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ORIGINAL ARTICLE

Applying Microsoft Forms Software in Formative Assessment in Teaching Mathematical Concepts for 7th Graders in Vietnam

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ABSTRACT
Formative assessment, a cornerstone of competency-based teaching, plays a pivotal role in enhancing learner progress. In Vietnamese schools, its potential for driving educational transformation is ripe for exploration. This research delves into the innovative use of Microsoft Forms as a digital tool for designing formative assessment tools for 7th-grade mathematics, with a focus on key mathematical concepts in the curriculum. The study adopts a robust mixed-method approach, combining qualitative and quantitative analyses. It engaged 116 7th-grade students from secondary schools in Quang Ninh, Phu Tho, Nam Dinh, and Thai Binh provinces. Additionally, semi-structured interviews were conducted with 30 mathematics teachers from the same regions, providing deep insights into the practical application of this technology. The findings highlight the significant impact of Microsoft Forms in fostering effective formative assessment. Teachers can anticipate student difficulties, identify common errors, and respond with timely, tailored interventions. Students, in turn, show heightened interest and confidence in the classroom, embracing mathematical concepts with enthusiasm. The research also introduces two innovative techniques to enhance the skills of both teachers and students in leveraging Microsoft Forms effectively. This study underscores the transformative potential of digital tools in modern education, particularly within the framework of Vietnam's 2018 General Education Curriculum for mathematics. It concludes by recommending the broader adoption of Microsoft Forms across diverse teaching scenarios, signaling a new era in math education where technology bridges gaps and unlocks student potential.

1. INTRODUCTION

In modern education, formative assessment, rooted in the concept of the zone of proximal development (ZPD) proposed by L.S. Vygotsky has emerged as a powerful tool for fostering student growth and aligning teaching with individual learning needs. The ZPD identifies the range within which a learner can achieve mastery with appropriate guidance and support. Correctly identifying this zone allows teachers to design targeted and meaningful learning experiences that promote student growth. One of the most effective methods for pinpointing a learner's ZPD is through formative assessment, which relies on intentional and strategic engagement between teachers and students (Ash & Levitt, 2003).

The study of formative assessment has its roots in the 1960s (Scriven, 1967) and has evolved into a practice that emphasizes collaboration between educators and learners to co-create knowledge and learning products within the ZPD (Brown et al., 1993; Newman et al., 1989; Moschkovich, 1989). The effectiveness of formative assessment depends on its ability to provide timely and individualized feedback, enabling both teachers and students to make real-time adjustments to learning activities. This adaptability underscores why formative assessment is considered indispensable in modern teaching practices.

Over the years, researchers have proposed various tools for formative assessment, including checklists, rubrics, learning portfolios, short tests, exit tickets, and learning profiles. With the rapid advancement of information technology, digital platforms such as Padlet, Quizizz, Microsoft Forms, Google Forms, and Google Docs have become valuable resources for collecting, analyzing, and acting on learner feedback. However, practical surveys reveal a significant disparity between the potential of these tools and their actual use in classrooms. For instance, studies indicate that many teachers use Microsoft Forms merely as a digital substitute for traditional testing. The software is often used to administer uniform tests to entire classes, with teachers correcting mistakes immediately or asking students to present solutions to the whole class. This approach overlooks the fundamental purpose of formative assessment: tailoring instructions to meet the individual cognitive levels of learners (Ash & Levitt, 2003). As a result, the transformative potential of tools like Microsoft Forms remains underutilized.

This study aims to bridge this gap by focusing on the practical use of Microsoft Forms in 7th-grade mathematics classrooms in Vietnam. Specifically, it addresses three critical research questions:

How is Microsoft Forms currently being used for formative assessment in teaching 7th-grade mathematics?

How can Microsoft Forms be optimized for formative assessment to align with competency-based teaching methods?

What challenges do teachers face when using Microsoft Forms for formative assessment in teaching mathematical concepts?

Despite extensive research on formative assessment techniques, the relationship between digital tools like Microsoft Forms and their effectiveness in competency-based education remains underexplored. This research gap is particularly significant in the context of Vietnamese schools, where integrating technology into teaching has been increasingly prioritized under the 2018 General Education Curriculum. By investigating the current practices, challenges, and opportunities associated with Microsoft Forms, this study aims to offer actionable insights and strategies for leveraging digital tools to enhance formative assessment, ultimately improving student engagement and learning outcomes in mathematics classrooms.

2. LITERATURE REVIEW

2.1. Typical student activities during the process of teaching mathematical concepts

Mathematical concepts are the cornerstone of mathematics, forming the basis upon which the entire discipline is constructed. Within the mathematical community, it is widely acknowledged that mathematics emerges from a set of fundamental concepts and primitive propositions. From these axiomatic foundations, all other mathematical constructs are systematically derived using rigorous rules of logical inference. Theorems, unless they are axioms themselves, are validated through meticulous proofs anchored in these foundational principles (Vinner, 1991).

Research consistently emphasizes the centrality of concept mastery in mathematics education. The National Council of Teachers of Mathematics (NCTM, 1989; 1991) underscores the necessity of fostering students' understanding of mathematical concepts as a primary goal of secondary school education. Concepts serve as the bedrock of mathematical knowledge, providing the framework for logical reasoning and problem-solving. Consequently, the teaching of mathematical concepts in secondary schools is not merely a curricular requirement but a critical endeavor that underpins students' intellectual growth. Effective teaching strategies must be employed to ensure students gain a profound and meaningful grasp of these concepts.

Nguyen (2015) describes mathematics as a form of cognitive reflection pertaining to a class of objects. To teach mathematical concepts effectively in secondary education, a systematic approach involving three key stages is essential:

(1) *Approaching the Mathematical Concept*: Approaching a mathematical concept involves introducing it with methods suitable to the students' cognitive level. This can be achieved via deduction, induction, or construction. Among these, induction is particularly effective, as it actively engages students in discovering the essence of the concept. Teachers can utilize illustrative examples, both relevant and non-examples, to guide students in analyzing, comparing, and contrasting these cases. Through this process, students discern common characteristics and uncover the intrinsic properties of the concept. This method fosters an active learning environment where students play a central role in constructing their understanding.

(2) *Consolidating the Mathematical Concept*: Consolidating a concept requires systematic reinforcement and integration of the newly acquired knowledge. Teachers can employ the following component activities to deepen students' understanding:

- Language Activity: Students articulate the formal definition of the concept and clarify associated terms.
- Identification Activity: Students verify whether specific objects satisfy the conditions of the concept.
- Representation Activity: Students create examples of objects that conform to the concept's definition.
- Specialization Activity: Students explore particular cases or conditions that narrow the concept's scope.
- Generalization Activity: Students identify broader applications or instances where the concept can be extended.
- Conceptual Classification Activity: Students categorize the concept within a logical framework, determining its relationships with previously learned concepts.

These activities encourage active cognitive engagement and systematic organization of knowledge, ensuring that students internalize the concept and integrate it into their broader understanding of mathematics.

(3) *Applying the Concept*: The final stage emphasizes the practical application of the concept in solving mathematical problems and real-world scenarios. Teachers should design problem-solving activities that encourage students to utilize their newly acquired knowledge in meaningful ways. This stage not only reinforces understanding but also develops critical thinking and problem-solving skills.

The Role of Formative Assessment: Throughout all three stages, formative assessment plays a vital role in monitoring and supporting students' cognitive development. By observing and evaluating students' participation in these activities, teachers can identify difficulties, provide immediate feedback, and adjust instructional strategies. This continuous assessment ensures that students gain confidence, overcome obstacles, and achieve a deeper understanding of mathematical concepts.

In conclusion, teaching mathematical concepts requires a structured and dynamic approach. By following these three stages - approaching, consolidating, and applying concepts - teachers can empower students to master foundational ideas, fostering both intellectual curiosity and practical problem-solving skills. This pedagogical framework not only enriches students' mathematical knowledge but also equips them with the tools necessary for lifelong learning in an increasingly quantitative world.

2.2. Formative assessment and the use of Information Technology in formative assessment

Formative assessment, also known as assessment for learning, has garnered significant attention over the past few decades, particularly since the publication of the influential article "Inside the Black Box" by Black and Wiliam in 1998. This article argued that when used appropriately, formative assessment in the classroom can positively impact student learning (Black & Wiliam, 1998; Harlen et al., 1999). Harlen's research further provides clear evidence that formative assessment improves learning and raises students' achievement standards (Harlen, 2000).

Formative assessment is a method in which students receive immediate feedback along with actionable ideas to improve their performance. The feedback must be "specific, accurate, timely, clear, focused on achievable goals, and expressed in a way that will encourage an individual to think," enabling students to modify their work, correct errors, and enhance their learning (Jenkins, 2010). Research highlights that feedback in formative assessment has a significant impact on student learning and outcomes (Kluger & De Nisi, 1996; Black & Wiliam, 1998; Higgins et al., 2002). However, for feedback to be effective, it must involve specific tasks that provide relevant learning information (Hattie & Timperley, 2007) and be delivered in a timely manner (Higgins et al., 2002).

Formative assessment is often described as a continuous cycle where feedback is integral. Teachers collect evidence of student activity, evaluate it, and decide on the next steps to support and elevate students' understanding

(Harlen et al., 2000). Teachers diagnose the gap between students' current abilities and their potential within the zone of proximal development, interpreting evidence by comparing their initial expectations with learners' actual outcomes. This process enables teachers to align their understanding of student comprehension with instructional goals and decide how to guide students effectively (Ash & Levitt, 2003).

Research by Hattie and Timperley (2007), Clark (2008) outlines the key components of the formative assessment system: 1) the goals students need to achieve, 2) the current state of students' understanding, and 3) the next steps students must take. These components are essential as they foster continuous interaction between teachers and students to improve learning. Without clear goals, students cannot understand lesson objectives or stay motivated to engage with the material. Without assessment results (feedback), students remain unsure about their performance and struggle to make informed decisions. Lastly, without identifying the next steps, teachers miss opportunities to address knowledge gaps, resolve errors, and guide their instruction based on students' performance (Hattie & Timperley, 2007; Clark, 2008).

Incorporating information technology into teaching and assessment has become increasingly essential. Numerous studies have explored the role of IT in creating interactive educational environments that enhance teaching methods and assessment quality (Danielson, 2011; Ali & Elmahdi, 2001; Fawzi, 2010; Irving, 2015; Damick, 2015; Caldwell, 2007; Baylor & Ritchie, 2002). Irving (2015) emphasizes that IT supports formative assessment by creating classroom environments where teachers and students can assess learning and track progress throughout the teaching process. Teachers use various techniques, such as interviews, warm-up activities, quizzes, group discussions, and the think-pair-share method, to encourage student participation in formative assessments. Bhagat and Spector (2017) found that technology enhances learning outcomes, motivation, and attitudes across disciplines. Given the digital nature of today's learners, Bhagat and Spector (2017) also call for further research on how technology can support formative assessment. IT integration allows real-time data collection and timely feedback, addressing limitations such as the time required to gather and analyze student work (Beatty & Gerace, 2009). However, Bhagat and Spector (2017) note that most prior studies on formative assessment have not adequately emphasized IT's role.

When selecting IT tools for formative assessment, Robertson et al. (2019) from Grand Canyon University proposed eight essential criteria: immediacy, detailed feedback, personal feedback, reusability, a suitable interface, interaction, value-added features, and overall score. These criteria serve as practical guidelines for effectively choosing and utilizing software in formative assessment.

Based on the analysis above, it is evident that formative assessment holds particular importance in general classrooms and mathematics classes. In typical mathematical scenarios, especially when teaching mathematical concepts, appropriate formative evaluations are essential to support each student in achieving the lesson objectives in a manner that aligns with their individual learning style. The integration of information technology into formative assessment has demonstrated its effectiveness in addressing challenges such as time constraints and large class sizes. This approach enables teachers to provide proactive and timely support to each student, even within the limited time available, compared to traditional assessment methods.

2.3. Using Microsoft Forms software in formative assessment

Microsoft Forms is a relatively new online application from Microsoft and part of the Office 365 suite that allows users to create surveys and questions. When using this software for formative assessment it can provide the following benefits: Direct feedback tailored to each learner based on their responses; grading of questions so students can track their progress or teachers can quickly view total scores per student; tests can be easily shared via links or embed codes; teachers can view real-time results in class or review them on demand; teachers can review answers by question to assess overall understanding of a specific topic among all students or individual students to identify those needing assistance; collaboration with colleagues by sharing and assigning editing rights to tests; and resetting answers with a click for reuse with a new group of students. These benefits of Microsoft Forms are truly valuable for formative assessment, addressing time constraints and enhancing interaction with students during classroom assessments without the support of information technology.

One of the functions of Microsoft Forms is its ability to design multiple-choice questions - a form of objective assessment widely used in formative and summative evaluation in education (Mehta & Mokhasi, 2015). Conducting formative assessments online offers the advantage that students can work in their own learning style, at their own pace, and can repeat assessments multiple times while receiving immediate feedback (Buchanan, 2000). Immediate feedback is a particularly significant advantage of online multiple-choice questions (MCQs), as it has been shown to have the greatest impact on student learning when provided immediately after assessment (Epstein et al., 2001). Gibbs (2006) argues that the frequency of feedback significantly contributes to the overall quality of feedback and, consequently, its impact on student learning. Therefore, MCQ assessments have been proven effective in providing feedback to students (Ramsden, 1992). Gipps (2005) notes that it is crucial for feedback to include not only scores but also comments, evaluations, and guidance on how students can improve their learning strategies. Careful design of multiple-choice tests is essential to ensure students receive quality feedback.

In particular, Microsoft Forms has a highly useful feature known as branching. This feature is especially meaningful in assessments for student progression. When designing questions, instructors can incorporate branching logic into surveys or tests to dynamically adjust based on each student's responses to specific questions. In a branching survey or test, the next question appears only if it is relevant to the user's previous answer. With this branching feature, teachers can preplan responses for most scenarios students encounter, promptly correct mistakes, or provide tailored support to each student as they progress toward lesson objectives.

3. MATERIALS AND METHODS

In this study, we employed both qualitative and quantitative research methods. Qualitative research is an educational research type where the study is based on participants' viewpoints, involving broad, open-ended questions; data collection from participants through spoken or written responses; and analysis and organization of these verbal and textual data based on subjective meanings (Creswell & Poth, 2016; Shorten & Smith, 2017). In our qualitative research, we primarily utilized observational techniques: observing visible phenomena (Schensul et al., 1999), watching participants by paying attention to what happens, occasionally using recording tools for specific purposes. In this study, we conducted structured observations (systematically designed observation content) to observe the process of designing questions in a 7th-grade mathematics concept lesson plan using Microsoft Forms for formative assessment.

The next qualitative assessment method we employed was interviews. According to Esterberg (2002), an interview is a meeting between two individuals to exchange information and ideas through questions and answers, resulting in communication outcomes and jointly constructing meanings on a specific topic. Therefore, we used interviews with teachers from some of the junior high schools mentioned above.

The questionnaire for teachers in this study consists of 16 content items, covering their knowledge of Microsoft Forms software and its use in teaching mathematical concepts in 7th grade. Specifically, it includes: 1 question regarding teachers' understanding of the role of Microsoft Forms in assessing the learning process; 4 questions regarding the extent of using this software in typical teaching situations of Mathematics; 8 questions focusing on the skills in using Microsoft Forms during different stages of teaching mathematical concepts; 3 final questions concerning teachers' feedback on difficulties, advantages, and their expectations regarding the use of this software. For students, there are 6 questions, focusing on skills in using the question sets prepared on Microsoft Forms by teachers and whether they desire to learn mathematical concepts using Microsoft Forms. We utilized a Likert scale to rank responses from strongly disagree to strongly agree in the survey forms.

The teachers and students participating in this survey were randomly selected from junior high schools located in provinces such as Quang Ninh, Thai Binh, Nam Dinh, and Phu Tho. With the survey results obtained, we used descriptive statistical software, SPSS, to analyze the data. This analysis helped us identify technical recommendations for using Microsoft Forms software to conduct formative assessments in teaching mathematical concepts in 7th grade.

4. RESULTS AND DISCUSSION

4.1. Results

4.1.1. The current status of using Microsoft Forms software in formative assessment while teaching mathematics grade 7

The qualitative and quantitative methods used in this study include semi-structured interviews and focus group discussions. These methods were employed to explore experiences of using Microsoft Forms software when teaching mathematical concepts in junior high schools generally and specifically for 7th graders. The interviews were conducted based on survey questionnaires with 30 participating teachers. Given the nature of their work, the teachers in the surveyed junior high schools may teach across grades 6, 7, 8, and 9. From the 30 teachers surveyed, we gathered data on the number of classes taught by each teacher, totaling 46 classes. The percentage distribution of these classes across grades 6, 7, 8, and 9 is shown in the following table:

Table 1. Information about the classes taught by teachers in the focus group

Frequencies			
		Responses	
		N	Percent
Class	6	8	17.4%
	7	13	28.3%
	8	11	23.9%
	9	14	30.4%
Total		46	100.0%

In this study's survey, 100% (all 116 students) who participated were 7th-grade students, aligning with the content of the survey questions.

Table 2. Information about student interviewees, categorized by grade level and the number of students in each grade

Class		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7	116	100.0	100.0	100.0

After processing the survey data, we obtained the mean and standard deviation values for the questions in the teacher questionnaire as follows:

Table 3. Mean and standard deviation values for responses in the teacher questionnaire

	N	Mean	Std. Deviation
1. Do you often use Microsoft Forms to teach mathematics?	30	3.70	0.794
2. Do you often use Microsoft Forms to teach mathematical concepts?	30	3.23	0.858
3. Do you frequently use Microsoft Forms to teach mathematical theorems or properties?	30	3.17	1.020
4. Do you frequently use Microsoft Forms to teach mathematical rules/methods?	30	3.23	1.006
5. Do you frequently use Microsoft Forms to teach solving mathematical exercises?	30	3.33	1.124
6. Have you ever used Microsoft Forms to design objective multiple-choice questions when teaching mathematical concepts?	30	3.37	0.964
7. Have you designed branching objective multiple-choice questions based on student's' answers using Microsoft Forms when teaching mathematical concepts?	30	3.27	0.980
8. Do you design branching options to help students correct mistakes?	30	3.30	1.022
9. When students have successfully used branching questions to correct mistakes, can they proceed to complete the next main question?	30	3.33	1.155
10. When students use branching questions to correct mistakes but are still unsuccessful, does the Microsoft Forms software direct them to appropriate learning resources or provide direct assistance from the teacher to help them with their mistakes?	30	3.30	0.988
Valid N (listwise)	30		

Teachers made several changes in their lesson plans when implementing Outcome-Based Education (OBE). When they put them into practice, they observed many positive changes in their classrooms.

Table 4. Reliability coefficients of the questions in the teacher questionnaire

	Scale Mean if Item Deleted	**Scale Variance if Item Deleted**	**Corrected Item-Total Correlation**	**Cronbach's Alpha if Item Deleted**
Do you often use Microsoft Forms to teach mathematics?	29.31	67.293	0.739	0.967
Do you often use Microsoft Forms to teach mathematical concepts?	29.79	65.884	0.793	0.965
Do you frequently use Microsoft Forms to teach mathematical theorems or properties?	29.86	62.195	0.894	0.961
Do you frequently use Microsoft Forms to teach mathematical rules/ methods?	29.79	62.313	0.898	0.961
Do you frequently use Microsoft Forms to teach solving mathematical exercises?	29.69	60.222	0.918	0.960
Have you ever used Microsoft Forms to design objective multiple-choice questions when teaching mathematical concepts?	29.66	63.948	0.823	0.964
Have you designed branching objective multiple-choice questions based on students' answers using Microsoft Forms when teaching mathematical concepts?	29.76	62.975	0.878	0.962
Do you design branching options to help students correct mistakes?	29.72	62.207	0.888	0.961
When students have successfully used branching questions to correct mistakes, can they proceed to complete the next main question?	29.69	61.365	0.819	0.965
When students use branching questions to correct mistakes but are still unsuccessful, does the Microsoft Forms software direct them to appropriate learning resources or provide direct assistance from the teacher to help them with their mistakes?	29.72	63.421	0.838	0.963

Based on the obtained results regarding the mean values, standard deviations, Cronbach's alpha coefficients, and correlations among the questions in the tables above, we found that the majority of teachers used Microsoft Forms software in teaching typical situations in Mathematics. However, concerning the use of branching questions within Microsoft Forms, we observed that some teachers only occasionally utilized this feature.

Analyzing the difficulties teachers encountered through the surveys and direct interviews, 18 out of 30 the teachers indicated that the software was still relatively new to them. They lacked skills in using the software and designing branching questions for teaching Mathematics effectively. Therefore, to ensure teachers can proficiently use Microsoft Forms for effective formative assessment, it is crucial to equip them with essential knowledge about the role, significance, and impact of Microsoft Forms software. Additionally, training sessions should focus on imparting basic and necessary skills, accompanied by relevant illustrative examples.

Regarding the student survey, we obtained the following results:

Table 5. Mean and standard deviation values of the responses to in the student questionnaire

	N	Mean	Std. Deviation
1. Have you ever been asked by your teacher to use Microsoft Forms during math classes?	116	2.58	1.238
2. Have you ever been asked by your teacher to use Microsoft Forms during lessons on mathematical concepts?	116	2.57	1.246
3. When answering objective multiple-choice questions on Microsoft Forms, if you answer a question incorrectly, are you immediately given another question to correct your mistake?	116	2.79	1.275
4. When answering objective multiple-choice questions on Microsoft Forms, does the sequence of questions you receive look the same as that for other students in the class?	116	2.82	1.241
5. When answering objective multiple-choice questions on Microsoft Forms, do you find it easier to absorb knowledge?	116	3.07	1.235
6. Do you want teachers to use Microsoft Forms during math lessons?	116	3.28	0.708
Valid N (listwise)	116		

Table 6. Reliability coefficients of the questions in the student questionnaire

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1. Have you ever been asked by your teacher to use Microsoft Forms during math classes?	14.53	22.999	0.815	0.883
2. Have you ever been asked by your teacher to use Microsoft Forms during lessons on mathematical concepts?	14.54	22.668	0.842	0.879
3. When answering objective multiple-choice on Microsoft Forms, if you answer a question incorrectly, are you immediately given another question to correct your mistake?	14.32	22.671	0.816	0.883
4. When answering objective multiple-choice questions on Microsoft Forms, does the sequence of questions you receive look the same as that for other students in the class?	14.29	22.957	0.816	0.883
5. When answering objective multiple-choice questions on Microsoft Forms, do you find it easier to absorb knowledge?	14.04	22.807	0.837	0.880
6. Do you want teachers to use Microsoft Forms during math lessons?	13.83	30.996	.344	0.936

From the analysis based on data collected from the student questionnaires, it is evident that although students had been exposed to Microsoft Forms to a certain extent during their learning process, they desired more frequent usage to align with their individual learning trajectories. This serves as an encouragement for teachers to pay more attention to, explore, and use Microsoft Forms tools more extensively.

4.1.2. How is Microsoft Forms software effectively used in formative assessment when teaching mathematical concepts in 7th grade?

During their lessons, the four teachers in this study observed their student engagement. They shared that in the first lessons implemented OBE, the students were not fully engaged. Several students were even reluctant to participate in the classroom activities. However, they gradually enjoyed learning with OBE and engaged more with the lessons.

As analyzed above, we used Microsoft Forms software with the function of designing multiple-choice questions with 4 options and branching capabilities.

Each activity in teaching mathematical concepts can be considered as an idea for designing multiple-choice questions. The correct pathway is that students will answer the main questions. When students encounter difficulties (choosing the wrong option in each multiple-choice question), the computer will switch to an easier question (branching question) based on each student's mistakes, helping them immediately correct those errors. Once a student resolves the mistake, they can return to the main pathway with the main questions. Therefore, each student's pathway will not be the same along the path of addressing the key questions.

Here is an illustration:

Example: 7th-grade students learn the concept of direct proportionality (Mathematics textbook for grade 7, Canh Dieu Series, volume 1, page 59): If quantity y is related to quantity x by the formula y = kx (where k is a nonzero constant), then we say y is directly proportional to x with the proportionality constant k.

Multiple-choice questions for the first phase of approaching the concept via the sequential pathway could be as follows:

Circle the correct statement among the following statements:

Question 1. The length x (m) and the mass m (kg) of a phi 18 iron bar are related by the formula $m = 2x$. The appropriate numbers to fill in the ? in the following table are:

x(m)	4	5
m(kg)	?	?

A1. 2; 2,5 *B1. 8; 10* *C1. 8; 2,5* *D1. 2; 10*

If students choose the correct option B1, they will proceed to question 2. If students choose option A1, C1, or D1, it indicates that they have not fully understood the meaning of the hypothesis$m = 2x$ given in the problem. Therefore, a branching question to address this mistake could be:

Question 1.1. Assuming, $m = 2x$ given the value of xxx, how will the value of mmm be calculated?

A1.1. Take the value of *x* and divide by 2 B1.1. Take the value of *x* and add 2

C1.1. Take the value of *x* and multiply by 2 D1.1. Take the value of *x* and subtract 2.

If students choose the correct option C1.1, they can immediately go back to question 1; however, if they continue to choose the incorrect options A1.1, B1.1, or D1.1, they can proceed to question 1.2 as follows:

Question 1.2. What relationship does the notation $m = 2x$ represent between m and x?

A1.2. m is the product of 2 and x

B1.2. m is the result of dividing 2 by x

C1.2. m is the result of the difference between 2 and x

D1.2. m is the result of the sum of 2 and x

If students choose the correct option A1.2, the system will take them back to question 1.1. If students choose options B1.2, C1.2, or D1.2, the system will provide a hint: when two letters or a number and a letter are written next to each other, it represents multiplication. Then, students will redo question 1.2.

Question 2. Given the numbers in the table below.

x	0	2	4	6
y	0	4	8	12

Which formula below represents the corresponding pairs of numbers x and y in the table above?

A2. y = x + 4 B2.y = x +2 C2.y = x.2 D2.y = x. ½

If the student chooses option C2 correctly, the computer will proceed to question 3.

If choosing A2 (due to observing the value of y and being 4 units apart), the computer will move to branching question 2.1 as follows:

Question 2.1. Which pair of numbers x, y below represent the relation *y = x + 4* ?

A21. x = 0; y = 0 B21. x = 2; y = 4 C21. x = 4; y = 8 D21. x = 6; y = 12

This question is very easy for students to choose the correct option, which is C21. Then, the students will be returned to question 2.

If choosing B2 due to the student observing the value of x and being 2 units apart, the computer will move to branching question 2.2 as follows:

Question 2.2. Which pair of numbers x, y below represent the relation *y = x + 2* ?

A22. x = 0; y = 0 B22. x = 2; y = 4 C22. x = 4; y = 8 D22. x = 6; y = 12

This question is very easy for students to choose the correct option, which is B22. Then, the students will be returned to question 2.

If choosing D2 due to the student confusing the roles of x and y, the computer will move to branching question 2.3 as follows:

Question 2.3. Which pair of numbers x, y below represent the relation *y = x. ½* ?

A23. x = 0; y = 0 B23. x = 2; y = 4 C23. x = 4; y = 8 D23. x = 6; y = 12

Question 3. In the table in question 1, for each value of x, the value of y is calculated as the product of 2 and x, so y is said to be directly proportional to x with a proportionality constant of 2. Which of the following statements expresses that y is directly proportional to x with a proportionality constant of k?

A3. If for each value of x, the corresponding value of y is calculated as the quotient of a constant k (which is a non-zero constant) divided by x, then we say that y is directly proportional to x with a proportionality constant of k.

B3. If for each value of x, the corresponding value of y is calculated as the sum of a constant k (which is a non-zero constant) and x, then we say that y is directly proportional to x with a proportionality constant of k.

C3. If for each value of x, the corresponding value of y is calculated as the difference between a constant k (which is a non-zero constant) and x, then we say that y is directly proportional to x with a proportionality constant of k.

D3. If for each value of x, the corresponding value of y is calculated as the product of a constant k (which is a non-zero constant) multiplied by x, then we say that y is directly proportional to x with a proportionality constant of k.

If the student chooses D3 correctly, they will proceed to question 4. If the student chooses A3, B3, or C3, they will be directed to question 3.1 as follows:

Question 3.1. In the table from question 1, for each value of x, the value of y is calculated as the product of 2 and x, so y is said to be directly proportional to x with a proportionality constant of 2. When replacing the value 2 with a non-zero constant k, what relationship between x and y do we obtain?

A31. y = kx B31. y = k : x C31. y= k + x D31. y = k - x

Students can easily choose the correct answer, which is A31. Afterward, they will be returned to question 3.

Stage 2. Reinforcing the concept of direct proportionality

Question 4. If x and y are directly proportional with a proportionality constant of 4, when y = 16, what is the corresponding value of x?

A4. 12 B4. 20 C4. 4 D4. 64

Here, the correct option is C4. If the student chooses options A4, B4, or D4, they will be directed to a hint question as follows:

Question 4.1. When x and y are directly proportional with a proportionality constant of 4, which formula expresses the relationship between x and y?

A4.1. y = 4x B4.1. y = x : 4 C4.1. y = x - 4 D4.1. y = x + 4

If the student chooses the correct option A41, they will proceed to question 5. If the student chooses options B4.1, C4.1, or D4.1, they will be redirected back to question 3. If they answer question 3 correctly, they will return to question 4. If they answer question 3 incorrectly, they will proceed to question 3.1.

Question 5. If x and y are directly proportional with a proportionality constant k, and when x = -5, y = -7, find the proportionality constant k.

A5. $k = \frac{5}{7}$ B5. $k = \frac{7}{5}$ C5. k = -2 D5. k = - 12

If the student chooses the correct option B5, they will proceed to question 6. If the student chooses any of the other options A5, C5, or D5, they will be directed to question 5.1 as follows:

Question 5.1. In the formula y = kx (where k is a constant, not equal to 0), how is the value of k calculated?

A5.1 $k = \frac{x}{y}$ B5.1 $k = \frac{y}{x}$ C5.1 k = y - x D5.1 k = y + x

Students will easily choose the correct option, which is B5.1, and will be returned to question 5 afterward.

Question 6. Which statement below is correct?

When two quantities are directly proportional to each other:

A6. The sum of the corresponding quantities is a constant number.

B6. The difference of the corresponding quantities is a constant number.

C6. The product of the corresponding quantities is a constant number.

D6. The ratio of the corresponding quantities is a constant number.

If the student chooses the correct option D6, they will proceed to question 7. If the student chooses any of the options A6, B6, or C6, they will be returned to question 5.

Stage 3. Applying the concept of direct proportionality

Question 7. The mass and volume of a homogeneous metal rod are directly proportional. It is known that a homogeneous metal rod with a volume of 9 dm^3 has a mass of 729 kg. Calculate the mass of the metal rod if the volume is 3 dm^3.

A7. 6561 kg B7. 2187 kg C7. 81 kg D7. 243 kg

Here, the correct option is D7. If a student chooses A7, B7, or C7, it indicates that the student hasn't yet understood the fundamental nature of the direct proportional relationship between the volume and mass of the metal rod.

To solve this question, students can think as follows:

- Based on the concept: for two directly proportional quantities, given a specific pair (x; y), for another specific x value, finding the corresponding specific y value requires determining the proportionality constant k. This constant always remains unchanged. Starting from the initial specific pair (x; y), we can determine k, thus obtaining the correct answer.

- Based on the property: when x and y are directly proportional, if x increases (decreases) by a certain factor, y also increases (decreases) by the same factor. Therefore, if the volume decreases by 3 times, the mass will also decrease by 3 times, providing the correct answer.

When a student chooses options A7, B7, or C7 (which are incorrect options), the student will be redirected to question 7.1.

Question 7.1. The mass (m) and volume (V) of a homogeneous metal rod are directly proportional. It is known that a homogeneous metal rod with a volume of 9 dm^3 has a mass of 729 kg. In this case, the formula relating the mass and volume of the metal rod and the proportionality constant k is:

A7.1. m=81.V; k=81

B7.1. V=81.m; k=1/81

C7.1. m=81.V; k=1/18

D7.1. V= 81.m; k=81

If the student chooses the correct option A7.1, they will proceed to either question 7.2 or 7.3. If the student chooses any of the other incorrect options, they will be redirected back to question 3.

Question 7.2. The mass and volume of a homogeneous metal rod are directly proportional according to the formula m = 81V. Calculate the mass of the metal rod if the volume is 3 dm³.

A7.2. 6561 kg B7.2. 2187 kg C7.2. 81 kg D7.2. 243 kg

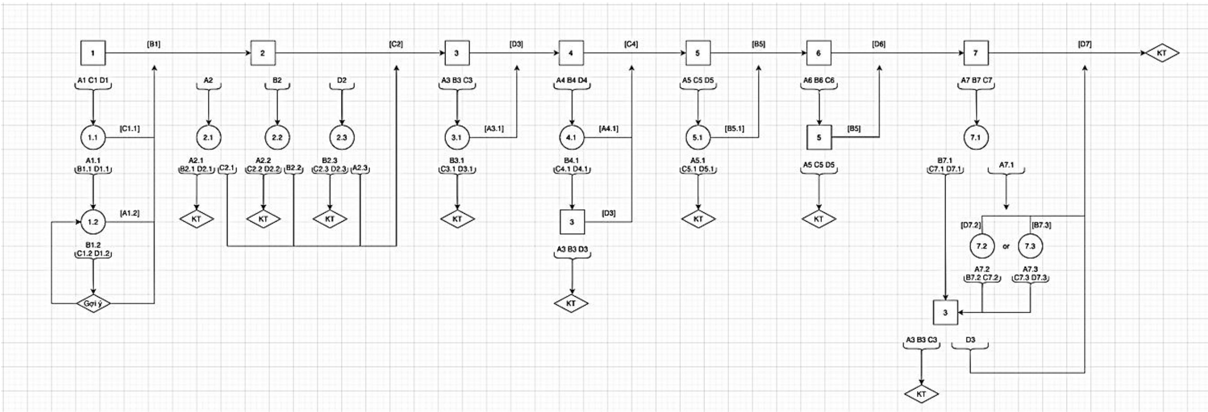
Alternatively, if the student chooses branch 2.

Question 7.3. The mass and volume of a homogeneous metal rod are directly proportional. It is known that a homogeneous metal rod with a volume of 9 dm³ has a mass of 729 kg. If the volume of this metal rod decreases by 3 times, what will be its mass?

A7.3. Increases 3 times B7.3. Decreases 3 times C7.3. Remains unchanged

Here, students can easily choose the correct option B7.3. If they choose an incorrect option (the remaining options), they will be redirected back to question 3.

The logic diagram of the main questions and branching questions is illustrated below:



All the main questions and branching questions were conducted by students on a computer using the link or by scanning the QR code. Students can complete the system of questions using the following link: https://forms.office.com/r/3Vg2CMiedt or QR code.

Above is an illustrative example of using a three-stage process to teach a mathematical concept. Clearly, we can see how each student follows a personalized learning path with the help of Microsoft Forms software. Although we do not directly see the role of the teacher as in traditional classroom teaching, it is evident that the teacher's preparation before class is meticulous, anticipating most of the thoughts, mistakes, and difficulties each student may encounter to provide timely assistance. This contributes to demonstrating the humanitarian aspect of education in general and evaluating the learning process in particular.

4.2. Discussion

The study first explored the frequency and methods of using Microsoft Forms software in designing multiple-choice objective questions for formative assessment in teaching mathematics by junior high school teachers. The data analysis indicated that the mathematics teachers in some junior high schools in Northern Vietnam were aware of and began using Microsoft Forms in their teaching. This finding aligns with the broader trend of digital transformation in education currently underway in Vietnam (Zizikova et al., 2023).

The study also revealed how teachers utilized this software to design multiple-choice questions for various teaching scenarios in mathematics. However, their use of the tool has predominantly involved presenting the questions to the class as a whole, comparing student answers with the correct ones, and addressing incorrect responses either through direct corrections or by inviting a student representative to explain the correct approach. This practice exposes a gap in personalized learning during process assessments, as the current approach remains largely uniform. The branching feature of Microsoft Forms offers potential to bridge this gap by supporting tailored learning experiences for individual students.

Illustrating the use of Microsoft Forms in teaching a 7th-grade mathematical concept, the study suggests a structured two-stage process. In the first stage, teachers design both main circuit and branching questions. The main circuit questions are developed based on typical student activities related to the concept being taught, ensuring that solving each question helps students explore a specific aspect of the concept. The final question in the main circuit requires students to articulate the entire concept, reinforcing their understanding. Teachers also design questions to reinforce theoretical knowledge, practice skills directly related to the concept, and apply the learned knowledge to new situations or practical scenarios.

Branching questions are introduced immediately after each main question to address common mistakes. These questions are simpler, more visual, and tailored to help students correct errors made in the main questions. Depending on the mistakes identified, teachers can provide additional hints or direct guidance through these branching opportunities. At the end of this stage, teachers create a diagram of the main circuit and branching questions, as illustrated in the example of teaching direct proportionality.

The second stage involves translating the designed questions into Microsoft Forms. Teachers use the software's tools for creating multiple-choice questions and incorporate the branching feature to create a dynamic learning experience. After completing the design, they test and refine the program to ensure functionality. However, teachers need to consider the limitations of the "Add branching" feature, which only supports downward navigation through sections. If a question requires students to revisit an earlier section, the teacher must duplicate that section and place the duplicate below the current question. For example, if a student answers question 3 incorrectly and is directed to question 3.1, answering 3.1 correctly redirects them back to a duplicated version of question 3 in a lower section.

The study identified several limitations of the branching function. Firstly, the feature's inability to support backward navigation requires workarounds such as duplicating earlier sections. Secondly, when a wrong answer branches to the "End form" section, the software displays "Submit" instead of "Next," potentially revealing the correct answer. To avoid this, teachers can redirect incorrect answers to a separate end notification section, ensuring that the "Next" button remains active for all responses.

Addressing these technical challenges will enhance the effectiveness of Microsoft Forms in teaching and learning. The software enables students to engage in self-learning, research, and progress assessment anytime and anywhere, fostering an individualized approach to education. By optimizing its functionality, teachers can support each student's desire for unlimited knowledge expansion and empower them to learn according to their own pace and interests.

5. CONCLUSION

Applying Microsoft Forms to explore the teaching process in specific scenarios, such as teaching the concept of direct proportionality in 7th-grade Mathematics, highlights the software's potential in Mathematics education. This approach is particularly significant as it supports individual student progress by addressing their unique difficulties, mistakes, and personal challenges, rather than focusing solely on group-based learning outcomes. By leveraging the multiple-choice objective question design and branching logic features of Microsoft Forms, teachers can provide timely and tailored support to students during real-time learning activities in Mathematics classes.

This method offers a solution to the challenges of personalized teaching in large classes with limited instructional time. It enables students to learn according to their cognitive abilities and progress at their own pace. However, effective implementation requires teachers to invest considerable time and effort in meticulously designing instructional programs before each class. Such preparation ensures that the software's capabilities are fully utilized to enhance learning outcomes.

Despite its promise, the application of Microsoft Forms in teaching and assessment faces several challenges. Teachers must develop the technical proficiency to use the software effectively and prepare thoroughly for assessment activities. Moreover, adequate technical support and training are essential to equip teachers with the necessary skills and confidence to integrate this tool into their teaching practices. Addressing these challenges will require sustained attention and support from educational administrators and policymakers, ensuring the effective and sustainable integration of technology in education.

Looking ahead, an intriguing question arises: could further research and advancements in artificial intelligence (AI) provide additional support for teachers? AI could potentially aid in developing more diverse, profound, and tailored branching scenarios that align more closely with students' developmental stages and learning needs. This possibility remains an open area for exploration and presents a compelling avenue for future research in the ongoing effort to enhance the educational experience.

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