Journal of Management World **2025**, 1:216-222
DOI: 10.53935/jomw.v2024i4.641

Exploring the Need for Differentiated Instruction Frameworks in Enhancing 21st Century Skills in Mathematics Education

Mohd Afifi Bahurudin Setambah[1*], Azli Ariffin[2], Syaza Hazwani Zaini[3], Anis Norma Mohamad Jaafar[4], Habibi Ratu Perwira Negara[5], Hayato Hanazono[6]

[1,2,3,4]Universiti Pendidikan Sultan Idris, Malaysia; mohdafifi@fpm.upsi.edu.my (M.A.B.S.).
[5]UIN Mataram, Indonesia.
[6]Miyagi University of Education, Japan.

Abstract. This study aims to explore the need to develop a 21st century knowledge and skills framework based on differentiated instruction, especially in mathematics education. This study uses a cross-sectional survey design by combining quantitative and qualitative data. 100 mathematics teachers from various schools in Malaysia were selected with certain criteria to be used as a study sample. While 3 teachers among the teachers were interviewed to obtain their views in depth. The study findings show that teachers have basic knowledge of differentiated instruction, but they are not confident in implementing it in mathematics teaching, especially in applying 21st century knowledge and skills. The findings show that there is a high need to develop a 21st century knowledge and skills framework based on differentiated instruction for mathematics education. This study is expected to have implications for improving teachers' skills in teaching mathematics, supporting the curriculum and strengthening students' soft skills.

Keywords: Differentiated Instruction, 21st Century Skills, Mathematics, Teaching, Malaysia.

1. INTRODUCTION

The Malaysian Education Blueprint 2013–2025 (MEB) has set the development of human capital as a key agenda in the effort to produce global-class students. Global-class human capital refers to students who possess 21st century skills, which include not only high academic skills, but also thinking skills, collaboration skills, and information and communication technology skills (Hafizi & Kamarudin, 2020; Razak & Din, 2020). However, studies have shown that there are significant challenges in equipping Malaysian students with these 21st century skills, particularly in the context of mathematics education (Mohamad et al., 2023). These skills can be seen through balanced attributes, such as ethics, spirituality, leadership, national identity, and thinking and knowledge skills. This mission aims to produce human capital that is competitive in a global society. Therefore, teaching and learning need to take into account the outcome aspect rather than just focusing on educational inputs.

However, previous studies have shown that traditional teaching methods practiced by most educators in developing countries, including Malaysia, still fail to integrate elements of critical thinking skills among students. An approach based on memorizing mathematical facts and formulas is still dominant in the classroom, with little focus on developing problem-solving abilities and creative thinking (Hafizi & Kamarudin, 2020). This approach is not sufficient to equip students with the 21st century skills required in the modern workforce. Studies found that many educators still use lecture approaches, individual training, and class discussions without giving sufficient focus to critical thinking skills (Sulaiman et al., 2022; Rozi, 2021). Therefore, there is a need to adapt teaching strategies that focus more on the development of critical and creative thinking skills, which will enhance students' ability to deal with the challenges of the 21st century. However, a study by Nagappan (2010) found that 103 out of 364 teachers were not confident in their ability to apply critical thinking skills in their teaching. Similarly, the lack of training and pedagogical knowledge among teachers is a major obstacle in improving students' thinking skills (Benedicto & Andrade, 2022). The need to emphasize training and mastery of teaching methods that enrich thinking skills among teachers and prospective teachers must be prioritized. (Hafizi & Kamarudin, 2020; Dwee et al., 2016). In addition, the element of critical thinking skills also has a significant relationship with leadership skills, which are increasingly seen as an important aspect of education and human capital development (Dong & Qin, 2023; Jamil, 2021; Nor & Sihes, 2021). Leadership skills, especially in communication, are closely related to critical thinking skills and are needed to produce graduates who are able to lead and work in teams (Setambah, 2019: Pellegrino & Hilton, 2012). The Ministry of Education of Malaysia (2007) has made the development of leadership skills as one of the learning outcomes to be achieved in the effort to produce excellent human capital. This coincides with the needs of the industry, where employers are looking for candidates who are not only excellent in academics, but also have high soft skills such as leadership, communication, and critical thinking skills (Hirudayaraj et al., 2021) (Karimi & Piña, 2021; Goulart et al., 2021). In line with this challenge, the Ministry of Education Malaysia (2015) proposed the use of experiential learning approaches to empower human capital. However, studies have found that students pay less attention to co-curricular activities when they are not relevant to their academics (Selvarajoo & Baharudin, 2023; Ismail et al., 2020). Therefore, the integration of activities that develop soft skills into structured teaching and learning can overcome this deficiency (Tang, 2018; Rawat et al., 2014).

* Correspondence: mohdafifi@fpm.upsi.edu.my

In this context, this study aims to explore the need to develop a 21st century knowledge and skills framework based on differentiated pedagogy specific to mathematics subjects, especially in the topic of basic operations. This study will also explore the key elements that need to be present in the framework to support effective learning, thus improving students' 21st century knowledge and skills. Along with the abolition of the Primary School Assessment Test (*Ujian Penilaian Sekolah Rendah*, UPSR) and the Form Three Assessment (*Pentaksiran Tingkatan Tiga*, PT3) by the Ministry of Education of Malaysia, there is room to change the teaching approach to be more comprehensive and relevant to the needs of the 21st century (Hasimi & Muhammad, 2021). Therefore, this study is expected to provide an important contribution in formulating a more inclusive and effective pedagogical guide in mathematics education.

2. DIFFERENTIATED INSTRUCTION

Differentiated instruction (DI) is an approach to teaching that is tailored to the needs, abilities, and personalities of individual students, with the aim of achieving more effective learning. Tomlinson (2014) defines differentiated instruction as a teaching method that involves modifications in the content, process, product, and learning environment to meet the needs of different students in the classroom (Figure 1). This approach allows teachers to adapt their teaching to match students' levels of understanding and diverse learning styles. According to Mustaffa et al. (2021), DI not only provides space for students to learn according to their abilities, but also to stimulate their interest and motivation towards learning. DI in mathematics education is an approach that addresses diverse student needs by modifying content, process, and product based on readiness, interests, and learning styles (Magayon & Tan, 2020). Research indicates that DI can enhance mathematical understanding and achievement in school and college settings (Insorio, 2024; Bal, 2023). Implementing DI involves strategies such as flexible grouping, tiered assignments, and compacting. However, challenges include time-consuming preparation, classroom management issues, and resource limitations (Insorio, 2024; Abbati, 2012). Successful implementation requires teacher competency, confidence, and commitment (Abbati, 2012; Woolcott et al., 2021). While DI has shown positive impacts on student engagement and motivation, its effect on attitudes towards mathematics may be limited (Bal, 2023). To bridge the gap between theory and practice, ongoing professional development and supportive organizational conditions are crucial (Woolcott et al., 2021; Abbati, 2012).

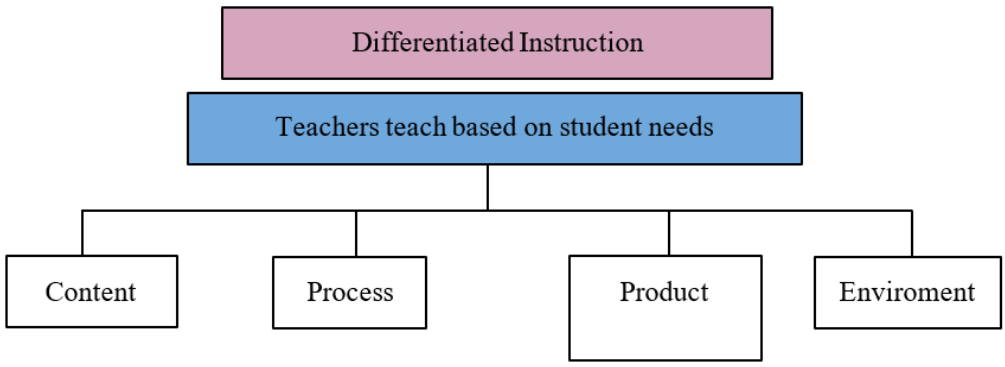


Figure 1: Differentiated Instruction Concept.

Along with that, 21st century learning emphasizes the importance of critical skills that students need to have to face the challenges of the modern world. 21st century learning combines academic knowledge with broader skills, including critical thinking, creativity, communication, collaboration, and literacy in information and communication technology (ICT) (Alismail & McGuire, 2015). There are four main principles in 21st century learning that must be applied in the planning and implementation of teaching: (i) student-centered learning; (ii) collaborative learning; (iii) contextual learning; and (iv) community-integrated learning (Khalil & Osman, 2017). These principles indicate that learning approaches need to be flexible and adaptable to the needs of students in heterogeneous classes. One of the important components of 21st century education is the mastery of the 4Ks, namely critical skills, communication skills, collaboration, and creativity. These four skills are considered the foundation that students need to master to succeed in an increasingly knowledge- and technology-oriented world (Ministry of Education Malaysia, 2024). In Malaysia, the emphasis on these skills is also a main focus in the Malaysian Education Blueprint (MEB) 2013-2025, which aims to produce students who are not only knowledgeable, but also globally competitive. In this context, teachers play a very important role in nurturing and developing the 4K skills among students. Therefore, the use of innovative pedagogies such as DI is very important to ensure that the needs of each student can be met. The use of differentiated pedagogy in the mathematics classroom, particularly in the teaching of basic operations, has been shown to have a positive impact on student achievement. With this approach, teachers can tailor instructional content to students' levels of understanding and provide a variety of activities that emphasize problem-solving, critical thinking, and teamwork skills. This allows students to master mathematical concepts in a deeper and more meaningful way, thereby increasing their achievement in the subject. In the context of mathematics education, previous studies have shown

that DI can improve students' understanding of complex mathematical concepts, such as basic operations. Tomlinson (2014) explained that in mathematics teaching, DI can be used to change the way students learn and understand teaching materials. For example, for students who have a poor understanding of mathematical concepts, teachers can use more visual or manipulative teaching aids, while more advanced students can be given more challenging tasks in the form of open-ended problems or research assignments that involve the application of mathematical concepts to real-life situations. In this way, all students, regardless of their level of proficiency, can learn in a way that suits their style and needs. The education system in Malaysia, especially in mathematics, often faces challenges in ensuring that all students are able to master the necessary basic skills. Problems such as lack of conceptual understanding and low self-confidence levels among students have been reported as contributing factors to poor academic achievement in this subject (Mohd Faizal Nizam Lee & Leow, 2017). Therefore, a DI approach that focuses on the individual needs of students is very relevant to overcome this problem. By providing a more student-centered learning experience, DI can help ensure that all students, especially in mathematics, gain a deep understanding and reach their full potential. The development of a DI framework in mathematics education, particularly in the mathematics, is in line with the objectives of the MEB 2013-2025 which aims to produce competent human capital in various 21st century skills. By integrating DI in mathematics teaching, students can be equipped with the skills needed to face the challenges of an increasingly complex world, including critical thinking skills, creativity, and problem solving (Ministry of Education Malaysia, 2015). The use of this approach in mathematics teaching will not only improve students' academic achievement, but also prepare them with important skills needed in their future lives and careers. Based on the literature review discussed, it is clear that the integration of DI in mathematics education can have a significant impact on student achievement in the subject. With an approach that emphasizes individual needs and 21st century skills, differentiated pedagogy can help teachers achieve the goals of the MEB 2013-2025, which aims to produce highly skilled and competent students. Therefore, this study aims to develop a DI framework that can support mathematics learning, and thus contribute to the development of human capital in Malaysia.

3. METHODOLOGY

This study aims to analyze the development needs of a 21st century knowledge and skills framework based on differentiated pedagogy in the context of mathematics learning. To achieve the objectives of this study, the researchers used a cross-sectional survey design. This design was chosen because it allowed for the collection of quantitative data from mathematics teachers who were directly involved in teaching mathematics, and provided a clear picture of the current needs for the development of the framework. The researcher selected mathematics teachers as the study respondents. The selection of participants was purposive using certain criteria to ensure a relevant sample and representative of the population being studied. The selection criteria were as follows: (i) mathematics teachers with at least five years of teaching experience; (ii) teachers from schools with a small number of students; and (iii) teachers teaching in grades 1 to 6. This study involved 100 mathematics teachers who met the criteria. An online questionnaire was used to collect data from these respondents. The questionnaire was developed by the researcher and was validated by seven experts in the field of mathematics pedagogy, and DI. The reliability of this questionnaire instrument was tested using Cronbach's alpha, which showed a value of 0.87, indicating a high level of reliability. In addition, the CVI value for this questionnaire was also 1, which confirmed the validity of the instrument. The main data of this study were obtained through an online questionnaire distributed to all mathematics teachers who met the selection criteria. The questionnaire contained items related to the need for the development of a differentiated pedagogical framework for 21st century mathematics education. The questionnaire was distributed to 100 eligible teachers, and they were asked to provide feedback based on their experiences and views on teaching practices involving differentiated pedagogy and 21st century skills in mathematics education. To strengthen the quantitative data and gain deeper insights, the researchers also conducted a document analysis through a literature review related to differentiated pedagogy and 21st century skills. This approach allowed the researchers to understand current theories and practices in this field and identify knowledge gaps that need to be addressed in this study. In addition to the questionnaire, this study also incorporated a qualitative approach through interviews. The interviews were conducted to gain a deeper and richer insight into the needs for the development of a 21st century knowledge and skills framework in differentiated pedagogy. A total of three teachers who had responded to the questionnaire were selected for interviews. The selection of these teachers was made based on their willingness to be interviewed voluntarily. Although seven teachers were selected based on their responses to the questionnaire, only three agreed to be interviewed. The interview protocol used in this study was reviewed by Malay language experts and content experts to ensure the validity and accuracy of the questions asked. The interviews aimed to gain a deeper perspective on the application of differentiated pedagogy in mathematics learning and how it can be adapted to the 21st century skills required in the Malaysian educational context. The quantitative data obtained from the questionnaire were analyzed using descriptive statistics to identify general patterns and emerging trends related to the needs of differentiated pedagogy-based teaching and learning in mathematics education. Meanwhile, the qualitative data from the interviews were analyzed using thematic analysis, where the main themes related to the needs and challenges in implementing differentiated pedagogy to enhance 21st century skills among mathematics students were identified and analyzed.

4. FINDINGS

Researchers analyzed the data collected through the research instrument with the help of SPSS software version 23. According to Chua (2006), the use of descriptive statistics is to describe, explain and explain the characteristics of variables. Through the needs survey questionnaire, an initial picture regarding the level of need for the development of a 21st century knowledge and skills framework based on differentiated pedagogy for mathematics education can be obtained. Table 1 shows the mean value and standard deviation for each questionnaire item according to the knowledge construct.

Table 1: Analysis of needs related to DI.

	Differentiated Instruction Knowledge	Mean	Standard Deviation
1	I have my own teaching style.	4.22	0.645
2	Everyone has different characteristics.	4.66	0.478
3	I knew about Differentiated Instruction before.	4.02	0.765
4	Everyone has a different learning intelligence.	4.68	0.468
5	Differentiated Instruction is a new method in today's world of education.	3.76	0.964
6	Differentiated Instruction can help me be sensitive to the intelligence of diverse students in the classroom.	4.25	0.592
7	Differentiated Instruction is needed in today's teaching and learning process.	4.25	0.751
8	I need to know more about Differentiated Instruction, especially in mathematics.	3.87	0.660
	Differentiated Instruction Skills	Mean	Standard Deviation
9	I am skilled in implementing differentiated instruction in the teaching and learning (T&L) of mathematics in the topic of basic operations.	3.79	0.754
10	I am skilled in managing lesson content or learning scope according to the diversity of students based on differentiated instruction approaches.	3.79	0.703
11	I am skilled at diversifying different instruction activities according to the suitability of the topic and learning objectives.	3.75	0.768
12	I am skilled in preparing teaching and learning materials for differentiated instruction teaching of basic operations topics.	3.71	0.780
13	I am skilled in managing differentiated instruction activity materials based on the set time plan.	3.70	0.749
14	I am skilled in controlling differentiated instruction activities and the learning process according to planned teaching and learning objectives.	3.73	0.727
15	I am able to improve students' 21st century skills through the use of differentiated instruction approaches.	3.87	0.618
	The need to develop a 21st century knowledge and skills framework based on differentiated isntruction	Mean	Standard Deviation
16	Has a framework that contains elements of Differentiated Instruction in teaching mathematics (basic operations) not been developed?	4.01	0.739
17	Is there a need to develop a Differentiated Instruction framework suitable for teaching mathematics (basic operations)?	4.13	0.618
18	Can the application of differentiated instruction elements in mathematics (basic operations) influence teachers' teaching?	3.91	0.749
19	Is the application of differentiated instruction elements very effective in teaching students with different intelligences?	4.20	0.566
20	Is the application of differentiated instruction elements able to influence teachers' teaching in delivering lesson content in different ways?	4.12	0.730
21	Are elements of Differentiated instruction important to apply in teaching mathematics (basic operations) to develop students' 21st century skills?	4.21	0.617
22	Will the use of Differentiated Instruction approach in teaching increase teacher productivity?	4.08	0.688
23	Will the use of Differentiated instruction in teaching increase students' opportunities to achieve better results?	4.07	0.659
24	Is Different Pedagogy capable of developing students' 21st century knowledge and skills?	4.23	0.649

The interpretation of this survey data is based on the values proposed by Zulkifli Awang (2012). According to him, values of 1.00 to 2.49 are considered low, values of 2.50 to 3.79 are moderate and values of 3.80 to 5.00 are high. Based on the findings of the data from Table 1, it is shown that each item has a high level except for item 5, item 9, item 10, item 11, item 12 and item 14. These items have values less than 3.80 and are considered to be at a moderate level.

When viewed in more detail, the knowledge construct in differentiated pedagogy on average has a high level with a mean value of 4.21. The need is seen when teachers need to integrate mathematics in their differentiated pedagogy knowledge. For the skill construct, the findings show that teachers have good knowledge, but lack practical aspects, namely skills in implementing differentiated pedagogy with a mean value of 3.76. This shows that teachers still need training and guidance to implement differentiated pedagogy, especially in mathematics. Regarding the need to develop a framework, teachers believe that there is a need to develop a framework to serve as a guide. They believe that a framework that incorporates 21st century skills elements will improve the students' own development. This data finding is reinforced by the analysis of interviews conducted on 3 teachers

regarding differentiated pedagogy, which found two themes, namely knowing about differentiated pedagogy, having heard but not knowing about differentiated pedagogy. 2 of these 3 teachers have knowledge about differentiated pedagogy. They can state the characteristics of differentiated pedagogy teaching and learning. This can be seen through the interview excerpts of respondents 1 and 3 as follows:

"Okay, pedagogi terbeza biasa dengar, sekarang tengah hot. Pedagogi terbeza ini bahan berlainan ikut aras murid, cara kita mengajar pun lain. Boleh kita kumpulkan pelajar lemah, sederhana dan cemerlang dalam kumpulan yang berbeza-beza. Jadi bahan yang kita berikan tu nanti berbeza la"

Okay, differentiated instruction is something we often hear about, it's all the rage right now. Differentiated instruction is different materials according to the level of the students, and the way we teach is also different. We can group weak, average and excellent students into different groups. So, the materials we give will be different.

" ermm, saya pernah dengar ni. Saya rasa kita perlu guna bahan yang berlainan pada murid samaada murid tu lemah, sederhana dan pandai. Jadi tahap tugasan kita juga akan berbeza juga nanti"

ermm, I've heard this before. I think we need to use different materials for students whether they are weak, average and smart. So, the level of our assignments will also be different later on

Teachers have also implemented it in the teaching and learning process of mathematics. However, they are not very confident in their own skills to implement the session. This can be seen through the statement from respondent 2 as follows:

"saya pernah laksanakan pedagogi terbeza saya rasa. Saya bahagikan dalam kumpulan. Saya sediakan bahan yang berbeza-beza khususnya tugasan la. Tugasan kumpulan lemah saya bagi yang senang, tugasan susah saya bagi kumpulan yang pandai. Saya rasa itu la pedagogi terbeza. Murid akan jawab la soalan yang berbeza-beza berkenaan."

I have implemented differentiated instruction, I think. I divide into groups. I prepare different materials especially assignments. I give the weak group assignments to the easy ones; I give the difficult assignments to the smart ones. I think that is differentiated pedagogy. Students will answer different questions about

Based on the statement issued. The researcher believes that the teacher in question is trying to implement differentiated pedagogy for his teaching session. However, he lacks the skills to implement it. This statement supports the findings of the survey study through a questionnaire conducted by the researcher. For the need to develop a framework of knowledge and skills for the 21st century based on differentiated pedagogy, especially mathematics. All three respondents agreed that they need specific guidance to implement this approach. This view was emphasized by respondent 1 who stated that he really needs to develop a framework or model as a guide to make teaching using differentiated pedagogy, especially mathematics, clearer.

"… saya rasa amat perlu sebab kalua kita ada satu kerangka atau model, cikgu-cikgu boleh gunakan model tersebut. Jadi kita lebih jelas kepada proses pelaksanaan pedagogi terbeza ini. Kadang-kadang kita ikut cara kita sahaja. Ikut pemahaman kita bagi laksanakan pedagogi terbeza. Kalau guru besar kata ada laksanakan pedagogi terbeza. Kami jawab ada… tetapi pelaksanaannya kami tidak yakin betul atau tidak. Jika ada model, mungkin akan lebih tersusun, dan jelas. Kami juga akan lebih yakin."

I think it is very necessary because if we have a framework or model, teachers can use that model. So, we are clearer about the process of implementing this differentiated pedagogy. Sometimes we just follow our own way. Follow our understanding to implement differentiated pedagogy. If the headmaster says there is a differentiated pedagogy. We answer yes... but we are not sure if the implementation is correct or not. If there is a model, it might be more organized and clearer. We will also be more confident

In addition, respondent 2 also emphasized that guidelines for implementing differentiated pedagogical methods to develop 21st century knowledge and skills are very much needed.

"..bagi saya, perlulah bangunkan model ni. Kita selama ini tahu guna pendekatan. Tapi dalam masa yang sama nak bangunkan pengetahuan dan kemahiran abad ke-21 gunakan pendekatan ini susah. Kita pun kurang jelas dengan pelaksanaan pedogogi terbeza. Inikan pulak suruh cikgu masukkan elemen pabad ke-21. Jadi kalua ada model atau panduan. Kami boleh la ikut cara pelaksanaannya yang betul."

For me, it is necessary to develop this model. We have known how to use the approach. But at the same time, it is difficult to develop 21st century knowledge and skills using this approach. We are also not clear about the implementation of differentiated instruction. This is why teachers should include 21st century elements. So, if there is a model or guide, we can follow the correct implementation method.

For respondent 3, he stated that the need to develop this framework is very urgent. He also stated that it is appropriate that there is a framework as a guide for teachers and can help teachers to design teaching and learning based on this differentiated pedagogy, as well as develop human capital in terms of 21st century skills.

Respondent 3's statement is as follows:

"… pedagogi terbeza ini saya pernah dengar. Saya tahu, memang belum ada panduan hendak laksanakannya. Kalau dalam matematik lagi la tidak ada. Jadi kalau tuan hendak bina kerangka tersebut. Bagusla. Orang kata berguna la nanti. Semua cikgu boleh dapat idea untuk melaksanakan proses pengajaran dan pembelajaran nanti.

I've heard of this different instruction. I know, there really isn't a guide to implementing it. In mathematics, there isn't one yet. So, if you want to build that framework. That's great. People say it will be useful later. All teachers can get ideas to implement the teaching and learning process later. Based on the findings of this interview. It can be concluded that there is a need to develop a clear framework to be used as a guide in

implementing differentiated pedagogy. This framework also needs to be integrated with 21st century knowledge and skills to help teachers understand the implementation of improving human capital in depth. The findings of the interview with three teachers show that they really need a framework that can be used as a reference for the implementation of teaching and learning based on differentiated pedagogy that is systematic, clear and effective. This can also increase their confidence in implementing this method.

5. DISCUSSION

The need to develop a framework of 21st century knowledge and skills based on differentiated pedagogy is crucial in ensuring more inclusive and effective teaching practices in the classroom. This framework not only has a positive impact on teachers in planning and implementing teaching, but also helps meet the individual needs of students with different backgrounds, abilities and learning styles. In this context, teaching is no longer one-size-fits-all, but rather a differentiated approach tailored to the specific abilities and needs of each student (Hapsari et al., 2018). A structured framework provides clear guidance to educators in planning instruction that is appropriate for students' achievement levels. For example, for weaker students, teachers can provide easier assignments and more support, while more capable students are given greater challenges. This not only helps teachers deliver instruction more effectively, but also gives students the opportunity to develop according to their individual abilities. Differentiated instruction, through a clear framework, will enable teachers to meet students' academic and social development needs more holistically (Ouyang & Ye, 2023). In addition, a framework that integrates 21st century skills such as critical thinking, problem solving, creativity, and communication will better prepare students for the dynamic challenges of the modern workforce. Studies have shown that employers are increasingly seeking graduates who not only possess strong academic qualifications, but also demonstrate soft skills that allow them to thrive in complex, ambiguous situations. (Walters-Williams, 2022). This framework also encompasses important elements of the human capital needed by students to face the challenges of the 21st century world. In addition to emphasizing academic achievement, differentiated pedagogy based on 21st century skills encourage the development of critical thinking, collaboration, digital literacy, leadership, and communication skills. Students exposed to this framework not only learn academic subjects, but are also guided to become creative, innovative, and competitive individuals. In other words, this framework can produce students who not only excel in academics, but also have the life skills needed to succeed in an increasingly complex global world (Ng, 2023). This 21st century knowledge and skills framework also have important implications for future curriculum development. The curriculum developed needs to be more responsive to the needs and differences of students. It should be flexible, adaptable to the context and needs of students, and emphasize the development of critical skills that are essential to face the challenges of today's world. This kind of curriculum approach can ensure that students not only have solid academic knowledge, but also practical skills to face everyday life, adapt to change, and collaborate in various contexts (Anggraeni et al., 2022). Overall, this 21st century knowledge and skills framework based on differentiated pedagogy will not only benefit students, but also increase teachers' readiness to master more dynamic and innovative teaching techniques. With a clear framework, teachers can more easily deliver teaching content using more effective and relevant methods. This will encourage an improvement in the overall quality of education. Furthermore, the development of this framework has an important contribution to the development of a future curriculum that is more flexible and can meet global needs. Through a more inclusive approach and a focus on 21st century skills, students will not only be provided with deeper knowledge, but also with more comprehensive life skills, which will prepare them to succeed in various fields in an increasingly challenging world. With such a framework, students will have the opportunity to develop holistically, not only in academic aspects but also in social skills, communication, leadership, and problem-solving. This will provide them with a strong foundation to succeed in higher education, the world of work, and everyday life. Therefore, the formation of this 21st century knowledge and skills framework is a very important step in the transformation of national education and needs to be implemented immediately to ensure that education in Malaysia is relevant to today's global needs.

6. CONCLUSION

There is a clear and urgent need to develop a 21st century knowledge and skills framework based on differentiated pedagogy, particularly in the teaching and learning of mathematics. This study found that, although teachers understand the basics of differentiated pedagogy, there is a lack of practical skills to implement this approach effectively in the context of mathematics. Teachers need more systematic and detailed guidance, especially in integrating 21st century skills such as critical thinking, leadership skills, effective communication, and creativity into their teaching. A structured framework can provide clear guidance to teachers to plan more inclusive and responsive teaching to the diverse needs of students. With this framework, teachers will be more confident in implementing teaching that meets current and future needs. In addition, the successful implementation of this framework not only benefits students' academic development, but also plays an important role in developing soft skills relevant to the global challenges of the 21st century.

To ensure the effectiveness of the use of this framework, further research needs to be conducted to understand more deeply how this framework can be applied in mathematics subjects. Impact assessment on the development of students' 21st century skills is also important to ensure that the developed framework has a

positive impact in preparing students to face an increasingly complex world. Therefore, continued support from stakeholders, particularly the Ministry of Education Malaysia, State Education Departments, District Education Offices, as well as schools, is needed to ensure that the implementation of this framework can be carried out effectively and have an optimal impact on mathematics education in Malaysia.

REFERENCES

Anggraeni, P., Sunendar, D., Maftuh, B., Sopandi, W., & Puspita, R D. (2022, January 1). Why 6 Cs? The Urgency of Learning at Elementary School. https://doi.org/10.2991/assehr.k.220303.008

Benedicto, P N., & Andrade, R. (2022, May 16). Problem-Based Learning Strategies and Critical Thinking Skills Among Pre-Service Teachers. *International Journal of Science Technology Engineering and Mathematics*, *2*(2), 1-28. https://doi.org/10.53378/352885

Dong, X., & Qin, Z. (2023, January 1). Research on Teacher Ability Improvement in Higher Vocational Colleges under the background of new engineering. *SHS Web of Conferences*, 157, 02013-02013. https://doi.org/10.1051/shsconf/202315702013

Dwee, C Y., Anthony, E M., Salleh, B M., Kamarulzaman, R., & Kadir, Z A. (2016, October 1). Creating Thinking Classrooms: Perceptions and Teaching Practices of ESP Practitioners. *Procedia - Social and Behavioral Sciences*, *232*, 631-639. https://doi.org/10.1016/j.sbspro.2016.10.087

Goulart, V G., Liboni, L B., & Cezarino, L O. (2021, July 14). Balancing skills in the digital transformation era: The future of jobs and the role of higher education. *Industry and Higher Education*, *36*(2), 118-127. https://doi.org/10.1177/09504222211029796

Hashmi, R. S., & Muhammad, N. (2021). Changing Dimensions of Nation-Building in 21st Century Pakistan: A Critical Analysis. *Journal of the Research Society of Pakistan*, *58*(4), 142.

Hafizi, M H M., & Kamarudin, N. (2020, March 1). Creativity in Mathematics: Malaysian Perspective. *Universal Journal of Educational Research*, 8(3C), 77-84. https://doi.org/10.13189/ujer.2020.081609

irudayaraj, M., Baker, R M., Baker, F., & Eastman, M. (2021, October 14). Soft Skills for Entry-Level Engineers: What Employers Want. *Education Sciences*, 11(10), 641-641. https://doi.org/10.3390/educsci11100641

Ismail, A M., Osman, Z., Ghani, A., & Mokhtar, A E. (2020, December 24). Co-Curricular Activities in Selected Private Schools to Independent Students – Qualitative Analysis. *International Journal of Academic Research in Business and Social Sciences*, *10*(12). 950-957. https://doi.org/10.6007/ijarbss/v10-i12/8387

Jamil, M. (2021, November 7). Secondary School Science Teachers' Practices for the Development of Critical Thinking Skills: An Observational Study. *Journal of Social and Development Sciences*, *2*(IV), 259-265. https://doi.org/10.47205/jdss.2021(2-iv)22

Karimi, H., & Piña, A A. (2021, July 30). Strategically Addressing the Soft Skills Gap Among STEM Undergraduates. *Journal of Research in STEM Education*, 7(1), 21-46. https://doi.org/10.51355/jstem.2021.99

Laar, E V., Deursen, A J A M V., Dijk, J V., & Haan, J D. (2017, March 3). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, 72, 577-588. https://doi.org/10.1016/j.chb.2017.03.010

Laine, C E., & Mahmud, M S. (2022, September 25). The Influence of Problem-Based Learning (PBL) on Mathematics Learning: Systematic Literature Review. *International Journal of Academic Research in Progressive Education and Development*, *11*(3). https://doi.org/10.6007/ijarped/v11-i3/15033

Mohamad, M., Palani, K., Nathan, L S., Sandhakumarin, Y., Indira, R., & Jamila, E. (2023, June 17). Educational Challenges in the 21st Century: A Literature Review. *International Journal of Academic Research in Progressive Education and Development*, *12*(2). 1307-1314. https://doi.org/10.6007/ijarped/v12-i2/16865

Ng, P T. (2023, May 22). Learning in an era of uncertainty in Singapore: diversity, lifelong learning, inspiration and paradigm shift. *Educ Res Policy Prac*. https://doi.org/10.1007/s10671-023-09348-1

Nor, H M., & Sihes, A J. (2021, October 8). Critical Thinking Skills in Education: A Systematic Literature Review. *International Journal of Research in Business and Social Science*, *11*(11). 198-201. https://doi.org/10.6007/ijarbss/v11-i11/11529

Ouyang, J., & Ye, N. (2023, January 1). Differentiated Instruction: Meeting the Needs of All Learners. *Curriculum and Teaching Methodology*, *6*(11). 57-61 https://doi.org/10.23977/curtm.2023.061111

Pellegrino, J W., & Hilton, M L. (2012, December 18). Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century. https://www.hewlett.org/uploads/documents/Education_for_Life_and_Work.pdf

Nagappan, R. (2010). Teaching thinking skills at institutions of higher learning: Lessons learned. *Pertanika Journal of Social Science and Humanities*, *18*(1), 1-14.

Rawat, N., Rastogi, A., Jaiswal, K., & Nigam, A. (2014, November 1). Analysis of relationship between extracurricular activities and academic performance by computational intelligence. *Innovative Applications of Computational Intelligence on Power, Energy and Controls with their impact on Humanity (CIPECH)*, 472-475. https://doi.org/10.1109/cipech.2014.7019087

Razak, N S A A., & Din, R. (2020, October 1). Video Usage among Secondary School Students during the COVID-19 Pandemic. *Universal Journal of Educational Research*, *8*(11A), 43-48. https://doi.org/10.13189/ujer.2020.082106

Rozi, N F. (2021, December 6). Classroom Debate Strategy To Enhance Students' Critical Thinking Skills In Argumentative Writing. Exposure. *Jurnal Pendidikan Bahasa Inggris*, 10(2), 274-288. https://doi.org/10.26618/exposure.v10i2.5916

Selvarajoo, P C B., & Baharudin, S N A. (2023, April 11). Factors Contributing to Poor Academic Achievement among Underachieving Students in A High School in Klang Valley: A Case Study. *International Journal of Academic Research in Business and Social Sciences*, *13*(4), 1986 – 1997. https://doi.org/10.6007/ijarbss/v13-i4/16902

Sulaiman, S., Mohamad, M., Mansor, A N., Alias, B S., & Aziz, A A. (2022, March 1). Pupils' and Parents' Perspectives Towards Using Smartphone Strategies to Improve Reading Skills. *Theory and Practice in Language Studies*, 12(3), 498-510. https://doi.org/10.17507/tpls.1203.09

Tang, K N. (2018, February 1). The importance of soft skills acquisition by teachers in higher education institutions. *Kasetsart Journal of Social Sciences*. 2018. https://doi.org/10.1016/j.kjss.2018.01.002

Walters-Williams, J. (2022, January 1). H-CUP: Increasing Higher Order Thinking Skills Levels through a Framework Based on Cognitive Apprenticeship, Universal Design and Project Based Learning. *Creative Education*, *13*(09), 2878-2902. https://doi.org/10.4236/ce.2022.139181