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Development of Interactive Multimedia Learning Software (i-Tutor Bahasa Melayu) for Rural Secondary Schools in Malaysia: A Needs Analysis

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ABSTRACT

The Malay language is crucial in Malaysia as the national language, language of knowledge, and language of unity. This study investigates the need for developing interactive multimedia learning software for teaching Malay grammar in rural secondary schools. The objective is to address the challenges faced in learning Malay grammar, the use of technology in education, and the existing digitalization gaps in rural areas. Methodology involved surveys and interviews with Malay language teachers to assess students' interest, teaching methods, challenges, software availability, and essential components for multimedia software development. Findings reveal moderate student interest, a blend of traditional and emerging teaching methods, significant challenges in mastering grammar, limited learning software, and consensus on necessary multimedia components. Conclusions highlight the potential for innovative teaching methods, the importance of overcoming learning challenges, and the need for better technology integration in rural education. This study emphasizes the digital divide between urban and rural schools and proposes tailored technology solutions to enhance Malay grammar education in rural areas.

1. Introduction

In Malaysia, the Malay language plays a vital role as the national language, the language of knowledge, the official language and the primary medium of instruction [1]. This importance is reflected in Article 152 (1) of the Federal Constitution, supported by the National Language Act 1963/67 (Act 32) and the Education Act 1996 (Act 550). These laws mandate Malay as the primary language used in public schools. As a result, students are required to study Malay, and their proficiency in the language is essential for passing key national exams like the Sijil Pelajaran Malaysia (SPM). From as early as Form 1, students are guided to develop core language skills—listening, speaking, reading, and writing—under the guidelines of the Secondary School Standard Curriculum

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(KSSM) [2]. A key element in strengthening these skills is a solid grasp of grammar, which plays a major role in shaping overall language competence [3-5].

Despite this, many studies highlight ongoing challenges in students' ability to master Malay grammar, particularly among those in rural areas. Mamat *et al.,* [6] found that the use of digital technology in classrooms can significantly improve students' engagement and learning outcomes in Malay language lessons. According to Abdul Latef *et al.,* [7], interactive multimedia tools are especially effective, as they incorporate elements like video, audio and animation that encourage active learning. Similarly, Ryn *et al.,* [8] observed that technology can enhance teaching quality, provided that the tools are easy to use and accessible to both students and teachers.

Recent research also highlights the value of gamification in teaching and learning (T&L). Many teachers see gamification as an effective way to boost students' interest and improve their language skills. It has been particularly useful in helping students expand their vocabulary and providing an engaging approach to grammar lessons, encouraging participation and better retention [9]. This supports earlier findings on the benefits of digital tools in creating dynamic and interactive learning environments.

Additionally, the adoption of blended learning methods, especially through platforms like Learning Management Systems (LMS), has shown positive results in grammar and vocabulary learning [10]. Students reported good experiences with LMS platforms, suggesting that combining traditional classroom instruction with digital resources can enhance their overall learning journey. This blended approach allows for flexible, self-paced learning and provides access to multimedia materials that help break down complex grammar concepts.

However, rural schools face considerable challenges in implementing these approaches due to limited technological infrastructure, poor internet access, and a lack of adequate teacher training [11]. These obstacles widen the digital divide, making it harder for rural students to keep up with their peers in urban areas. The COVID-19 pandemic further exposed this gap, highlighting the urgent need for recovery plans that prioritize digital learning [12]. In Malaysia, approximately 42.3% of schools are located in rural areas [13], and many still lack the resources required for effective digital education [7,14,15].

This research aims to address these issues by exploring the development of interactive multimedia learning software specifically designed to support the teaching and learning of Malay grammar in rural secondary schools. By incorporating elements of gamification and blended learning, the proposed software is expected to create a more engaging and effective educational environment. Research has consistently shown that interactive multimedia can boost student engagement, enhance academic performance, and equip students with crucial 21st-century skills [16,17]. For example, multimedia projects such as digital storytelling have been shown to significantly improve students' language and speaking skills, illustrating the potential for such tools to enhance grammar learning [18]. Nevertheless, there is still limited research on the development of interactive multimedia software aimed at addressing the specific needs of rural schools in Malaysia [9].

The purpose of this study is to assess the need for developing interactive multimedia learning software that can enhance the teaching and learning of Malay grammar in rural secondary schools. The study aims to answer the following questions:

i. Are students interested in learning Malay grammar?
ii. What teaching methods are currently used by Malay language teachers to teach grammar?
iii. Do students experience difficulties in learning Malay grammar?
iv. Is there existing software available to assist with teaching Malay grammar in rural schools?

v. What key components should be included in the development of interactive multimedia learning software to support students' learning?

By addressing these questions, this study seeks to contribute to the digitalization of education in rural Malaysia, promoting greater equity in educational opportunities and improving learning outcomes. The findings will help shape policies and drive the development of targeted learning tools, ensuring that students in rural areas have equal access to quality educational resources. This initiative will not only enhance academic success but also play a role in bridging the digital divide that continues to affect Malaysia's education system.

2. Methodology

This study aims to conduct a needs analysis to determine the need for developing interactive multimedia educational software for teaching and learning Malay grammar in rural secondary schools. In this needs analysis study, a survey research design was used, and the data obtained from this study were analysed using quantitative methods. Needs analysis is defined as assessing the value of a specific group that has a problem to be solved [18]. A series of questionnaires were distributed to 33 Malay language teachers. All these teachers are selected using purposive sampling technique and have experience in teaching Malay for lower secondary schools in rural schools. The purpose of purposive sampling for this needs analysis study is to ensure that the research sample has sufficient experience and expertise in the field of study being studied and can give a clear picture as well as clear conclusions about the scope of the study. This questionnaire was taken and modified from the study of Ching *et al.,* [19] who conducted a similar study. All these 40 questions are rated using the seven Likert scales. This questionnaire was validated and tested before the actual study was conducted with a Cronbach Alpha value of 0.92.

This research methodology also incorporates a qualitative component to offer a more thorough knowledge of instructors' experiences and perceptions. This will entail interviewing a representative sample of group members in semi-structured interviews. The purpose of the interview questions was to delve into their viewpoints, obstacles, and understandings surrounding the subject matter. We will be able to contextualise and enhance the quantitative findings with the addition of qualitative data, giving us a more comprehensive understanding of the research problem. Thematic analysis approaches were employed to examine the interview transcripts in order to detect recurrent themes and patterns [20]. To provide a deeper and more complex analysis of the data, the qualitative and quantitative conclusions will be combined.

In summary, this needs analysis study was conducted to determine the need to develop interactive multimedia learning software in rural areas as well as in selecting and determining appropriate content to be included in the software developed as training material to support learning of Malay grammar.

3. Results

3.1 Survey Method

In this study, data were collected from questionnaires to analyse information related to the need to develop interactive multimedia learning software for teaching and learning of Malay grammar in rural areas. The description of the data is done at a descriptive quantitative level by considering only the total frequency and percentage as this is enough to show the results and ultimately achieve the goal. The results of this study are divided into six sections including demographic information of

respondents, students' interest in learning Malay grammar in rural areas, and language teaching and learning methods for Malay grammar in rural areas, problems that are encountered when teaching and learning Malay grammar in rural areas, surveying existing Malay grammar learning software, and suitable components in developing multimedia interactive learning software as learning support materials for students.

3.1.1 Respondent demographics

Table 1 presents a summary of the profile information of respondents participating in the needs analysis. The analysis of respondents' profile information was analysed descriptively using frequencies and percentages based on items 1 to 4 of the questionnaire including gender, teaching experience, level of education and type of school.

Table 1
Profile information of respondents participating in the needs analysis

Background		Frequency	Percentage
Gender	Male	10	30.3%
	Female	23	69.7%
Teaching Experience	6-10 years	18	54.5%
	11-15 years	5	15.2%
	16-20 years	3	9.1%
	More than 21 years	7	21.2%
Level of Education	Master's degree	4	12.1%
	Bachelor's degree	29	87.9%
Type of School	Rural	33	100%

Table 1 reveals a gender distribution where females make up 69.7% of the sample, outnumbering males at 30.3%. In terms of teaching experience, there is a range of diversity, with many educators having significant tenure. Over half of the respondents (54.5%) have taught for 6 to 10 years, while a substantial portion (21.2%) have over 21 years of experience. The presence of experienced educators is crucial for further research. Educational attainment varies, with 87.9% of bachelor's degree holders while 12.1% holds master's degree, primarily at the university level. The respondents (100%) are from rural areas, emphasizing on understanding and addressing the specific needs and challenges of rural educational settings. This demographic analysis is vital for tailoring interventions and strategies to suit the characteristics and educational context of rural secondary schools effectively.

3.1.2 Students' interest in learning Malay grammar in rural areas

Table 2 shows the level of students' interest in Malay grammar in rural areas through the frequency and percentage scale for each item as well as the average level value. The results showed that students' overall interest level was moderate, with items 2, 3 and 4 standing out as the items with the highest average values. Although students showed interest, enthusiasm and focus in teaching and learning Malay, there was a scope for increased interest in some aspects. Indeed, a score of 1 show that students who enjoy learning grammar have the lowest average score. Therefore, this analysis provides useful information for researchers to plan more effective learning strategies and stimulate students' interest in learning Malay grammar in rural areas.

Table 2
Students' interest in learning Malay grammar in rural areas

No.	Item	Scale (Frequency and Percentage (%))							Mean	Level
		1	2	3	4	5	6	7		
1	Students enjoy learning Malay grammar	-	-	2 (6.1)	15 (45.5)	16 (48.5)	-	-	4.42	Moderate
2	Students show interest during Malay grammar learning sessions	-	-	-	17 (51.5)	16 (48.5)	-	-	4.48	Moderate
3	Students are enthusiastic when learning Malay grammar	-	-	-	17 (51.5)	16 (48.5)	-	-	4.48	Moderate
4	Students focus on teaching and learning Malay grammar	-	-	-	17 (51.5)	16 (48.5)	-	-	4.48	Moderate
5	Students appear cheerful when learning Malay grammar	-	-	-	8 (24.2)	25 (78.5)	-	-	4.76	Moderate

3.1.3 Methods of teaching and learning Malay grammar in rural areas

Table 3 highlights the varied use of Malay grammar teaching methods in rural areas, with traditional methods like "chalk and talk" being the most popular (5.36). However, other methods such as grammar books (5.55) and asking students questions (5.67), also received significant attention. This suggests a trend towards diversifying teaching methods, possibly due to the recognition of the importance of interaction and deep understanding in learning grammar. The use of ICT in teaching Malay grammar in rural areas received average ratings (4.30), indicating potential for increased technology integration. ICT can enhance students' engagement and deliver learning materials more dynamically.

Table 3
Methods of teaching and learning Malay grammar in rural areas

No.	Item	Scale (Frequency and Percentage (%))							Mean	Level
		1	2	3	4	5	6	7		
6	I use the chalk and talk method when teaching Malay grammar	-	-	1 (3.0)	5 (15.2)	12 (36.4)	11 (33.3)	4 (12.1)	5.36	High
7	I use a Malay grammar book when teaching Malay grammar	-	-	-	5 (15.2)	10 (30.3)	13 (39.4)	5 (15.2)	5.55	High
8	I use magazines or newspapers when teaching Malay grammar	-	3 (9.1)	7 (21.2)	11 (33.3)	5 (15.2)	4 (12.1)	3 (9.1)	4.27	Moderate
9	I like to ask students questions when teaching grammar	-	-	3 (9.1)	3 (9.1)	8 (24.2)	7 (21.2)	12 (36.4)	5.67	High
10	I use ICT when teaching Malay grammar	-	1 (3.0)	2 (6.1)	16 (48.5)	14 (42.4)	-	-	4.30	Moderate

However, lack of infrastructure support and the digital divide in rural areas may hinder ICT adoption. These results offer a comprehensive view of Malay grammar teaching in rural areas, with traditional methods still widely supported. In conclusion, there is potential for innovation and improvement in teaching methods, which could lead to a more effective and efficient teaching strategy to enhance students' Malay Language understanding and speaking skills specifically those coming from the rural areas.

3.1.4 Problems faced by students in teaching and learning Malay grammar in rural areas

Table 4 indicates significant challenges in learning Malay grammar in rural areas. Students struggle with mastering Malay grammatical concepts, as evidenced by the high percentage of respondents noting difficulties in understanding and remembering these concepts. This is supported by high average scores for items like "*Students have difficulty mastering Malay grammar*" and "*Students do not understand Malay grammar concepts*."

Table 4
Problems faced by students in teaching and learning Malay grammar in rural areas

No.	Item	Scale (Frequency and Percentage (%))							Mean	Level
		1	2	3	4	5	6	7		
11	Students have difficulty mastering Malay grammar	-	-	3 (9.1)	8 (24.2)	11 (33.3)	6 (18.2)	5 (15.2)	5.06	High
12	Students find it difficult to remember the correct use of Malay grammar	-	-	3 (9.1)	8 (24.2)	8 (24.2)	10 (30.3)	4 (12.1)	5.12	High
13	Students do not understand the concept of Malay grammar	-	-	2 (6.1)	9 (27.3)	10 (30.3)	8 (24.2)	4 (12.1)	5.09	High
14	Students will repeat the same grammar mistakes	-	-	3 (9.1)	7 (21.2)	12 (36.6)	8 (24.2)	3 (9.1)	5.03	High
15	Weak students face problems in learning grammar	-	-	1 (3.0)	3 (9.1)	11 (33.3)	7 (21.2)	11 (33.3)	5.73	High
16	Students with poor grammar will affect the quality of the Malay language from the aspect of sentence structure and writing	-	-	-	2 (6.1)	12 (36.4)	5 (15.2)	14 (42.4)	5.94	Very High
17	Students have enough time to finish the topic of Malay grammar	-	4 (12.1)	4 (12.1)	11 (33.3)	14 (42.4)	-	-	4.06	Moderate

Moreover, time constraints hinder students' comprehension and proficiency in Malay grammar. Respondents expressed a need for more time to grasp the subject, suggesting that the current allocation may be insufficient for full comprehension. Additionally, students tend to repeat the same mistakes, emphasizing the importance of an approach that emphasizes conceptual understanding and correct application. In short, the analysis highlights key issues in learning Malay grammar in rural areas, emphasizing the importance of focusing on concept comprehension, skill mastery, and adequate time allocation for Malay grammar topics. Implementing remedial measures and enrichment can enhance the effectiveness and quality of learning in this area.

3.1.5 A survey of existing software for learning Malay grammar

Table 5 is the results of a survey of existing Malay grammar teaching and learning software in rural areas. Based on this table, it can be concluded that the learning software available for teaching and learning Malay grammar in rural areas is still limited. Item 18 shows that many respondents (63.6%) do not agree that there is many learning software for teaching and learning grammar in schools.

Table 5
A survey of existing software for learning Malay grammar

No.	Item	Scale (Frequency and Percentage (%))							Mean	Level
		1	2	3	4	5	6	7		
18	There is many learning software available for teaching and learning grammar in schools.	3 (9.1)	4 (12.1)	4 (12.1)	21 (63.6)	1 (3.0)	-	-	3.40	Low
19	KPM provides Malay language learning software for use in schools.	2 (6.1)	3 (9.1)	9 (27.3)	18 (54.5)	1 (3.0)	-	-	3.40	Low
20	Existing software is suitable for teaching and learning grammar in rural schools	7 (21.2)	7 (21.2)	10 (30.3)	4 (12.1)	2 (6.1)	3 (9.1)	-	3.88	Moderate
21	Existing software uses the internet entirely.	-	-	-	-	25 (75.8)	4 (12.1)	4 (12.1)	5.36	High
22	Existing software is easy to use.	1 (3.0)	8 (24.2)	4 (12.1)	8 (24.2)	10 (30.3)	2 (6.1)	-	3.73	Moderate
23	I always use the software in my teaching.	2 (6.1)	8 (24.2)	7 (21.2)	7 (21.2)	9 (27.3)	-	-	3.39	Low
24	Existing software is suitable for teaching and learning in rural areas	2 (6.1)	9 (27.3)	6 (18.2)	16 (48.5)	-	-	-	3.09	Low

Furthermore, item 19 also shows that most respondents (54.5%) do not agree that the Ministry of Education Malaysia (KPM) provides Malay language learning software for use in schools. Although item 20 showed slightly better results, many respondents (30.3%) agreed that existing software is suitable for teaching and learning grammar in schools, but the suitability of it in a rural setting is still considered moderate. Indeed, a score of 21 shows that many respondents (75.8%) strongly agree that existing software uses the Internet exclusively for its intended purposes. This factor becomes the main limitation and affects the acceptance and suitability of using technology in learning in rural areas (points 22, 23 and 24).

In sum, this evidence suggests that there is a gap in the development and research of the Malay language learning software, especially in the context of rural schools. This indicates a further expansion in the provision and understanding of the Malay language learning software in rural areas to increase the interest and effectiveness of learning.

3.1.6 Appropriate components in the development of interactive multimedia learning software as student learning support materials

Table 6 is the result of the findings on the appropriate components in the development of interactive multimedia learning software for teaching and learning Malay grammar. From the data provided, it can be concluded that most of the respondents strongly agree, as almost all components evaluated during the development of interactive multimedia learning software were met.

Table 6
Appropriate components in the development of interactive multimedia learning software as student learning support materials

No.	Item	Scale (Frequency and Percentage (%))							Mean	Level
		1	2	3	4	5	6	7		
25	Grammar software should contain complete notes.	-	-	-	-	8 (24.2)	6 (18.2)	19 (57.6)	6.33	Very High
26	Grammar software should have pictures to explain the usage of a grammar.	-	-	-	-	8 (24.2)	6 (18.2)	19 (57.6)	6.33	Very High
27	Grammar software should have quiz questions to test student understanding.	-	-	-	-	6 (18.2)	6 (18.2)	21 (63.6)	6.46	Very High
28	Grammar software should have reinforcement exercises for all levels of students.	-	-	-	-	7 (21.2)	5 (15.2)	21 (63.6)	6.42	Very High
29	Grammar software should have grammar teaching videos/animations to attract students' attention.	-	-	-	-	6 (18.2)	9 (27.3)	18 (54.5)	6.36	Very High
30	Grammar software should have game elements to attract students' interest.	-	-	-	-	6 (18.2)	6 (18.2)	21 (63.6)	6.46	Very High
31	The games in the grammar software connect the elements of grammar learning.	-	-	-	-	6 (18.2)	7 (21.2)	20 (60.6)	6.42	Very High
32	The content of grammar software should contain a variety of colours to attract students' attention.	-	-	-	-	6 (18.2)	8 (24.2)	19 (57.6)	6.39	Very High
33	Grammar software that is multimedia can attract students' attention.	-	-	-	-	5 (15.2)	9 (27.3)	19 (57.6)	6.42	Very High
34	Grammar software must contain edutainment elements.	-	-	-	-	6 (18.2)	10 (30.3)	17 (51.2)	6.33	Very High
35	Grammar software should contain sounds to attract students' attention.	-	-	-	-	6 (18.2)	8 (24.2)	19 (57.6)	6.39	Very High
36	Grammar software is interactive so that it can attract students' attention.	-	-	-	-	6 (18.2)	6 (18.2)	21 (63.6)	6.46	Very High
37	Grammar software can stimulate students' interest in learning.	-	-	-	-	6 (18.2)	8 (24.2)	19 (57.6)	6.39	Very High
38	Grammar software contains clear buttons.	-	-	-	-	7 (21.2)	10 (30.3)	16 (48.5)	6.27	Very High
39	The menu display should be clear to make it easier for students to explore the software.	-	-	-	-	5 (15.2)	11 (33.3)	17 (51.5)	6.36	Very High
40	Grammar software should have simulations and work steps that can help students' understanding.	-	-	-	-	5 (15.2)	8 (24.2)	20 (60.6)	6.46	Very High

However, items 25 to 40 all scored an average of over 6, showing a high level of agreement among respondents regarding the need for these components to be included in multimedia learning software. Most respondents strongly agreed that grammar software should have elements such as complete notes, pictures to explain grammar usage, quizzes, reinforcement exercises, instructional videos/animations, game elements, grammar learning relationships, colour diversity, multimedia effects, edutainment, sounds, interactivity, student interest stimulation, clear buttons and a clear menu display.

Although the mean scores for all items were high, it should be noted that there were some differences in the frequency of agreement. For example, item 38 on button clarity had a lower mean score than most other items, suggesting that respondents may have specific needs in this regard. Overall, this table provides a comprehensive view of respondents' perceptions of the components required in the development of interactive multimedia learning software, with most respondents fully agreeing with the requirements.

3.2 Interview Method

This interview was conducted using a structured interview method. The respondents were asked about 10 interview questions to gain their views on this software development. The results of the interviews were transcribed and analysed using thematic analysis methods. The interview findings were categorized into eight themes, namely:

i. Teaching methods
ii. Students' interest in learning Malay grammar
iii. Existing software for teaching and learning Malay language
iv. Students' problem in learning Malay grammar
v. The importance of grammar in Malay language
vi. Suggested topic of software
vii. Suggested approach and strategy
viii. Perception towards software development.

3.2.1 Respondent demographic

A total of 5 Malay language teachers were selected using the purpose sampling method for this study. The demographics of the respondents, as shown in Table 7, shed important light on the traits of the teachers who participated in the research. Three female teachers and two male teachers make up the sample, suggesting a gender distribution that favours more female representation. The fact that every respondent has a Bachelor's or Master's degree in Malay language or education attests to their excellent academic credentials in the subject area. Eight to twenty years is the range of teaching experience, with Teacher C having the highest experience at twenty years, closely followed by Teachers A and D with nineteen years apiece. At eight years old, Teacher E has the least amount of teaching experience. In the language department, the responders also hold various portfolios: Teacher A is the Head of the Language Department, Teacher B is the Head of the Malay Language Panel, and Teachers C, D and E are Malay Language Teachers. The variety of roles and duties offers a comprehensive viewpoint on the language training methods and difficulties encountered by the participants. In general, the demographics of the respondents underscore the credentials, expertise, and leadership positions of the educators engaged in the investigation, thereby fostering a more profound comprehension of the research subject and its consequences for language learning.

Table 7
Respondent demographics

No.	Respondent	Gender	Academic Qualification	Experience	Portfolio
1	Teacher A (R1)	Female	Bachelor Degree in Malay Language	19 years	Head of Language Department
2	Teacher B (R2)	Female	Bachelor Degree in Malay Language	13 years	Head of Malay Language Panel
3	Teacher C (R3)	Male	Bachelor Degree in Malay Language	20 years	Malay Language Teacher
4	Teacher D (R4)	Male	Bachelor Degree in Malay Language	19 years	Malay Language Teacher
5	Teacher E (R5)	Female	Master Degree in Malay Language	8 years	Malay Language Teacher

3.2.2 Thematic analysis

The study determined various important themes about the development of interactive multimedia learning software for teaching Malay language grammar, based on the results of the structured interviews conducted with five Malay language instructors in Malaysian rural secondary

schools. Table 8 shows the results based on the themes mentioned in the document are summarised as follows:

i. Teaching Methods: The predominant teaching methods used by the teachers included chalk and talk, modules, worksheets, and 21st-century learning approaches. These methods were commonly employed to teach Malay grammar.
ii. Students' Interest in Learning Malay Grammar: Teachers expressed varying views on student interest in learning Malay grammar, with responses ranging from moderate to less interest, depending on the topic taught and students' understanding.
iii. Existing Software for Teaching and Learning Malay Language: Most teachers reported a lack of existing software for teaching and learning Malay language, with some mentioning rare initiatives by educational bodies.
iv. Students' Problems in Learning Malay Language Grammar: Teachers highlighted common challenges faced by students, including difficulties in mastering grammar, influence by native languages, confusion in sentence structure, and struggles with distinguishing between passive and active sentences.
v. The Importance of Grammar in Malay Language: Teachers emphasized the significance of grammar in sentence structure, writing, communication, and examination performance, underscoring its crucial role in mastering the Malay language.
vi. Suggested Topics of Software: Teachers recommended topics such as *Kata Ganti Nama, Imbuhan meN-, Ayat Aktif, Ayat Pasif, Menukarkan ayat aktif kepada ayat pasif,* and *Menukarkan ayat pasif kepada ayat aktif* for inclusion in interactive multimedia learning software.
vii. Suggested Approach and Strategy: Teachers proposed the use of quizzes, interactive multimedia elements, multimedia elements, simulations, notes, and tutorials to enhance student learning and understanding of Malay grammar.
viii. Perception Toward Software Development: Teachers expressed a strong need for interactive multimedia learning software, highlighting its importance in enhancing teaching and learning processes, improving student engagement, and facilitating understanding of grammar concepts.

Table 8
Thematic analysis

Themes		Examples from teacher's comments and suggestions	No. of teachers
Theme 1: Teaching Methods			5
1	Chalk and talk	*" I normally use explanation techniques first, … then question and answer" – R1* *"The old chalk and talk method" – R3* *"… use talk n chalk method only, no special software is used … " – R4* *" … also the method of giving instructions during grammar teaching and learning (T&L)." – R5*	4 (80.0%)
2	Modules	*"the grammar T&L method I normally use is the use of modules …" – R2*	1 (20.0%)
3	Worksheet	*"I normally use the grammar T&L method I …. and also worksheets" – R2* *"I normally use the drill method … during grammar T&L." – R5*	2 (40.0%)
4	21st Century Learning	*" I normally use ….., discussion…." – R1* *"…. Sometimes I do group activities to make it easier for them to work together, especially in doing exercises." – R2* *"….. and we also use 21st Century Learning." – R4*	3 (60.0%)

Theme 2: Student Interest in Learning Malay Grammar			5
1	Moderate	*" … It's moderate" – R2* *"… It's moderate for sure" – R4*	2 (40.0%)
2	Less	*"It's less. … "– R3*	1 (20.0%)
3	Uncertain	*"It's normal. Depending on the topic. Because grammar has many topics. If it's difficult for them, it seems that some people are not interested. …" – R2* *"… Depends on the topic taught. If it's easy and easy for them to understand, they're more interested" – R3* *"I want to say that they are not fully interested nor they are not interested at all…" – R4* *"Uncertain. Depends on the topic. If the topic is okay, they are interested." – R5*	4 (80.0%)
Theme 3: Existing Software for Teaching and Learning Malay Language			5
1	Less	*"There is but very rarely (JPN Initiative, Individual Initiative)" – R1*	1 (20.0%)
2	None	*"So far there is none. There is nothing provided" – R2* *"So far there is no software at all" – R3* *"Hmmmmm... KPM so far has not provided a special software for us to teach related to the Malay language" – R4* *"Aaa I have also never used any hmm interactive learning software for grammar learning at the same time as far as I know mmm there is no interactive multimedia learning software provided by any party for the use of TnL Malay Language." – R5*	4 (80.0%)
Theme 4: Students Problem in Learning Malay Language Grammar			5
1	Mastering Grammar	*"They are often confused …" – R1* *"So far, there are only a few students who can master it in the class I teach. The rest are more confused…" – R2* *""Aaa. What we often experience is that students often get confused … Very weak so far. …" – (R3)* *"…. so some of them are confused and wrong in terms of sentence structure." – R4* *"Ok for the student's performance… still at a less than satisfactory level … being confused…" – R5*	5 (100.0%)
2	Influence by native language	*" … Maybe also influenced by their mother tongue" – R1* *" … At the rural schools here, most of the students are non-Malays and are not native speakers of Malay. So these people may be confused or influenced by their mother tongue like the Iban language …" – R2* *" … They are also often confused by the conversion method or structure of their native language …" – R3* *"… Most of the students in rural areas are not native speakers of Malay, so some of them are confused and wrong in terms of sentence structure."- R4* *"Ok for the student's … is still at a less than satisfactory level because there are many influences … like being confused with the mother tongue, many students in rural areas are not native speakers of Malay language." – R5*	5 (100.0%)
3	Identify and break down the sentence structure	*"They are often confused because they have not been able to identify and break down the sentence structure. … The low performance students do not know the subject, predicate, verb. That's the problem." – R1*	1 (20.0%)

4	Passive sentences and active sentences	*" … The rest are more confused because they still cannot distinguish the use of passive sentences and active sentences…" – R2* *" …. they are also often confused by the conversion method or structure of their native language. Very weak so far. The reason they are confused is to change aaa.. in active sentences involving the subject KGND1 and KGND2. They often equate it with the subject KGND3. Aaa.. If active to passive is very weak. But if passive to active they can change it with minimal help from the teacher" – R3* *"… Usually, students can change active sentences to passive sentences if there is a subject that involves KGND3, while in KGND1, KGND2 students always use the wrong verb. Usually they will make a mistake, especially the verb me-kan with d-kan and with no suffixes… "- R4* *"… if you look at it from my student's point of view, they have a lot of problems to convert active sentences to passive sentences because students are quite confused to determine what type of affix is used or combined with the verb used, especially if it involves the KGND1 and KGND2" - R5*	4 (80.0%)
5	Normal order sentences to inverted sentences	"Aaa. What we often experience is that students often get confused by changing the normal order sentences to inverted sentences. So they also equate the formula to convert active sentences to passive sentences. …" – R3 "Students are often confused in changing active sentences to passive sentences, students will usually change normal order sentences to inverted sentences…." – R4	2 (40.0%)
Theme 5: The Importance of Grammar in Malay Language			5
1	Sentence's structure	*"If the grammar fails, the structure of the sentence is upside down…"– R1* *"Okey, if a student fails to master grammar, it means he can't create or he can't construct a correct sentence according to the correct sentence constituent sequence from the use of subject to the predicate and so on… " – R5*	2 (40.0%)
2	Writing	*"… especially in the production of writing and interferes with students' performance …" – R1* *"If they fail to master grammar they cannot … especially in writing. Because writing is also important" – R2* *"It is very important because it is the basic for mastering the field of writing later" – R3* *"… especially essay writing. Most students always make mistakes in writing…" – R4* *"… Okay, at the same time, student really can't master writing skills well" – R5*	5 (100.0%)
3	Communication	*"If they fail to master grammar they cannot communicate well …" – R2*	1 (20.0%)
4	Examination (SPM)	*"Grammar teaching is very important especially in all the Malay language exam where it is tested on, specifically essay writing. Most students always make mistakes in writing and grammar-based questions are also tested a lot in the test paper" – R4*	1 (20.0%)
Theme 6: Suggestion Topic of Software			5
1	*Kata Ganti Nama*	*"… they have not been able to identify and break down the sentence structure … do not know the subject, predicate, verb..." – R1* *"… involving the subject KGND1 and KGND2. They often equate it with the subject KGND3… " – R3* *"…subject that involves KGND3, while in KGND1, KGND2 students used the wrong verb always…"- R4* *"… they have a lot of problems to convert active sentences to passive sentences because students are quite confused to determine what type of affix is used or combined with the verb used, especially if it involves the KGND1 and KGND2" - R5*	4 (80.0%)

2	*Imbuhan meN-*	*They will normally make mistake, especially the verb me-kan with d-kan and no suffixes… "- R4* *"… they have a lot of problems to convert active sentences to passive sentences because students are quite confused to determine what type of affix is used or combined with the verb used…" - R5*	2 (40.0%)
3	*Ayat Aktif*	*"…The rest are more confused because they still cannot distinguish how to use passive sentences and active sentences…" – R2* *"… students often get confused by changing the normal order sentences to inverted sentences. So they also equate the formula to convert active sentences to passive sentences. …" – R3* *"Students are often confused to change active sentences to passive sentences, students will usually change normal order sentences to inverted sentences…." – R4*	3 (60.0%)
4	*Ayat Pasif*	*"…The rest are more confused because they still cannot distinguish how to use passive sentences and active sentences…" – R2* *"… students often get confused by changing the normal order sentences to inverted sentences. So they also equate the formula to convert active sentences to passive sentences. …" – R3* *"Students are often confused to change active sentences to passive sentences, students will usually change normal order sentences to inverted sentences…." – R4*	3 (60.0%)
5	*Menukarkan ayat aktif kepada ayat pasif*	*" … The rest are more confused because they still cannot distinguish how to use passive sentences and active sentences…" – R2* *"… students often get confused by changing the normal order sentences to inverted sentences. So they also equate the formula to convert active sentences to passive sentences. …" – R3* *"Students are often confused to change active sentences to passive sentences, students will usually change normal order sentences to inverted sentences…." – R4*	3 (60.0%)
6	*Menukarkan ayat pasif kepada ayat aktif*	*" … The rest are more confused because they still cannot distinguish how to use passive sentences and active sentences…" – R2* *"… students often get confused by changing the normal order sentences to inverted sentences. So they also equate the formula to convert active sentences to passive sentences. …" – R3* *"Students are often confused to change active sentences to passive sentences, students will usually change normal order sentences to inverted sentences…." – R4*	3 (60.0%)
Theme 7: Suggested Approach and Strategy			5
1	Quizzes	*"The use of various quizzes is very interesting for students to learn while playing and makes it easier for them to understand in T&L…" – R1* *"… Quizzes also help students to strengthen their understanding". –R2* *"… test their understanding through quizzes provided." – R3* *"… Quizzes can also engage students and reinforce their understanding… " – R4* *"… Quizzes can also engage students and reinforce their understanding…" – R5*	5 (100.0%)
2	Interactive Multimedia	*"… Coupled with interactive multimedia elements that can bring to life a constructive and interesting learning atmosphere." – R1* *"The use of interactive multimedia elements makes it easier for students to learn either independently or with their teacher. It can be repeated by students to facilitate their understanding ..." – R3*	2 (40.0%)

3	Multimedia Element	*"… multimedia elements that can bring to life a constructive and interesting learning atmosphere." – R1* *"The use of audio … is very helpful for students to understand learning…" –R2* *"… multimedia elements make it easier for students to learn either independently or with the teacher..." – R3* *"It can also help students to understand the learning process with … multimedia elements…" – R4* *"It can also help students to understand the learning process with … multimedia elements. …" – R5*	5 (100.0%)
4	Simulation	*"The use of … simulation is very helpful for students to understand learning…". – R2* *""It can also help students to understand the learning process with simulation ..." – R4* *"It can also help students to understand the learning process with simulations… The presence of … simulations make the learning environment easier for students" – R5*	3 (60.0%)
5	Notes	*"… Students should be equipped with easy-to-understand notes … to facilitate their understanding of the topics being taught" – R4* *"… The presence of notes … make the learning environment easier for students" – R5*	2 (40.0%)
6	Tutorial	*"… Students should be equipped with … tutorials to facilitate their understanding of the topics being taught" – R4* *"… The presence of … tutorials and simulations make the learning environment easier for students" – R5*	2 (40.0%)
Theme 8: Perception Toward Software Development			5
1	Needs	*"It is necessary because we need to be aware of IT things like this in the world today" – R1* *"Yes, it is very very necessary" – R2* *"Yes, it is very very necessary" – R3* *"Yes, it is very necessary in T&L in class to make it easier for students to understand formulas if there are formulas, especially active sentences, passive sentences" – R4* *"From the students' perspective, I really need the software" – R5*	5 (100.0%)
2	Attitude	*"If there is a device ready. This software is very useful for students, they can access it themselves if there is internet and there is no internet interruption" – R1* *"Yes, I am ready to use it. For that part, for me... if it is to teach weaker students it is very suitable because in that way, it can attract their interest to learn – R2* *"I am willing to use it with the condition that it must be offline. So far never used. Not yet automatically" – R3* *"Yaaa. Of course, using the software to mmmm.. students' skills, making them understand active sentences, passive sentences. In my opinion, it is appropriate to make it easier for students to remember the formula, if there is a formula they can easily memorize" – R4)* *"and if given the opportunity to use this software, I am very ready to use it when I am in the class. If you look at the multimedia software, it really helps students to understand how the process of changing active sentence goes to passive sentence, passive sentence to active sentence automatically and at the same time I have never used any software" – R5*	5 (100.0%)

3	Proposed Implementation Mode	*"If possible it should not use the internet so that usage can be maximized especially in city outskirts. Hmmmmm, the internet access in our place is sometimes good, sometimes not good, more to not good. Unstable" – R1* *"If you're in the city outskirts, it's better to go offline because the internet access here is unstable. Aa… the internet access in our place is sometimes okay and sometimes unstable" – R2* *"Offline. Very weak. And this affects the use of online software" – R3* *"If there is such software, I would suggest offline especially for rural students. So far the status of the internet is very weak and we are unable to fill in anything related to the internet" – R4* *"if one day/in the future there is an interactive multimedia learning software that is produced especially related to PDP grammar I would very much welcome or suggest that it can be used offline as it can facilitate students and also facilitate teachers. The status of internet access in my school is good and sometimes it's also unstable" – R5*	5 (100.0%)

The study's conclusion emphasises the necessity of development interactive multimedia instructional materials for Malay grammar instruction in rural locations. To make the software more useful and interesting for students, the concerns and recommendations of the teachers should be considered. To optimise utilisation, particularly in places with erratic internet access, the programme should concentrate on grammatical subjects, employ interactive multimedia components, and be accessible offline.

4. Discussions

The results show that there is a need for the development of interactive multimedia learning software for the teaching and learning of Malay grammar in rural secondary schools. In the context of the need to develop interactive multimedia learning software for the teaching and learning of Malay grammar in rural secondary schools, it is important to acknowledge that there is a gap that needs to be filled by digital learning aids.

The findings of the study show that students' interest in learning Malay grammar in rural areas does not reach the expected level, and there is a tendency to use more traditional teaching methods. This finding is also in line with previous studies which found that Malay teachers use more teacher-centred teaching methods that use teaching techniques based on the teacher's natural talent compared to the use of printed materials, audiovisual aids and multimedia software [21-24].

Problems in understanding grammar concepts and the lack of suitable learning software for rural contexts are also factors that need to be overcome. This finding provides additional evidence regarding several previous studies which found that Malay subjects still lack digital learning software [22,25]. The use of technology-based teaching methods is rare due to the lack of digital teaching aids, lack of skill in producing and handling digital teaching aids as well as weak and unstable internet connections. This finding also confirms the findings of a previous study which found that Malay language teachers still lack in technology skills and the skills and knowledge to manage technology-based teaching and learning [26-28].

It also explains the study of Harun *et al.,* [5] and Aziz *et al.,* [22] who stated that the use of computers in teaching and learning is still not widespread due to the lack of computer-aided learning software. This is because most of the existing software is found to be less suitable to be used outside of the city because it operates entirely using the internet also known as online [29]. In moving forward, the development of interactive multimedia learning software can provide an important alternative in improving this situation.

Several studies have been conducted on the development of learning software for Malay language learning. The advantages of game-based learning and multimedia technology in language instruction are demonstrated by the research conducted on the "*Kuasa Kosa Kata*" (3K) mobile learning application for Malay vocabulary [30,31]. The results of the study demonstrate how well-engaged students may be with interactive and game-based methods, which also enhance their acquisition of Malay language. Research has also looked into how well mobile applications work for teaching Malay to students studying abroad, suggesting that multimedia tools have a place in the field of teaching foreign languages [31]. It has been seen that the incorporation of interactive CDs, DVDs, and web-based applications has improved students' comprehension and ability to communicate in Malay [32]. Additionally, a thorough evaluation of multimedia tools used in teaching and learning processes has been carried out, offering insights into the various ways that multimedia elements including audio, video, animation, and 3-D are used in the classroom [16]. The potential of multimedia technologies to improve educational experiences is highlighted in this review.

By leveraging technology, this software can be designed to strengthen students' interests, provide more interactive and innovative teaching methods, and address problems in understanding grammar concepts. The components needed in developing this software have been identified through research, ensuring that the software produced meets the needs and expectations of users, especially in rural schools. The use of appropriate and efficient methods needs to be thoroughly studied to ensure equal access to teaching and learning in rural areas. Therefore, research on the development of specific technology for rural education still needs to be intensified in Malaysia because it is still limited [7].

By considering the benefits of the knowledge gathered from this research, interactive multimedia learning software development can be a step forward in raising the standard of Malay grammar instruction in remote secondary schools, guaranteeing that all students, regardless of location or geography, have equal access to high-quality instruction. This is so because the majority of research that are now available do not concentrate on the creation of software intended for usage in remote locations [7]. By emphasising the benefits of interactive multimedia and edutainment features to create an engaging and productive learning environment, the software that will be developed will be specifically created for use in rural schools. It also doesn't rely solely on the internet, which is the primary barrier to rural communities' technological integration.

5. Conclusions

In summary, the study emphasizes the importance of refining learning strategies, diversifying teaching approaches, and addressing the obstacles in Malay grammar education in rural settings. Expanding research and development of Malay language software, particularly tailored for rural schools is crucial to enhance learning effectiveness. Careful consideration of components in interactive multimedia software, focusing on addressing specific needs and fostering innovation in teaching methods, is essential for advancing Malay grammar education in rural areas. It is imperative that in future, the studies investigate how extended reality (XR) technologies might improve instruction in rural schools [33]. XR can create connections between teachers and students throughout the world, imitate real-life situations, and promote information sharing. Rural education could be greatly benefited by looking into how to incorporate efficient XR methods into basic and elementary teaching in regions with minimal resources.

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