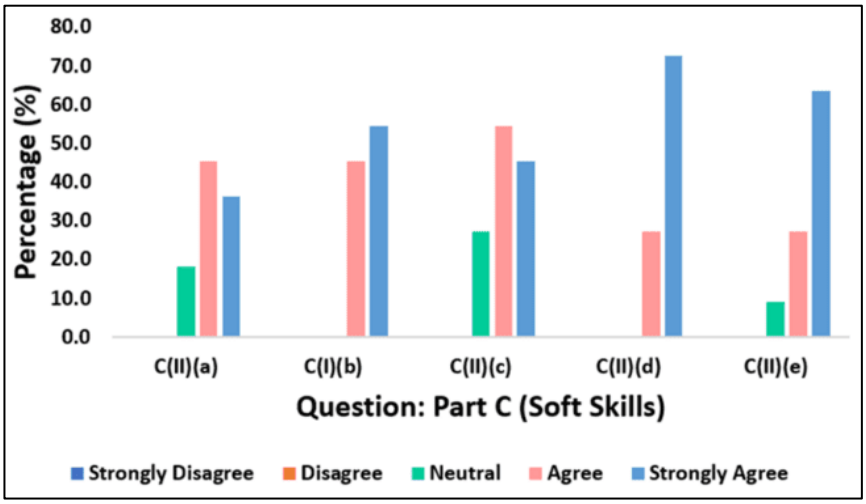


Figure 12: Percentage of Likert scale on programme effectiveness based on soft skills developed

4.5.3 Programme Effectiveness: Overall Programme

An analysis based on the overall programme effectiveness is summarised in Figure 13. All questions are based on satisfaction with activities; hoping for this programme to be held in the future; I learned something from this program; I'm interested in joining this program; I will recommend this programme as a teaching method to the visually impaired; this programme assists the visually impaired in learning braille in depth; this programme raises community awareness of the visually impaired; and this programme is appropriate to be used as an alternative, respectively (Gao & Shen, 2024). The percentage on the Likert scale showed that the overall programme was successful, as participants strongly agreed with the questions given. Eventually, this programme helps the visually impaired to gain an interest in learning braille with the addition of 3D printing kits as alternative teaching aids.

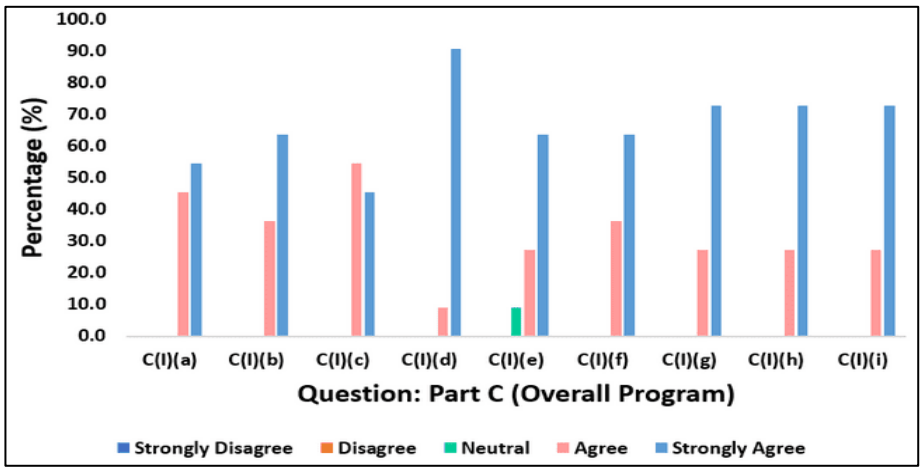


Figure 13: Percentage of the Likert scale on programme effectiveness based on overall programme implementation

4.6 Analysis of Educators' Assessment

An analysis based on educators' assessment has also been performed to obtain different perspectives with respect to this programme. Table 3 and Table 4 present the components of the evaluation criteria and responses based on Games 1 and 2, respectively. As for peer assessment, educators observed that 100% of participants had excellent teamwork during both games. This correlates with Figure 14, where participants positively developed their soft skills through teamwork (Medina-Merodio et al., 2024). Meanwhile, educators observed that the participants' behaviour performance also achieved a 100% ability to understand the activity in both games. This correlates with Figure 13, where all participants were able to understand the activity based on their own perspectives. However, several participants required assistance during Game 1 (44%), and others (66%) required assistance in Game 3. This was due to the participants' being beginners in learning braille. Therefore, the educators' assistance was required for them to complete each activity. For Game 2, since 3D-printed cassettes are a new tool, assistance was needed to further understand the 3D-printed cassette features. Generally, 100% of the participants were satisfied with the activities conducted during the programme.

Table 3: Evaluation criteria based on educators' observation during Game 1 (Spell It Right)

Evaluation Criteria	Components	Response
Peer Assessment	Teamwork Communication	100% of participants showed excellent teamwork and communication.
Behaviour Performance	Ability to understand the activity	66.67% of the participants showed a moderate level of understanding of the activity.
	Repetition of Activity	100% of participants were able to complete the given task without repetition.
	Acceptance of instruction	100% of participants were able to accept the given instructions.
	Requiring assistance	44% of the participants required assistance during the game.
Generic Component	Time taken to complete task	66.67% of the participants showed a moderate level of competency in completing the given task within the specified period.
Overall	Ability to recognise Hijaiyyah	77% of the participants believed that this activity helped them to recognise Hijaiyyah letters fluently.
	Satisfaction	100% of participants were satisfied with the activity

Table 4: Evaluation criteria based on educators' observation during Game 2 (Guess the Surah)

Evaluation Criteria	Components	Response
Peer Assessment	Teamwork Communication	100% of participants showed excellent teamwork and communication.
Behaviour Performance	Ability to understand the activity	44% of the participants showed a moderate level of understanding of the activity.
	Repetition of Activity	100% of participants were able to complete the given task without repetition.
	Acceptance of instruction	100% of participants were able to accept the given instructions.
	Requiring assistance	66% of the participants required assistance during the game.
Generic Component	Time taken to complete task	44% of the participants showed a moderate level of competency in completing the given task within the specified period.
Overall	Ability to recognise Hijaiyyah	77% of the participants believed that this activity helped them to recognise Hijaiyyah letters fluently.
	Satisfaction	66% of the participants were satisfied with the activity

5. CONCLUSION

The advancement in technology has increased researchers' interest in many fields of study in interacting with disabled people to support their lives as normal people with the addition of a teaching tool or device. In particular, visually impaired people have also faced the same circumstances, resulting in the development of many devices for them to read the Braille code in various techniques. In this study, a teaching module with the incorporation of 3D printing technology has developed a teaching module via a gamification approach. The utilisation of this module was carried out for beginners in order to portray the visually impaired Muslims learning Braille code in the Hijaiyyah characters. This access through gamification helps to establish players' skills in vocabulary and spelling among blind and sighted people, and particularly helps them to recite Braille Quran. Finally, the game designed for the module will use 3D-printed tape cassettes as a viable yet affordable production method to enthral beginners in learning Arabic letters of the Quran.

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