KARYA ILHAM PUBLISHING
CONNECTING MINDS, BRIDGING IDEAS, INSPIRING READERS

Progress in Computers and Learning

Journal homepage:
https://karyailham.com.my/index.php/picl
ISSN: 3083-8894

Need Analysis for Developing a Problem-Based Learning E-Module in Mathematics with Integrated Global Citizenship Education

Vimala Devi Subramaniam[1], Murugan Rajoo[2,*]

[1] Department of Mathematics, Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, 35900 Tanjung Malim, Malaysia

ARTICLE INFO

Article history:
Received 3 November 2024
Received in revised form 24 November 2024
Accepted 15 December 2024
Available online 31 January 2025

Keywords:
Problem-Based Learning; Global Citizenship Education; global awareness; mathematics

ABSTRACT

Global Citizenship Education is a framework designed to cultivate responsible citizens who respect values such as justice and equality, ultimately contributing to a more peaceful and sustainable world. By exposing primary school students to global issues, they can better understand critical challenges, particularly the eradication of global poverty, climate change, and peace, which can help them become more engaged global citizens. However, aspects of Global Citizenship Education are often overlooked in primary mathematics education. This study aims to evaluate mathematics teachers' perceptions of implementing a problem-based learning e-module that incorporates Global Citizenship Education into the topic of Data Handling. Additionally, it seeks to gauge the respondents' agreement on integrating Global Citizenship Education (GCED) into the mathematics teaching and learning process. An online questionnaire (Google Form) was administered to 52 primary school mathematics teachers from the state of Negeri Sembilan. The findings indicate that 40% of the respondents were unfamiliar with Global Citizenship Education, and 70% had never incorporated it into their mathematics teaching. Nevertheless, 80% of the teachers agreed that integrating Global Citizenship Education themes into mathematics classrooms would enhance students' global awareness and motivate them to learn mathematics. Furthermore, the study found that the Problem-Based Learning approach allows students to acquire new knowledge about real-world mathematical problems. In conclusion, there is a clear need to develop a problem-based learning e-module in mathematics that integrates Global Citizenship Education.

1. Introduction

Mathematics is a subject with considerable relevance to real-world applications and is utilized across various fields. Problem-solving has historically been a fundamental aspect of mathematical education [1]. At the conclusion of each topic, students are tasked with addressing word problems that require them to apply the concepts they have learned, thus facilitating the connection between theoretical knowledge and practical scenarios. Specifically, students must solve one or more questions presented in a word problem by implementing appropriate mathematical operations on the provided numerical information [2]. Recognizing the significance of problem-solving skills in

* *Corresponding author.*
E-mail address: murugan@fsmt.upsi.edu.my

https://doi.org/10.37934/picl.2.1.4048

navigating real-world uncertainties [3], it is essential to expose students to non-routine word problems to further develop these abilities [4]. Moreover, effective mathematics learning necessitates active student participation in the construction of new knowledge, which can foster a creative environment and enhance the overall quality of teaching. The knowledge acquired empowers students to consider their potential contributions to societal improvement [5]. Mathematics is applicable in numerous fields [6]; however, traditional mathematics education often prioritizes procedural methods over fostering critical thinking. This emphasis can hinder students' ability to relate mathematical concepts to real-world situations [7,8]. Consequently, the teaching and learning of mathematics should embrace a student-centered approach that encourages knowledge construction and cultivates mathematical thinking. Such an approach is rooted in constructivism and aligns with various learning methodologies, including problem-based learning (PBL) [8,9]. PBL is an instructional strategy that motivates students to apply theoretical concepts in practical contexts, facilitating the development of knowledge and skills through engagement with complex, real-world problems [10].

In the context of globalization, educational systems in various countries are adapting to reflect social and cultural diversity [11]. As a result, the role of education in the 21st century has expanded to include the promotion of peace, human rights, the celebration of diversity, sustainable development, and equality. Additionally, pressing global challenges—such as pandemics, climate change, and poverty—require educators to find effective ways to equip learners with the necessary skills to confront these issues. Consequently, Global Citizenship Education (GCED) has become increasingly vital in nurturing a sense of shared humanity [12].

Global Citizenship Education (GCED) is a form of civic education that highlights the political, economic, social, and cultural interconnectedness among individuals and communities, spanning local, national, and global dimensions [13]. It embodies a collective sense of shared humanity and fosters connections to a wider community. The global aspect of citizenship education has garnered increased attention concerning its implications for policy-making, curriculum design, teaching methodologies, and learning outcomes. This growing interest in GCED is largely attributed to its relevance in a globalized context, where it plays a critical role in shaping educational practices and informing policy [14,15]. As a result, this interconnectedness introduces new transnational concepts that deepen our understanding of global issues and challenges. Although a definitive definition of global citizenship education remains elusive, its significance and influence continue to rise within communities. The effects of globalization can be observed in individuals and places worldwide today [16].

The COVID-19 pandemic highlighted the increasing connectivity among diverse global communities facilitated by digital technologies and networks. Fostering a sense of belonging to a larger community and a shared humanity has been a strategic priority for UNESCO's education sector programs [13]. Furthermore, the pandemic revealed that the future of education can no longer be regarded as stable, as the assumption of continuous learning has been challenged. As uncertainty became the new norm, it became necessary to adapt the existing curriculum to reflect this evolving reality [17].

Global Citizenship can be categorized into eight areas: political, moral, economic, cultural, social, critical, environmental, and spiritual global citizenship [18]. Each of these categories is based on varying theories and interpretations of the concept of global citizenship. In the context of the civic imperative, Global Citizenship Education (GCED) prepares future citizens to actively engage and contribute to their communities at multiple levels, ranging from local to global [19].

The International Students Assessment (PISA) program describes global competence as a multifaceted skill set that includes cognitive, socio-emotional, and behavioural knowledge and abilities [20]. The Organization for Economic Cooperation and Development (OCED) identifies four fundamental aspects of global competence: the ability to understand local, global, and intercultural issues; the appreciation of varied perspectives and worldviews; the capacity for open, respectful, and effective interactions; and the commitment to actions that promote collective well-being and sustainable development. To assess these dimensions globally, the PISA Cognitive Test for Global Understanding was created. In conjunction with UNESCO's learning objectives, this assessment underscores the importance of global competence as a crucial capability for learners to exhibit their knowledge, skills, and attributes related to Global Citizenship Education (GCED) [21].

The increasing recognition of global citizenship education has heightened the focus on incorporating a global perspective into citizenship education, impacting policies, curricula, teaching, and learning methodologies. Rather than being treated as an isolated subject, Global Citizenship Education emphasizes the principles of global citizenship and seeks to be transformative by cultivating the knowledge, skills, values, and attitudes essential for students to actively participate in creating a more inclusive, equitable, and peaceful world [13]. Its implementation can take place within existing subjects or through co-curricular activities, with the approach largely determined by the teacher's creativity. An effective communication strategy can play a crucial role in spreading the components of citizenship education among students, thereby facilitating their learning experience indirectly [22].

Education is essential for boosting a community's ability to achieve sustainability [23,24]. By fostering global citizenship in students, educational frameworks equip them with the knowledge to address critical issues like climate change, social justice, dependency, health, well-being, and biodiversity. This involvement allows students to establish significant connections with the contemporary challenges facing our world [25,26].

Teaching global citizenship education should utilize an integrated curriculum model that prioritizes concepts over a strictly topic-based approach. When curriculum guidelines are organized into discipline-specific lists, it is crucial to support the synthesis of these elements in a way that is conceptually meaningful, fostering the authentic knowledge required for developing global citizens [27,28]. An integrated curriculum enhances students' comprehension of the connections between various disciplines, providing them with more meaningful learning experiences. As students recognize the relevance of the lessons, they are motivated to engage in higher-order thinking skills, enabling them to construct knowledge rather than simply memorize information [29].

Incorporating global citizenship education into primary school curricula through core subjects like mathematics provides an effective platform for students to investigate both local and global issues, promoting meaningful self-reflection. Mathematics acts as an essential tool for improving global awareness and communication by structuring information and fostering critical thinking skills [30]. The field of mathematics education recognizes the need for an approach that addresses global challenges. By implementing a global citizenship education framework in conjunction with Problem-Based Learning, educators create a real-world context that captivates students' curiosity, encouraging them to apply mathematical concepts to identify patterns and gain insights into the world around them. Besides that, the pandemic era, urged that teaching and learning may remain as online learning or by hybrid in the future [31]. Hence, this e-module with integrated Global Citizenship Education could be a reference for primary school mathematics teachers in future.

Education is an important field in determining the quality of a nation. Based on the previous studies, problem-solving skills among primary school students is still at the basic levels in mathematics education. Besides, by promoting and teaching about global citizenships it will enhance

to develop a base of global knowledge and skills among students. The findings of this study expected to assists the Malaysian Ministry of Education in determining the effects of mobile learning on global citizenship awareness among primary school students besides enhancing students' motivation towards learning mathematics.

2. Methodology

2.1 Study Design

This research will adopt a quasi-experimental design, which is recognized for its inferential capabilities. Leading experts in the field contend that this design is most suitable for assessing the effectiveness of interventions in real-world settings [32]. A research design encompasses the comprehensive strategy chosen to cohesively and logically integrate various components of the study, ensuring that the research problem is effectively addressed. It acts as a framework for data collection, measurement, and statistical analysis [33]. Specifically, this study will employ the design and development research (DDR) approach outlined by Richey and Klein [34]. According to Richey and Klein [34], this research design involves "the systematic study of design, development, and evaluation processes aimed at establishing an empirical foundation for creating instructional and non-instructional products." Saedah *et al.,* [35] further characterize DDR as "a research approach that can yield reliable and applicable information for practitioners in instructional technology and curriculum development." Additionally, the DDR approach comprises three stages: the need analysis stage, the design and development stage, and the assessment stage. It is essential to note that each stage utilizes different methods for sample selection, instrument application, and data analysis. This study concentrated specifically on the need analysis stage, which aims to gather data regarding the necessity for module development, particularly from the teachers' perspective.

2.2 Population and Study Sample

The study focuses on primary school mathematics teachers in Negeri Sembilan, Malaysia. A random sampling method was utilized to distribute an online survey questionnaire to all national primary school mathematics teachers across the state via their respective schools. The survey engaged 52 mathematics teachers. The primary aim of this need analysis is to collect feedback from these teachers regarding the effectiveness of Problem-Based Learning (PBL) in improving problem-solving skills among primary school students. Additionally, it seeks to evaluate the incorporation of Global Citizenship Education (GCED) within mathematics education to enhance students' awareness of global issues

2.3 Instrument

The need analysis for this study utilized an online questionnaire created through Google Forms to effectively reach the target audience. This method aimed to evaluate mathematics teachers' perceptions of implementing a problem-based learning e-module that integrates Global Citizenship Education (GCED) on the subject of Data Handling. Furthermore, it assessed the respondents' views on the inclusion of GCED in the mathematics teaching and learning process. This approach presented several benefits compared to traditional paper surveys, such as being environmentally friendly and paperless, saving time and costs, ensuring accurate collection of responses, and offering practical insights.

2.3.1 Validity and reliability instrument

To guarantee the authenticity of the results, it is essential for researchers to evaluate the validity and reliability of the instruments before they are utilized. In this study, experts in primary school education, mathematics education, and language studies conducted assessments of both content and language validation. These forms of validity can be categorized as rational validity since they are based on reasoned inferences about the task conditions designed to assess the targeted abilities, or through logical analysis [36].

A pilot study was undertaken to evaluate the reliability of the instrument and to improve the questionnaire items. This study involved 32 primary school teachers and focused on examining the reliability of the closed-item questionnaire, which employed a 5-point Likert scale. Table 1 below shows that the reliability coefficient, represented by Cronbach's alpha, exceeded 0.7 for all items, suggesting that the questionnaire exhibits strong reliability.

Table 1
Cronbach alpha value of the need analysis instrument

No	Elements	Cronbach Alpha value	No. of Items
1	Perception of Implementing a Problem-Based Learning (PBL) e-Module in Mathematics	0.825	10
2	Perception of Integrating Global Citizenship Education (GCED) in the teaching and learning process in Mathematics Classroom	0.874	9

3. Results and Discussion

According to the need analysis, a total of fifty-two teachers participated in the Need Analysis Questionnaire. Of these respondents, 21% identified as male, while 79% identified as female. The teachers shared their views on two primary aspects: i) the application of a Problem-Based Learning (PBL) e-module in Mathematics, and ii) the incorporation of Global Citizenship Education (GCED) within the teaching and learning processes of the mathematics classroom.

In this analysis, GCED is incorporated into an e-module centered on Data Handling, aiming to raise awareness of pressing global issues like pandemics, climate change, and poverty within the context of mathematics education.

The collected data were analyzed descriptively to derive percentage values, mean values, and standard deviations. Table 2 presents the interpretations of mean values, adapted from Ref. [37].

Table 2
Interpretation of the mean value

Mean Value	Interpretation
1.00-2.33	Low
2.34-3.67	Medium
3.68-5.00	High

3.1 Teachers Perception of Implementing a Problem-Based Learning (PBL) e-Module in Mathematics

Prior to the development of the Problem-Based Learning (PBL) e-module, it is crucial to comprehend teachers' views on the integration of the PBL e-module with Global Citizenship Education in mathematics instruction. The findings of the analysis, including the average percentage,

mean value, and standard deviation, are summarized in Table 3 based on the data collected from the questionnaire.

Table 3
Teachers' perception of Implementing a Problem-Based Learning (PBL) e-Module in Mathematics

No	Items	Disagree (%)	Agree (%)	Mean	Standard Deviation
1	PBL in learning mathematics is able to enhance problem-solving skills among students.	9.6	90.4	3.73	0.940
2	Students can generate new knowledge of real-world problems in mathematics classrooms through the PBL approach.	9.6	90.4	3.73	1.005
3	The Problem-Based Learning approach enables students to apply the knowledge on the topic of Data Handling better.	9.6	90.4	3.73	0.931
4	Students can visualize mathematical problems and be efficient logical-thinker in Problem-Based Learning Classroom.	9.6	90.4	3.71	0.936
5	The PBL approach motivates students to learn mathematics.	9.6	90.4	3.71	0.936
6	Lack of interactive materials with integrated PBL.	3.8	96.2	3.83	0.944
7	e-Modules enable students to explore learning through an interactive method.	0	100	3.98	0.828
8	e-Modules are able to minimize students' dependencies towards teachers.	0	100	3.96	0.839
9	e-Modules provides an alternative method of learning for students with an absenteeism problem	0	100	4.06	0.850
10	Using e-Modules in mathematics could improve the learning outcomes of learners.	0	100	4.06	0.850
	Average	5.18	94.82	3.85	0.906

Note: the term "disagree" combines "strongly disagree" and "disagree", while "agree" consists of "Moderately agree', "agree", and 'Strongly agree"

Table 3 illustrates the data interpretation, revealing a mean value of 3.85 and a standard deviation of 0.906. This indicates a significant level of concern regarding the issue. Consequently, it can be inferred that most primary school teachers believe that employing a Problem-based Learning e-Module in mathematics classrooms positively impacts students by improving their mathematical learning skills. Furthermore, the highest mean scores were associated with aspects of e-Modules that offer alternative learning approaches for students dealing with absenteeism and the use of e-Modules in mathematics to enhance academic performance (M=4.06, SD=0.850).

Utilizing Problem-Based Learning (PBL) e-modules in mathematics classes allows students to interact with real-world scenarios while gaining new insights. Through the use of these e-modules, learners can engage actively in their educational experience.

3.2. Teachers' Perceptions of Integrating Global Citizenship Education (GCED) in the Teaching and Learning process in Mathematics Classroom.

This section explores primary school mathematics teachers' views on the importance of incorporating Global Citizenship Education (GCED) into the mathematics teaching and learning process.

Table 4 presents a summary of the average percentage, mean value, and standard deviation obtained from the questionnaire data analysis. The findings reveal a strong consensus among teachers, reflected in an average mean value of 3.87 and a standard deviation of 0.902. This indicates that primary school mathematics teachers are significantly in favor of incorporating Global Citizenship Education into the mathematics curriculum.

Table 4

Teachers' perception of Integrating GCED in Mathematics classroom

No	Items	Disagree (%)	Agree (%)	Mean	Standard Deviation
1	It is essential to educate students about Global Citizenship Education (GCED) since elementary school.	9.6	90.4	3.73	0.940
2	Using GCED themes in the learning process is essential for the students.	9.6	90.4	3.73	1.005
3	Integrating GCED themes in mathematics classrooms will enhance students' awareness of global issues.	9.6	90.4	3.73	0.931
4	Integrating GCED themes in mathematics classrooms will be more interesting for the students to learn.	9.6	90.4	3.71	0.936
5	Students who know GCED can support their understanding during the teaching and learning process.	9.6	90.4	3.83	0.944
6	Students can understand the concept of Data Handling when relating it to real-world situations.	1.9	98.1	3.98	0.828
7	Students can relate the lessons to daily life situations if GCED themes are integrated into the teaching and learning process of Data Handling.	0	100	3.96	0.839
8	Students can relate the concept to real-world situations.	0	100	4.06	0.850
9	Integrating GCED in the learning process will help to solve environmental problems.	0	100	4.06	0.850
	Average	5.54	94.46	3.87	0.902

Note: the term "disagree" combines "strongly disagree" and "disagree", while "agree" consists of "Moderately agree', "agree", and 'Strongly agree"

The teachers believed that students could connect the lessons to daily life situations if GCED themes were integrated into the teaching and learning process of the topic Data Handling (M=3.96, SD= 0.839). Additionally, the educators emphasized the importance of introducing Global Citizenship Education (GCED) to students as early as elementary school (M=3.73, SD= 0.940).

Aligned with the perspectives of teachers, the Problem-Based Learning e-Module with Integrated Global Citizenship Education has the potential to enhance students' understanding of mathematical concepts while also increasing their awareness of global issues. Furthermore, the integration of technology in teaching and learning enables students to engage actively in the learning process by relating lessons to real-world situations.

4. Conclusions

In addition to incorporating technology into the teaching and learning process, it is essential to emphasize elements of global citizenship education within core subjects such as mathematics. This approach can empower students to shape a better future and become responsible global citizens. An integrated curriculum fosters an understanding of the interconnectedness among disciplines, providing students with profoundly meaningful learning experiences. Therefore, there is a pressing need to develop this Problem-Based e-module with Integrated Global Citizenship Education at the primary school level.

Acknowledgement
This research was not funded by any grant.

References
[1] Liljedahl, Peter, Manuel Santos-Trigo, Uldarico Malaspina, and Regina Bruder. *Problem solving in mathematics education*. Springer Nature, 2016. https://doi.org/10.1007/978-3-319-40730-2
[2] de Corte, Eric, Brian Greer, and Lieven Verschaffel, eds. *Making sense of word problems*. CRC Press, 2000.
[3] Csapó, Beno, and Joachim Funke. *The Nature of Problem Solving: Using Research to Inspire 21st Century Learning*. OECD Publishing. 2, rue Andre Pascal, F-75775 Paris Cedex 16, France, 2017. https://doi.org/10.1787/9789264273955-en
[4] Jäder, Jonas, Johan Lithner, and Johan Sidenvall. "Mathematical problem solving in textbooks from twelve countries." *International Journal of Mathematical Education in Science and Technology* 51, no. 7 (2020): 1120-1136. https://doi.org/10.1080/0020739X.2019.1656826
[5] Ali, Riasat, Aqila Akhter, Saqib Shahzad, Najma Sultana, and Muhammad Ramzan. "The impact of motivation on students' academic achievement in mathematics in problem based learning environment." *International Journal of Academic Research* 3, no. 1 (2011): 306-309.
[6] Baki, Adnan, Hakan Çatlıoğlu, Serkan Coştu, and Osman Birgin. "Conceptions of high school students about mathematical connections to the real-life." *Procedia-Social and Behavioral Sciences* 1, no. 1 (2009): 1402-1407. http://doi.org/10.1016/j.sbspro.2009.01.247
[7] Ginsburg, Herbert P., and Miriam Amit. "What is teaching mathematics to young children? A theoretical perspective and case study." *Journal of Applied Developmental Psychology* 29, no. 4 (2008): 274-285. https://doi.org/10.1016/j.appdev.2008.04.008
[8] McMahon, Graham. "Critical thinking and ICT integration in a Western Australian secondary school." *Journal of Educational Technology & Society* 12, no. 4 (2009): 269-281.
[9] Gürsul, Fatih, and Hafize Keser. "The effects of online and face to face problem-based learning environments in mathematics education on student's academic achievement." *Procedia-Social and Behavioral Sciences* 1, no. 1 (2009): 2817-2824. http://doi.org/10.1016/j.sbspro.2009.01.501
[10] Savery, John R. "Overview of problem-based learning: Definitions and distinctions. Interdisciplinary Journal of Problem-Based Learning (2006). https://doi.org/10.7771/1541-5015.1002
[11] Zhang, Junhao. "Educational diversity and ethnic cultural heritage in the process of globalization." *International Journal of Anthropology and Ethnology* 3, no. 1 (2019): 7.
[12] Education, Global Citizenship. " A Policy Making Awareness and Advocacy Handbook. Bangkok, UNESCO (2021).
[13] Education, Global Citizenship. "Topics and learning objectives." *Organisation des Nations Unies pour l'éducation, la science et la culture. Printed in France* UNESCO (2015).
[14] Rapoport, Anatoli. "We cannot teach what we don't know: Indiana teachers talk about global citizenship education." *Education, citizenship and social justice* 5, no. 3 (2010): 179-190. https://doi.org/10.1177/1746197910382256
[15] Davies, Ian, and Graham Pike. "Global citizenship education: Challenges and possibilities." *The handbook of practice and research in study abroad* (2010): 83-100. https://doi.org/10.4324/9780203876640-12
[16] Friedman, Jonathan. "Globalization, class and culture in global systems." *Journal of world-systems research* (2000): 636-656. https://doi.org/10.5195/jwsr.2000.198
[17] Aoki, Ted T. "Teaching as Indwelling Between Two Curriculum Worlds: The Coming Into Being of a Pedagogical Situation." *Alberta Journal of Educational Research* 70, no. 2 (2024). https://doi.org/10.55016/ojs/ajer.v70i2.79715

[18] Oxley, Laura, and Paul Morris. "Global citizenship: A typology for distinguishing its multiple conceptions." *British journal of educational studies* 61, no. 3 (2013): 301-325. https://doi.org/10.1080/00071005.2013.798393
[19] Giles, Libby. "Learning to live together and a life worth living." *APCEIU reconciliation, peace and global citizenship education: Pedagogy and practice* (2019): 12-19.
[20] Preparing our youth for an inclusive and sustainable world. *The OECD PISA Global Competence Framework*. OECD. (2018). https://www.oecd.org/education/Global-competency-for-an-inclusive-world.pdf
[21] Kim, Eun-Ji Amy. "Global citizenship education through curriculum-as-relations." *Prospects* 51, no. 1 (2021): 129-141. https://doi.org/10.1007/s11125-021-09554-w
[22] Khairil, Muhammad, Muhammad Nur Ali, Sharifah Zarina Syed Zakaria, Kadir Arifin, and Muhammad Rizal Razman. "Mass media coverage on terrorism in order to achieve peace and justice according to the World Agenda of Sustainable Development Goals (SDGs)." *Information* 20, no. 7A (2017): 4935â.
[23] Samsurijan, Mohamad Shaharudin, Azahan Awang, Kadir Arifin, Kadarudin Aiyub, Sharifah Zarina Syed Zakaria, and Muhammad Rizal Razman. "The conceptual framework for the quality of life urban village inhabitants' assessment." *Journal of Food, Agriculture and Environment* 12, no. 2 (2014): 910-915.
[24] Zakaria, Sharifah Zarina Syed. "Science education in primary school towards environmental sustainability." *Res. J. Appl. Sci* 6 (2011): 330-334. https://doi.org/10.3923/rjasci.2011.330.334
[25] Razman, M. R., J. M. Jahi, M. B. Mokhtar, K. Arifin, Z. Ramli, K. Aiyub, S. Z. S. Zakaria, and A. Awang. "The law of tort focusing on negligence towards environmental sustainability in Malaysia within the scope of interest approach." *Res. J. Appl. Sci* 8 (2013): 398-403.
[26] Rauf, Rahyunir, Nurman Nurman, Sharifah Zarina Syed Zakaria, and Muhammad Rizal Razman. "Strategic Issues on Primary Students' Knowledge Towards Sustainability of Human Habitat and Environment." *Journal of Food, Agriculture & Environment* 15, no. 1 (2017): 61-63.
[27] Henderson, Linda. "Unleashing talent: An examination of VanTassel-Baska's integrated curriculum model." *Post-Script* 5, no. 1 (2004): 54-73.
[28] Taba, H. "Handbook to Elementary Social Studies, an inductive approach." *Reading, Massachussetts, Addison-Wesley Publishing,* (1971).
[29] Bradbery, Deborah, and Ruth Reynolds. "Using an Integrated Curriculum to enhance primary students' understandings of Global Citizenship." In *Refereed paper presented to the Social Educators Association of Australia conference, February*, pp. 19-12. 2010.
[30] Oxford. *Maths and Global Citizenship*. Oxfam, 2015
[31] Chiang, Choon Lai, Hii Ching Lik, Lim Siew Shee, Ong Sze Pheng, and Tiong Timm Joyce. "Improving Digital Communication among Engineering Students in Online Learning." *Progress in Computers and Learning* 1, no. 1 (2024): 25-35. https://doi.org/10.37934/picl.1.1.2535
[32] Reichardt, Charles S. "Experimental and quasi-experimental designs for generalized causal inference." (2002): 510-514. https://doi.org/10.1086/345281
[33] Campbell, Donald T., and Julian C. Stanley. *Experimental and quasi-experimental designs for research*. Ravenio books, 2015.
[34] Richey, Rita C., and James D. Klein. *Design and development research: Methods, strategies, and issues*. Routledge, 2007.
[35] Siraj, Saedah, N. Alias, Dorothy DeWitt, and Zaharah Hussin. "Design and developmental research: Emergent trends in educational research." (2013).
[36] Ebel, Robert L., and David A. Frisbie. "Essentials of educational measurement." 5th ed. New Dehli: Prentice-Hall, (1991).
[37] Wiersma, William. *Research methods in education*. Needhan Heights, 2000.