

Need Analysis for Development of Circle Kit Mathematics Form Two

Amirah Fatimah Mohd Zulkiflee¹, Norazman Arbin^{1*}, Norsyazana Kamarudin², Siti Noor Asyikin Mohd Razali³, Riyan Hidayat⁴, Rezi Ariawan⁵, Firdaus Mohamad Hamzah⁶, and Mazlini Adnan⁷

^{1,7}Department of Mathematics, Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, 35900 Tanjung Malim, Perak, Malaysia.

²Sekolah Menengah Puteri Titiwangsa, Jalan Temerloh, 53200 Kuala Lumpur, Malaysia.

³Department of Mathematics and Statistics, Faculty of Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Pagoh Hub, 84600 Johor, Malaysia

⁴Faculty of Educational Studies, Universiti Putra Malaysia, 43400 Serdang, Malaysia

⁵Fakultas Keguruan dan Ilmu Pendidikan, Iniversitas Islam Riau, Indonesia

⁶Centre for Defence Foundation Studies, Universiti Pertahanan Nasional Malaysia, Kem Sungai Besi, 57000 Kuala Lumpur, Malaysia

* Corresponding author: norazman@fsmt.upsi.edu.my

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Abstract

A needs analysis was conducted to identify the current requirements and preferences of students for the development of a Circle Kit for Form 2 Mathematics topics. The research involved a random selection of secondary schools from Kedah, Perlis, and Johor, with 90 Mathematics teachers chosen through purposive sampling to serve as the study's samples. Employing a quantitative approach, data were collected using the Needs Analysis Questionnaire (NAQ) as the survey instrument, and the data were analysed using descriptive statistics. The findings revealed that 95.5% of the respondents acknowledged the need for a Circle Kit specifically tailored for Form 2 Mathematics. Moreover, a substantial majority, 75.4%, identified the Circle topic as the primary focus requiring attention in the development of the Circle Kit. Specifically, this study focuses on key aspects such as content, activities, assessment, and materials to optimise the effectiveness of the Circle Kit. In terms of content, 70.1% of teachers advocate for the inclusion of a comprehensive user guide to facilitate its use. For activities, 60.8% of teachers emphasise the importance of incorporating group tasks to foster student collaboration and teamwork. Regarding assessment, 62.4% support a flexible approach that integrates both individual and group evaluations. Lastly, 73.2% of teachers stress the significance of using hands-on materials to enhance learning experiences and increase student engagement. These findings will guide the design and implementation of the Circle Kit, ensuring it better supports Mathematics education. The development of the Circle Kit, specifically tailored for the Circle topic in Form 2 Mathematics, is crucial to improving teaching and learning outcomes. This study recommends that the design of the Circle Kit emphasise essential characteristics, including the integration of relevant content, engaging and interactive activities, the use of appropriate materials, and the incorporation of effective assessment methods. These elements are vital to fostering a comprehensive and dynamic learning experience for students.

Keywords: Circle, Form 2 Mathematics, Descriptive Statistics, Circle Kit

INTRODUCTION

The Malaysia Education Development Plan (PPPM) 2013–2025, aligned with the Standard Curriculum for Secondary Schools (KSSM), emphasises the critical importance of 21st-century learning, as outlined by the Ministry of Education Malaysia. This comprehensive framework, as detailed in [1], proposes a range of proactive and transformative measures aimed at enhancing students' academic achievements while cultivating Malaysian citizens equipped with the necessary skills to excel in a rapidly evolving global landscape. Central to this reform are four key competencies—creativity, critical thinking, collaboration, and communication [2]—which are considered vital for effectively addressing the challenges and opportunities of the 21st century.

Despite ongoing efforts to modernise Malaysia's education system, Malaysian students' performance in Mathematics—particularly in complex areas such as geometry—continues to lag behind international benchmarks, as highlighted in recent TIMSS reports [3]. This enduring gap points to significant challenges in achieving the intended educational outcomes, especially in topics that demand a deep understanding of abstract concepts. For example, the Form 2 Mathematics curriculum emphasises the study of Circles, covering key concepts such as the fundamental properties of circles, chord symmetry, and calculations involving circumference and area. However, this topic is often regarded as challenging due to its abstract and intricate nature. Research referenced in [4] indicates that many students struggle with this subject, adversely affecting their motivation and overall academic achievement.

Effective pedagogical strategies are essential for addressing the multifaceted challenges prevalent in the educational landscape. The teaching methodologies employed not only influence students' attitudes but also play a critical role in fostering their interest and improving academic performance [5]. Therefore, it is crucial for teachers to demonstrate creativity and expertise in diversifying their teaching approaches to deliver meaningful and impactful learning experiences [6]. By aligning their methods with the specific challenges faced by students, teachers can substantially enhance educational outcomes [7]. Consequently, the strategic application of well-designed teaching techniques tailored to specific topics is vital for deepening student understanding and promoting overall academic progress.

Teaching tools play a pivotal role in the educational framework, serving as indispensable resources that support and enhance the pedagogical process. As highlighted in [8], teaching aids provide supplementary informational materials that facilitate deeper student understanding. Specifically, the incorporation of tailored teaching aids for the topic of Circles is critical in helping students grasp abstract mathematical concepts, boosting their intrinsic motivation, and improving overall academic performance. Research by [9] and [10] demonstrates that the thoughtful application of educational tools significantly enhances both student engagement and achievement. Therefore, the careful selection and integration of effective instructional resources are essential for optimising teaching methodologies and enriching students' learning experiences.

Prior to the development of the Circle Kit, an extensive literature review was conducted to guide the design process. A 2020 study by [11] investigated the development of computer-assisted learning software tailored specifically for teaching the Form 2 topic of Circles. This software aimed to enhance students' comprehension and proficiency by incorporating interactive animations and real-time manipulation of geometric figures. While innovative, its effectiveness was constrained by several factors, including limited access to ICT resources—such as personal computers, mobile phones, and tablets—and compatibility issues across various operating systems. In contrast, the Circle Kit operates independently of software and utilises readily available, tangible materials as teaching aids. These hands-on resources provide a sensory-rich learning experience, enabling students to actively manipulate objects, which fosters engagement and sustains motivation. By addressing accessibility and usability challenges, the Circle Kit offers a practical and inclusive alternative for enhancing learning outcomes.

A subsequent study by [12] introduced a GeoGebra-based module designed specifically for teaching the Form 2 topic of Circles. This module aimed to deepen students' understanding of abstract mathematical concepts through interactive, technology-driven learning. GeoGebra offers advanced tools for exploring complex mathematical ideas that surpass traditional manual methods, allowing teachers to create personalised tasks aligned with specific learning objectives. However, the module's effectiveness is contingent upon several factors, including proper integration, teacher proficiency, and the quality of task design. As highlighted in [11], some schools face limited access to essential technological infrastructure,

such as computers, projectors, and stable internet connectivity. Additionally, novice users may find GeoGebra's interface daunting, requiring significant time and effort to become proficient. Effective use of GeoGebra also demands comprehensive teacher training; without this support, the software's potential to enhance learning remains underutilised. While visualisation is a critical component of mathematical understanding, overreliance on visual aids can impede the development of formal reasoning and proof skills. Complex tasks within GeoGebra may also lead to cognitive overload, particularly among younger students or those with weaker spatial reasoning abilities. Furthermore, the module's broad scope and ambitious objectives may fail to accommodate the diverse needs of students with varying levels of proficiency. Poorly designed tasks risk reducing students to passive participants, clicking through activities without fully grasping the underlying concepts. This is where the Circle Kit provides a valuable alternative. By incorporating play-based learning, the kit fosters engagement and enjoyment while reinforcing mathematical concepts. The use of physical materials offers concrete representations of abstract ideas, enabling students to visualise and internalise concepts before progressing to symbolic representations. Hands-on manipulation allows students to detect and correct errors in real time, promoting active learning and deeper comprehension.

Another study conducted by [13] focused on the development of a manipulative teaching aid known as the CG-Board, specifically designed to facilitate the teaching and learning of the topic of Circles. This innovative tool aimed to promote active engagement and hands-on learning among students. Accompanying the CG-Board was an activity book that provided structured exercises to enhance students' learning experiences. The CG-Board included separate components such as compasses, protractors, and drawing tools, enabling students to explore the properties of Circles through practical applications. The study revealed that the CG-Board significantly improved students' understanding of the fundamental properties of Circles and fostered active participation in lessons, creating an interactive and engaging classroom environment. However, the study also identified a notable limitation: the use of separate tools alongside the CG-Board posed challenges in terms of tool management, as essential items like compasses and protractors were prone to misplacement or loss, potentially disrupting the learning process. To address these limitations, the Circle Kit was developed as an improved teaching aid for the topic of Circles. Unlike the CG-Board, the Circle Kit integrates all necessary tools and materials into a single, cohesive unit. This design minimises the risk of misplacing components and enhances the organisation and efficiency of the learning process. By ensuring that all essential tools are readily available and easy to use, the Circle Kit provides a more seamless and convenient experience for both teachers and students. Furthermore, the Circle Kit prioritises user-friendliness and accessibility, making it suitable for diverse classroom settings. Its compact and portable design allows students to engage in hands-on activities with minimal disruptions, fostering a deeper understanding of mathematical concepts related to Circles while maintaining interest and motivation. Ultimately, the Circle Kit addresses the shortcomings of the CG-Board and offers a practical, integrated solution, paving the way for a more effective and engaging approach to teaching Mathematics.

A study conducted abroad by [14] explored the use of Hawgent Dynamic Mathematics software in facilitating students' understanding of the basic properties of Circles and the calculation of a Circle's area. The findings indicated that integrating this software into Mathematics instruction significantly enhances students' conceptual understanding of the area of a Circle. The Hawgent Dynamic Mathematics software employs dynamic and interactive visualisations, enabling students to better grasp the relationships among key elements of a Circle, including radius, diameter, circumference, and area. The study highlighted the potential of dynamic technology, such as this software, as an effective teaching aid for improving students' mastery of fundamental Mathematical concepts. However, the study also identified a notable limitation: many schools lack adequate ICT facilities and up-to-date infrastructure to effectively implement the software. This technological constraint can hinder the software's overall effectiveness as a teaching tool. To address this limitation, the Circle Kit was developed as an alternative teaching aid. The Circle Kit provides a manipulative, hands-on approach for teaching the basic properties of Circles, including their characteristics and the calculation of their area, without relying on advanced technology. By offering physical tools, the Circle Kit delivers a practical and accessible solution for schools with limited ICT resources. This design fosters an interactive and tactile learning experience, allowing students to engage directly with the concepts. The Circle Kit aims to bridge the gap between theoretical understanding and practical application, improving students' mastery of the topic of Circles in both conceptual and real-world contexts. This innovative teaching aid offers a viable, user-friendly alternative for enhancing Mathematics education, particularly in settings where technological infrastructure is limited.

Other study conducted in Nigeria by [15] examined the impact of an e-learning approach on students' academic achievement in Circle geometry at the secondary school level. The findings revealed that the integration of e-learning significantly enhances students' understanding of fundamental concepts in Circle geometry. This approach fosters a more interactive and engaging learning environment, which in turn boosts students' motivation and performance in Mathematics. However, the study also identified key challenges, including the need for sufficient ICT infrastructure and teacher training in the effective use of educational technology. Limited access to these resources can hinder the success of the e-learning approach in improving students' understanding of Circle geometry. Additionally, the study noted that the reliance on e-learning may reduce opportunities for direct interaction between students and teachers, which is essential for mastering more complex geometric concepts. To address these limitations, the Circle Kit was developed as a practical and interactive alternative. The Circle Kit enables students to directly explore basic concepts in Circle geometry without the need for electronic devices or internet connectivity. By providing a hands-on learning experience, the Circle Kit addresses issues of unequal access to technology while maintaining an engaging and effective approach to teaching geometry.

The literature review highlights the critical need not only to develop but also to refine existing computer-based learning modules to enhance students' understanding of the mathematical concept of the Circle. Such efforts aim to elevate the quality of pedagogical practices and improve learning outcomes. In alignment with this objective, the present research focuses on designing a practical and cost-effective teaching aid (BBM) that adheres to rigorous standards of validity. A comprehensive needs analysis is a crucial first step in this endeavour. This analysis will involve gathering feedback from Mathematics teachers in Kedah, Perlis, and Johor regarding their perceptions of the Circle Kit and identifying specific topics within the Form 2 Mathematics curriculum that could benefit most from this innovative approach. Furthermore, the analysis will define the key requirements for developing the learning kit and establish its core components, ensuring its effectiveness and relevance in enhancing Mathematics education.

METHODOLOGY

Research Design

The primary objective of this research is to develop an educational tool called the Circle Kit, structured meticulously following the Design and Development Research (DDR) framework. This framework is divided into three distinct phases: (1) Analysis, (2) Design and Development, and (3) Evaluation, as described by [16]. The needs analysis, a central component of this research, was conducted during the initial Analysis phase. The primary purpose of this analysis is to collect detailed feedback from secondary school Mathematics teachers in Kedah, Perlis, and Johor. These insights aim to assess teachers' receptivity to the Circle Kit and identify specific topics within the Form 2 Mathematics curriculum that could benefit most from its implementation. A quantitative research approach was employed, utilising a structured survey questionnaire distributed to a targeted group of secondary school Mathematics teachers. The collected data provides a comprehensive evaluation of both the perceived necessity and the potential effectiveness of the Circle Kit as a teaching aid in the context of Form 2 Mathematics. This systematic methodology not only assesses the overall acceptance of the Circle Kit but also pinpoints areas within the curriculum where its application could significantly enhance educational outcomes.

Research Sample

The participants of this study consisted of secondary school Mathematics teachers in Malaysia, randomly selected from schools in Kedah, Perlis, and Johor. These states were chosen due to their outstanding performance in Mathematics in the 2023 Malaysian Certificate of Education (SPM) examination, ranking among the top-performing states nationally. A total of 90 teachers participated in the online survey. The study employed a purposive sampling technique to ensure that participants met specific criteria relevant to the research objectives. In particular, the respondents were required to possess qualifications in teaching secondary school Mathematics, ensuring their suitability for providing insights pertinent to the study's focus.

Research Instrument

The research instrument used in this study is the Needs Analysis Questionnaire (NAQ), adapted from the Needs Analysis for Developing Challenge-Based Learning Modules in Mathematics for Form 4 students [17]. Questionnaires are considered an effective method for gathering essential insights related to material requirements or research objectives under investigation. The NAQ is divided into two sections: the first section focuses on the background of Form 2 Mathematics teachers, while the second section addresses the criteria for developing the Circle Kit. This includes evaluating the relevance and necessity of the topic, as well as key components such as content, activities, assessments, and materials to be incorporated into the Circle Kit's design. To ensure validity, the Need Analysis Content Validity Form (NACVF) was utilised. A panel of three experts was selected for validation: two lecturers from public universities specialising in Mathematics and one secondary school Mathematics teacher. The expert validation process aims to ensure that the instrument accurately identifies and measures the needs of the target group, verifying the following criteria: (a) the items are comprehensive and relevant to the specific context of the needs analysis, (b) the items are contextually appropriate, culturally sensitive, and aligned with the objectives of the needs analysis, (c) the language used is clear, simple, and free from ambiguity, and (d) the questionnaire effectively measures the intended constructs related to the needs being analysed. Data analysis involved reviewing the feedback provided by each expert via the NACVF, which was then evaluated using the Content Validity Index (CVI). Experts who provided feedback on scales 3 and 4 were categorised as the "agree" group, corresponding to ordinal scale 1, while those who rated scale 1 and scale 2 were placed in the "disagree" group, represented by ordinal scale 0. The CVI calculation was conducted using the formula n / N , where " n " denotes the number of experts in agreement, and " N " represents the total number of experts. The validation yielded a perfect reliability index, with a CVI score of 1.00. According to [15], a CVI value of 1.00 is acceptable for a panel consisting of five or fewer experts.

Data Analysis

The data collected were analysed using SPSS software, version 21.0. Quantitative data analysis was conducted through descriptive statistics to determine frequency values and percentages. As noted by [19], descriptive statistics involve the measurement of various metrics, including the minimum, mode, median, percentages, frequency, standard deviation, variance, and other related parameters. Since the primary objective of this study is to conduct a needs analysis, the use of descriptive analysis is sufficient at this stage. More advanced methods, such as inferential analysis, are not required at this preliminary phase. However, inferential analysis will be essential in the subsequent phase of the study to assess the effectiveness of the Circle Kit in improving students' academic performance.

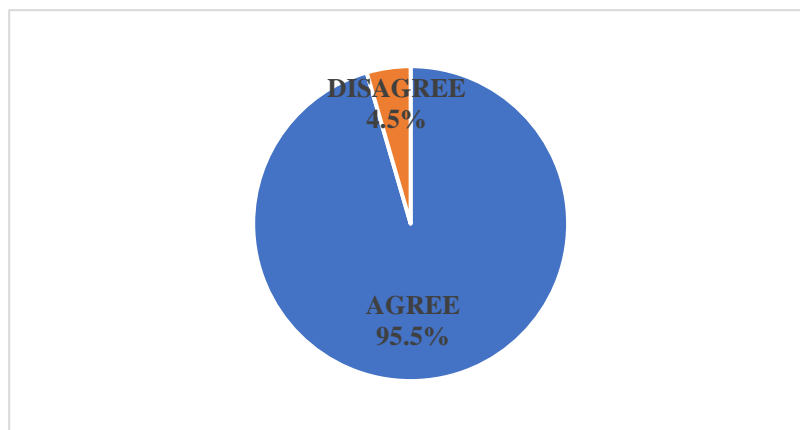
RESEARCH FINDINGS AND DISCUSSION

A total of 90 respondents actively participated in completing the survey questionnaire. The thorough analysis of the collected data provides a nuanced understanding of the findings, which are presented in detail as follows:

Needs

Figure 1 illustrates that a significant 95.5% of the teachers surveyed acknowledge the need for the development of a Circle Kit as a pedagogical tool specifically tailored for Form 2 students. This high level of agreement highlights a strong consensus among teachers about the potential advantages and value of integrating such teaching materials to improve teaching effectiveness.

Figure 1. Survey of the need to develop a Circle Kit

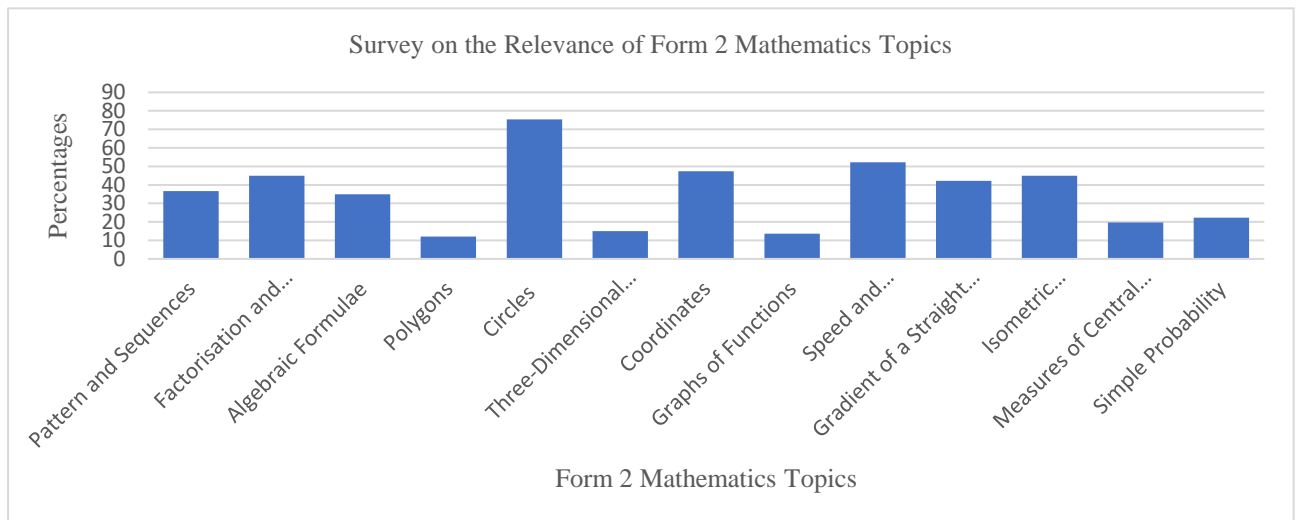


Relevance of Topics

Figure 2 shows that 75.4% of teachers have selected the topic of Circles as their preferred topic, the highest percentage among the various topics. This preference highlights a significant demand for a Circle Kit within the Form 2 Mathematics curriculum. It underscores the perceived importance of this topic and suggests that the development of a specialised teaching kit could greatly enhance the educational experience in this area. The Form 2 KSSM syllabus strategically emphasises the study of Circles due to their fundamental role in Mathematics and their broad applicability across various disciplines. Circles introduce essential geometric concepts such as radius, diameter, circumference, and area, which are integral to practical fields like engineering, design, and construction. Students also explore theorems involving tangents, chords, and angles, which promote critical thinking, logical reasoning, and proficiency in Mathematical proofs—skills that are vital for more advanced Mathematical study. However, according to a study conducted by [20], students continue to encounter significant challenges in understanding the topic of Circles, particularly their properties. Difficulty in grasping these fundamental concepts can hinder students' comprehension and mastery of related subtopics, such as calculating the area of a Circle. Moreover, the study of Circles bridges other areas of Mathematics, including algebra (e.g., solving equations involving π), trigonometry (e.g., angle calculations), and mensuration (e.g., area and perimeter computations). This interdisciplinary approach fosters a deeper appreciation of Mathematics as an interconnected field. A solid understanding of Circles also lays the groundwork for more advanced topics in Forms 4 and 5, such as trigonometry, coordinate geometry, and calculus. By prioritising Circles in Form 2, the syllabus strengthens students' geometric foundation, equipping them with both theoretical knowledge and practical problem-solving skills.

The topic of Circles serves as a foundational element in the study of mensuration and geometry. A study conducted by [21] highlighted that students often struggle to apply their knowledge of Circles to real-world problems, indicating challenges in bridging theoretical understanding with practical applications. Similarly, research by [22] revealed that misconceptions regarding the concepts of Circles are prevalent among students. Given its critical role in building essential geometric and mensuration skills, along with the need to address these challenges and misconceptions, the topic of Circles was selected as the focus of this study.

Figure 2. Survey on the Relevance of Form 2 Mathematics Topics



Content

Table 1 outlines the content aspects of the Circle Kit based on teacher feedback. The findings indicate that 70.1% of teachers advocate for the inclusion of a user guide reference, while 60% support the addition of clearly defined usage objectives for the kit. Moreover, 53.2% emphasise the need for comprehensive teaching and learning guidelines, including student worksheets. Additionally, 47.2% recommend integrating the kit with the Daily Lesson Plan (DLP), and 34.3% suggest incorporating step-by-step instructions for its effective use. Furthermore, 32.9% propose a classroom implementation guide as an essential component of the kit. A smaller percentage of teachers advocate for specifying the duration of activities (22.7%) and including assessment guidelines (21.4%).

The content aspects of the Circle Kit have significant implications for its practical application in education. Firstly, teachers emphasise the importance of well-structured, user-friendly materials to ensure ease of use and seamless integration into classroom practices. Secondly, features such as user guides, clear objectives, and comprehensive teaching guidelines are vital for simplifying lesson planning and delivery, enhancing the kit's value as an instructional resource. Thirdly, actionable guidance, including step-by-step instructions and alignment with the Daily Lesson Plan (DLP), facilitates effective classroom implementation by reducing ambiguity and ensuring consistent usage. Lastly, the inclusion of activity durations and assessment guidelines supports efficient time management and enables teachers to track student progress effectively. To maximise the Circle Kit's impact, its content must be meticulously designed, systematically organised, and aligned with established educational standards. This approach ensures the provision of clear instructions, robust instructional aids, and reliable assessment tools, empowering teachers to deliver engaging lessons that foster students' academic growth and overall development.

Table 1 Content Aspects of the Circle Kit

| No | Teaching Approach | Percentages (%) |
|----|--|-----------------|
| 1 | There is an objectives of kit development. | 60.0 |
| 2 | There is a kit usage guide. | 70.1 |
| 3 | There is a teaching and learning guide using the kit. | 53.2 |
| 4 | There is a Daily Lesson Plan (DLP). | 47.2 |
| 5 | Have steps of teaching and learning work using the kit. | 34.3 |
| 6 | Have a period time for learning activities. | 22.7 |
| 7 | Have pupil worksheets. | 44.3 |
| 8 | Provided with classroom guidance on the implementation of the kit. | 32.9 |
| 9 | There is a scoring guide on the outcomes. | 21.4 |

Activity

Table 2 provides an overview of the activity aspects of the Circle Kit, highlighting teachers' preferences for its design. The data reveals that 60.8% of teachers advocate for incorporating collaborative group activities, emphasising the value of teamwork in completing assigned tasks. Furthermore, 46.3% of teachers recommend aligning activities with PAK21 standards, while 45.6% support engaging students in presenting and sharing their learning outcomes. Additionally, 37.1% endorse the inclusion of brainstorming sessions, 31.2% emphasise the importance of concise note-taking to consolidate information, and 25.7% propose group presentations as an assessment method.

The findings emphasise a strong inclination toward interactive, collaborative, and student-centered pedagogical approaches, with significant implications for educational practice. Collaborative group activities are instrumental in fostering social and communicative competencies, enhancing peer-to-peer learning, and encouraging collective problem-solving. The alignment of activities with PAK21 standards supports the cultivation of critical thinking, creativity, and technological integration, equipping students with essential 21st-century skills. Engaging students in presenting learning outcomes reinforces conceptual understanding while developing public speaking and communication abilities. Activities such as brainstorming sessions promote critical thinking, teamwork, and the exploration of diverse perspectives, thereby enriching the learning process. Furthermore, note-taking aids in consolidating key ideas, fostering effective study habits, and enhancing knowledge retention. Group presentations, as a means of assessment, enable the evaluation of both individual contributions and group understanding while fostering accountability and responsibility. Collectively, these preferences reflect a paradigm shift toward dynamic, participatory learning environments that prioritise engagement and the practical application of knowledge, aligning with contemporary educational philosophies aimed at preparing students for the demands of the 21st century.

Table 2 Activity Aspects of the Circle Kit

| No | Teaching Approach | Percentages (%) |
|----|---|-----------------|
| 1 | Students carry out group activities (collaborate) for the activities given. | 60.8 |
| 2 | Pupils do brainstorm activities. | 37.1 |
| 3 | Pupils collect information in the form of note. | 31.2 |
| 4 | Pupils perform assessments in the form of group presentations. | 25.7 |
| 5 | Pupils present and share learning outcomes. | 45.6 |
| 6 | Activities in the form of 21 st Century Learning. | 46.3 |

Assessment

Table 3 delineates the assessment aspects of the Circle Kit, offering insight into the preferences of teachers regarding evaluation strategies. The findings reveal that 62.4% of teachers advocate for assessments conducted either individually or within group settings, reflecting an emphasis on flexible and inclusive evaluation structures. Additionally, 52.9% of teachers support the use of observational techniques, underscoring the value of real-time assessments to monitor and capture students' practical performance. Furthermore, 47.1% of teachers express a preference for non-exam-based assessments, signalling a shift toward alternative methods that foster creativity, critical thinking, and problem-solving, moving away from traditional, formal testing. Lastly, 40% of teachers advocate for the inclusion of oral assessments, highlighting the importance of evaluating verbal communication and expression as a key component of the learning process.

Table 3 Assessment Aspect of the Circle Kit

| No | Teaching Approach | Percentages (%) |
|----|---|-----------------|
| 1 | Assessment is not in the form of a full-fledged exam. | 47.1 |
| 2 | Assessment is carried out through observation method. | 52.9 |
| 3 | Assessment is carried out orally. | 40.0 |
| 4 | Classroom Assessment is done individually or groups. | 62.4 |

Materials

Table 4 outlines the material aspects identified as essential for the effective implementation of the Circle Kit, showcasing the range of resources deemed necessary by teachers. A substantial majority (73.2%) of teachers emphasised the significance of incorporating concrete, hands-on materials as indispensable tools for enhancing student understanding and engagement with abstract concepts. In addition, 62.9% of respondents highlighted the importance of non-electronic media resources, such as books, charts, and flashcards, which provide versatile and accessible instructional aids, particularly in classrooms with limited technological infrastructure. Conversely, 47.1% of teachers expressed a preference for electronic media, including projectors, videos, and slides. These digital resources are increasingly regarded as critical components of contemporary teaching practices, offering dynamic and interactive approaches to content delivery. Finally, 37.5% of teachers advocated for the inclusion of experiential learning materials, such as field trips, projects, and exhibitions. These materials provide students with authentic, real-world learning experiences that extend and reinforce theoretical knowledge acquired in the classroom. The findings underscore the need for a balanced integration of diverse material types in the Circle Kit to ensure its adaptability and effectiveness across varied educational contexts.

The overall implications of the materials suggest that teachers recognize the importance of utilising a diverse range of teaching aids to enhance the learning process. Emphasis on tactile materials, such as manipulatives or models, plays a key role in improving students' understanding of abstract concepts by providing both hands-on and visual learning experiences. This reflects teachers' appreciation for interactive, experiential learning approaches aimed at fostering deeper comprehension. Non-electronic media, valued for their accessibility and versatility, are seen as effective tools for reinforcing key concepts across various learning styles. Although electronic media is not yet the dominant choice, its increasing role in lesson design signifies the growing importance of digital tools in creating dynamic, multimedia-rich lessons. This shift aligns with the broader educational trend of integrating both traditional and digital teaching methods. Additionally, the emphasis on experiential learning—such as field trips, projects, and exhibitions—offers students immersive learning experiences that extend beyond textbooks, encouraging critical thinking, problem-solving, and the application of knowledge in real-world settings. In conclusion, the data underscores a holistic approach to teaching that values diverse materials for meeting the varied needs of students, highlighting a movement toward more interactive, multimedia, and real-world learning experiences while preserving the foundational role of traditional resources in education.

Table 4 Material Aspects of the Circle Kit

| No | Teaching Approach | Percentages (%) |
|----|---|-----------------|
| 1 | Electronic media materials such as projectors, videos, slides, and others. | 47.1 |
| 2 | Non-electronic media materials such as books, charts, scan cards and others. | 62.9 |
| 3 | Experiential materials such as field trips, projects, exhibitions and others. | 37.5 |
| 4 | Use of concrete materials as a teaching aid. | 73.2 |

CONCLUSION

The primary aim of this research is to evaluate the need for developing a specialised teaching tool, the Circle Kit, tailored to support the teaching of the Circle topic in the Form 2 Mathematics curriculum. This study arises from the understanding that certain mathematical concepts, especially in geometry, necessitate more than conventional teaching methods to achieve a thorough understanding. The Circle topic, as a fundamental component of geometry, is crucial in helping students master more advanced geometrical concepts encountered in higher-level Mathematics [23]. Consequently, it is essential to provide teachers with appropriate resources to facilitate effective instruction. Teachers tend to favour specific instructional strategies, such as group activities and hands-on materials, due to their alignment with established pedagogical frameworks that promote effective learning. For example, the Constructivist Theory asserts that learning is an active and constructive process in which learners assimilate new knowledge by connecting it with prior understanding. Group activities encourage peer interaction, fostering social learning, while hands-on materials facilitate experiential exploration, enhancing conceptual comprehension. Likewise, the principles of Active Learning emphasise that students achieve improved outcomes through engagement and participation, with collaborative tasks and interactive experiences stimulating active involvement, critical thinking, and problem-solving skills. The findings of this study highlight the necessity for concrete, manipulable teaching materials to effectively teach the Circle topic. The Circle Kit has emerged as an essential tool, enhancing both teaching and learning by providing a physical and visual reference that simplifies abstract concepts. By allowing students to interact directly with geometric elements, the kit helps clarify complex ideas and bridges the gap between theoretical knowledge and practical understanding. Furthermore, the use of the Circle Kit aligns with contemporary pedagogical frameworks, such as the 21st Century Learning (PAK21) paradigm, which emphasises student-centered learning. In this context, the kit promotes an active learning environment where students are encouraged to explore, inquire, and engage with the material, fostering deeper cognitive processing. This approach is crucial in today's educational landscape, where the development of critical thinking, problem-solving skills, and independent learning is paramount. The integration of the Circle Kit as a teaching resource not only addresses the specific challenges of the Circle topic but also supports broader educational goals, enhancing pedagogical effectiveness, promoting student engagement, and aligning with modern educational practices that prioritise interactive, student-driven learning experiences.

The comprehensive requirements related to the content, activities, materials, and evaluation mechanisms for the Circle Kit were thoroughly analysed based on feedback from teachers actively utilising it. In examining the content, teachers universally agreed on the critical necessity of a well-structured, detailed user guide to ensure accurate implementation of the kit's methodologies. The inclusion of clear instructions is essential not only for the effective deployment of the kit but also for minimising the risk of misapplication, thereby ensuring consistent achievement of learning outcomes. Regarding the activity design, teachers emphasised the importance of fostering active student engagement through collaborative group activities. This cooperative approach encourages students to work together, promoting a dynamic and interactive learning environment. Active participation and sustained interaction during these group activities significantly enhance the learning experience, contributing to both social and cognitive development, which aligns with contemporary educational theories advocating for experiential and cooperative learning models [24]. With respect to evaluation, teachers agreed that assessments should be flexible, encompassing both individual and group-based evaluations. This dual approach offers a comprehensive assessment of students' personal and collaborative competencies, essential for a holistic educational experience. Additionally, teachers expressed strong support for the incorporation of tangible, physical teaching aids, noting their significant impact on enhancing the pedagogical process. These concrete materials facilitate the delivery of abstract concepts and improve students' understanding through hands-on experiences, particularly in problem-solving activities. Such materials not only simplify the instructional process but also enhance conceptual retention and critical thinking, fostering deeper cognitive engagement and aligning with educational practices that emphasise active learning and hands-on exploration [23].

Following a comprehensive review, it has been determined that the development of the Circle Kit, specifically designed for the topic of Circles in the Form 2 Mathematics curriculum, is essential for enhancing the teaching and learning experience. This initiative seeks to provide teachers with a robust tool that streamlines instruction, allowing for a more effective and engaging pedagogy. The Circle Kit is not only intended to improve instructional efficacy but also to facilitate a deeper, more comprehensive

understanding of geometric concepts related to circles. By offering interactive methods for presenting complex ideas, the kit aligns with contemporary educational research emphasising the critical role of instructional materials in promoting high-quality learning. As highlighted in [25], the integration of teaching aids is essential in optimising educational delivery, as these materials serve to provide additional resources and diverse approaches that cater to various learning styles. Ultimately, the Circle Kit aims to bridge gaps in comprehension, support diverse pedagogical strategies, and enhance educational practices within the classroom, thereby equipping teachers to meet the varied needs of students and fostering meaningful academic progress in the study of geometry.

The findings of this study are in alignment with the Malaysian Education Development Plan (PPPM) 2013-2025, particularly its focus on 21st-century learning (PAK21). The Circle Kit directly supports key educational objectives outlined in the PPPM, including the promotion of critical thinking, collaboration, creativity, and communication—fundamental elements of the PAK21 framework. Through the inclusion of group-based activities and hands-on materials, the Circle Kit fosters active, student-centered learning, allowing students to explore mathematical concepts through experiential and inquiry-based methods. Additionally, the PPPM emphasises the development of problem-solving skills and the application of knowledge to real-world contexts, objectives that the Circle Kit effectively addresses by transforming abstract geometric concepts into tangible learning experiences, thus bridging theoretical knowledge with practical application. The integration of collaborative learning tasks within the Circle Kit further aligns with the PPPM's emphasis on enhancing social and communication skills through cooperative problem-solving, contributing to the development of well-rounded, competent learners.

The emphasis on continuous teacher development within the Malaysia Education Development Plan (PPPM) is mirrored in this study's recommendation for professional development workshops focused on the effective use of the Circle Kit. Such workshops ensure that teachers are equipped with contemporary pedagogical techniques, thereby enhancing instructional quality and improving student outcomes. Furthermore, the dual-assessment approach proposed in this study aligns with the PPPM's focus on holistic student evaluation, addressing both cognitive and social learning aspects. Overall, the Circle Kit supports the strategic objectives of the PPPM by improving pedagogical practices, promoting 21st-century competencies, and contributing to Malaysia's broader educational vision of cultivating globally competitive learners.

Based on the findings of this study, several key recommendations are proposed to enhance the development and implementation of the Circle Kit. Firstly, a comprehensive, user-friendly guide should be created, offering step-by-step instructions, examples, and troubleshooting tips, along with strategies for differentiated instruction to address diverse student needs. Secondly, it is recommended to incorporate more hands-on, interactive group activities that promote critical thinking and collaborative learning, with teacher feedback used to refine and adjust activities for optimal student engagement. Thirdly, the design of flexible, multi-dimensional assessment tools is crucial for evaluating both individual and group performance, providing real-time feedback on cognitive and social learning outcomes. Additionally, ongoing professional development workshops should be organised to train teachers on the Circle Kit's features and effective pedagogical strategies, allowing for the sharing of best practices and the continual refinement of teaching methods. Lastly, a feedback system should be established to enable students to share their experiences with the Circle Kit, facilitating continuous improvements in its design and maximising its impact on student learning outcomes. Implementing these recommendations will optimise the Circle Kit's effectiveness, thereby enhancing teaching and learning in Mathematics education.

Future research could involve piloting the Circle Kit in various classroom contexts, including urban, rural, and mixed-ability environments, to assess its adaptability and scalability across diverse student populations. Investigating the impact of teacher professional development on the effective implementation of the Circle Kit would offer valuable insights into the best practices for training teachers. Furthermore, exploring how the Circle Kit can be seamlessly integrated into existing Mathematics curricula would help identify its potential for enhancing classroom instruction while ensuring alignment with established educational standards, like [26] and [27]. Research on student learning outcomes could focus on measuring cognitive improvements, such as advancements in conceptual understanding, problem-solving abilities, and spatial reasoning, facilitated using the Circle Kit. Additionally, investigating its role in fostering mathematical creativity would provide deeper insights into its contribution to innovative thinking during mathematical tasks. Evaluating its impact on student engagement, motivation, and attitudes toward Mathematics would further elucidate its potential to create a more dynamic and enjoyable learning

environment. Lastly, design and development studies could involve collecting feedback from both teachers and students to refine the Circle Kit's design, ensuring that it effectively addresses classroom needs. Exploring the integration of digital components or augmented reality could further enhance the kit's functionality, providing more interactive and engaging learning experiences while staying aligned with the latest technological advancements in education.

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