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DEVELOPMENT SKY CLASS APPLICATION TO CALCULATE TURTLE USING THE CONCEPT OF NUMBER PATTERNS: PRELIMINARY PHASE

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Abstract

Mobile Learning (ML) has been proven to be useful for learning. Nevertheless, ML also possesses immense potential in the domain of evaluation. This research aims to create an ML product designed for learning assessment. This study is categorised as developmental research and employs a methodology including preliminary and prototype phases. Nevertheless, this study did not report all of the stages. The research has advanced to the Principal Draft Design phase. The approach employed involves analysing the requirements of both students and teachers in developing machine learning for assessment purposes. In addition, experts and practitioners conduct an assessment to ensure its effectiveness. This step is deemed essential before the final development stage is implemented. The outcomes Upon thorough evaluation of the results from all Validators, it was concluded that the "Sky Class" ML application is appropriate for usage, and the input supplied does not necessitate substantial revisions.

Keywords: Assessment, Higher-order thinking skill, Mobile learning, Sky class.

1. Introduction

The fundamental purpose of contemporary mobile learning (ML) applications is to enhance the student learning experience [1]. Through multiple means, including customising learning materials, anticipating student performance [2, 3], and providing adaptive feedback [4, 5]. Nevertheless, ML has tremendous potential in the assessment field [6]; moreover, it can modify the methodologies utilised for performing evaluations. ML can be applied to automate the evaluation process. Minimise the strain on teachers and promote the uniformity and impartiality of assessments [7]. ML techniques can appraise essay replies with increased precision [8]. ML has a fair assessment that is founded on specified criteria. The application of advanced data analysis skills by ML can provide a full grasp of the advancement and requirements of individual pupils, hence permitting the more effective adaptation of teaching techniques.

ML is used in evaluation to focus on performance-based assessment that aligns with the educational structure [9]. Utilising machine learning in education has been reported for evaluation [10-14], and offer prompt and unbiased feedback, consequently diminishing the burden on the teacher [15]. Application of ML necessitates the utilisation of suitable assessment standards [16] and focuses on scrutinising students' output. The significance of considering technical, validity, and pedagogical factors while assessing machine learning [9-16].

One of the interesting subjects in education is mathematics. Mathematics has been taught since pre-school. Many reports regarding mathematics have been published [17-22]. One of the topics covered is numbers and notation, which can have either a standardised format or be a composite of multiple different numbers. Using the notion of number patterns is one approach to researching and comprehending turtle reproduction. Turtle breeding involves life cycles and migration to lay eggs on beaches [23]. In contrast, number patterns are mathematical sequences structured [24] that follow the addition rule between previous numbers. These concepts can offer deep insight despite their fundamental differences. By employing mathematical analyses such as number patterns, scientists can attempt to detect patterns or trends in turtle breeding behaviour, such as the frequency of migration or the number of eggs laid in a single nesting season. This strategy provides chances to gain a deeper comprehension of the natural patterns in sea turtle populations, which can aid in conservation efforts and preservation.

This study attempts to comprehensively describe all the crucial steps - beginning with data collection and pre-processing - in creating a machine-learning model for scoring. The innovation of this study lies in three aspects: (i) the development of machine learning applications for evaluation, (ii) the provision of a succinct flow chart description, and (iii) the utilisation of the concept of numerical patterns to create questions with a turtle theme.

2. Literature Review

Technological advances have significantly contributed to education's progress and development [25-27]. In this development process, students encounter mobile communication technology gadgets connected to the internet, also known as ML Several reports concerning the utilization of applications [28-30]. This has emerged

as a new trend that enables learning through the use of mobile devices. The integration of telecommunications and internet technology enables the creation of ML systems that communicate with web servers via mobile devices [31]. The primary focus of ML in mathematics education is not just on information acquisition via mobile devices but also on supporting meaningful learning processes and assisting students in shaping their own knowledge. Introducing ML in mathematics and sains materials can assist students in making links between studying content and the realities of the world of applications and gadgets they use on a daily basis [32].

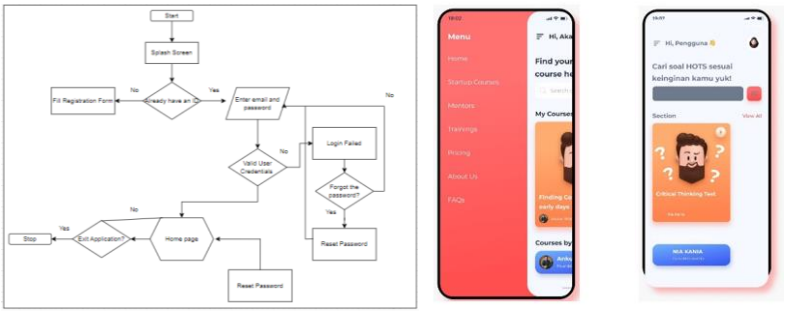
Number patterns, such as geometric series [33], arithmetic series [34-36], and other mathematical patterns, are sets of numbers that follow specific rules or criteria [37]. The Fibonacci sequence exemplifies the widely recognised numerical idea that each number is the sum of the two preceding numbers [38]. Turtle breeding is a life cycle activity involving turtles' migration across great distances and laying eggs on the beach [39]. Turtles exhibit philopatry by returning to the beaches of their birth to engage in natal homing and lay their eggs. Despite their different contexts, both number patterns and turtle breeding patterns underline the importance of order and structure in nature, emphasising that certain principles or cycles may be seen and comprehended in both mathematics [40].

3. Methodology

This investigation is classified as development research and employs a research design comprising two distinct phases: the conceptual and the prototype phases. In the preliminary phase of the research methodology, students' perspectives and objectives regarding integrating technology into the educational process are collected. Various instruments, such as surveys, interviews, and assessments, were implemented to establish a strong foundation for developing products that are both effective and pertinent to the requirements of students. The prototype phase ensures that a product is suitable for real-world demands by meticulously designing it and involving researchers, professionals, students, and instructors. This researcher focused on developing a set of Draft Design Principles as a result of the evaluation. This phase entails the development of ML, which is employed for assessment through expert evaluation. These initial designs and concepts for the ultimate product are generated and expressed by researchers during this phase.

4. Results and Discussion

The insights obtained from students and teachers served as the foundation for developing a roadmap for mobile learning products designed for learning assessment. The problem blueprint comprises mobile learning items designed for learning assessment that are proven to be useful from both the instructor and student perspectives. Students derive significant advantages from the iterative nature of ML [41]. Consequently, students can review and enhance their understanding of the subject matter at their convenience and from anywhere. Students' thinking skills can grow due to properly analysing the ideas they have acquired in many circumstances. Consistent practice enhances students' critical and creative thinking abilities by bolstering their capacity to assess, evaluate, and utilise acquired knowledge [42, 43]. Figure 1 displays the sketch or storyboard for creating the ML "Sky Class" and the ML products that were developed.

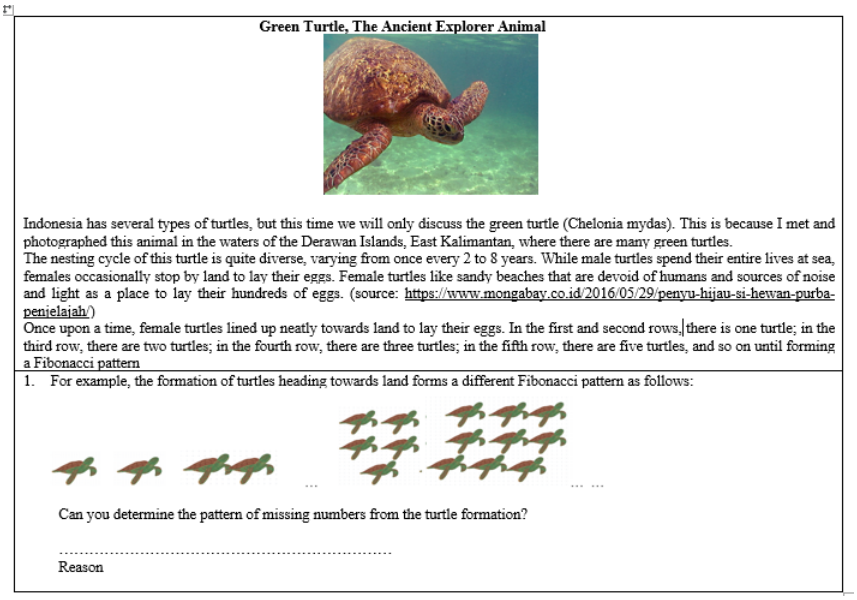


(a) **(b)**

Fig. 1 (a) Flowchart of storyboard and (b) Sky class application.

The ML application is called Sky Class. The term "Sky" can also be understood as something that is expansive and all-encompassing, akin to the boundless celestial expanse above all individuals. In the realm of ML, this term refers to the platform's objective of ensuring that learning opportunities are accessible to all individuals, regardless of their location or physical constraints [44-47]. The following are the ML products that were developed.

Figure 1(b) is the menu display in the ML application "Sky Class". In this section, several features, including Home, will take users to the initial display. Teachers will allow students to discuss the subject matter with teachers [48]. About Us is a feature that explains the ML application "Sky Class". The ML application called "Sky Class" has a set of devices requiring students to perform analysis. Students can participate in question-oriented exercises to enhance their cognitive capacities. Figure 2 is an example of a question that incorporates the concept of numbers within the framework of turtle programming



Green Turtle, The Ancient Explorer Animal

Indonesia has several types of turtles, but this time we will only discuss the green turtle (Chelonia mydas). This is because I met and photographed this animal in the waters of the Derawan Islands, East Kalimantan, where there are many green turtles.
The nesting cycle of this turtle is quite diverse, varying from once every 2 to 8 years. While male turtles spend their entire lives at sea, females occasionally stop by land to lay their eggs. Female turtles like sandy beaches that are devoid of humans and sources of noise and light as a place to lay their hundreds of eggs. (source: https://www.mongabay.co.id/2016/05/29/penyu-hijau-si-hewan-purba-penjelajah/)
Once upon a time, female turtles lined up neatly towards land to lay their eggs. In the first and second rows, there is one turtle; in the third row, there are two turtles; in the fourth row, there are three turtles; in the fifth row, there are five turtles, and so on until forming a Fibonacci pattern

1. For example, the formation of turtles heading towards land forms a different Fibonacci pattern as follows:

Can you determine the pattern of missing numbers from the turtle formation?

.....

Reason

Fig. 2. Example of a question in sky class.

Number patterns and turtle breeding do not have a direct relationship. However, number patterns can be symbolic or analogous to turtle breeding. Turtle reproduction can be observed through a certain sequence or arrangement of numerical patterns. Here is an example that uses numbers to define patterns in turtles. Practice questions provide pupils with a high degree of flexibility as they can be completed at any location and at any time [49]. Finally, this study adds new information regarding mathematics in education as reported elsewhere bringing new ideas for the teaching and learning process [50-57].

5. Conclusion

The findings demonstrate that mobile learning is efficacious for acquiring knowledge and evaluating student learning outcomes. Integrating mobile learning technologies in exams can enhance the validity of evaluations of students' cognitive abilities. The validation of the findings from this research is highly dependable and applicable in the field of education, particularly for enhancing teacher professional development. Mobile learning technology is an effective instrument for assessing and evaluating one's teaching practices. The "Sky Class" platform positively affects students' thinking skills. Utilising the features of "Sky Class" is effortless for both teachers and students. According to experts, this product is highly user-friendly and adaptable. The Sky Class is highly ideal for testing both students and teachers in the field. Each component's average ML validity findings fall within the very good range. Additional research is advised to evaluate the efficacy and utility of implementing it directly in the classroom.

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References

1. Zafrullah, Z.; and Ramadhani, A.M. (2024). The use of mobile learning in schools as a learning media: Bibliometric analysis. *Indonesian Journal of Educational Research and Technology*, 4(2), 187-202.
2. Vidak, A.; Šapić, I.M.; and Zahtila, K. (2024). A user experience survey of an augmented reality android application for learning Coulomb's law. *Physics Education*, 59(4), 045033
3. Dash, A.K.; Behera, S.K.; and Dogra, D.P. (2023). PlutoAR: A scalable marker-based augmented reality application for interactive and inclusive education. *Multimedia Tools and Applications*, 83, 57685-57708
4. Nagar, H.; Paul, A.; Machavaram, R.; and Soni, P. (2024). Reinforcement learning particle swarm optimization based trajectory planning of autonomous ground vehicle using 2D LiDAR point cloud. *Robotics and Autonomous Systems*, 178, 104723.
5. Jeyapal, R.; Matrouk, K.; and Purushothaman, D. (2024). An efficient heuristic-aided adaptive autoencoder-based dilated DNN with attention mechanism for enhancing the performance of the MIMO system in 5G communication. *Multimedia Systems*, 30(3), 116.

6. Koleini, N.; Boroughani, T.; Eslami, Z.R.; dan Xodabande, I. (2024). Exploring the impacts of mobile-assisted learning on university students' technical vocabulary knowledge. *International Journal of Educational Research Open*, 7, 100344.
7. Margaris, A.; Filippas, I.; and Tsagkaris, K. (2022). Hybrid network–spatial clustering for optimizing 5g mobile networks. *Applied sciences*, 12(3), 1203.
8. Chen, Y.; Hartley, K.; Schrader, P.G.; and Zhang, C. (2024). Effects of mobile-assisted funds-of-knowledge writing practice in developing Latinx English learners' intercultural sensitivity. *Journal for Multicultural Education*, 18(1/2), 98-113.
9. Yang, G.; and Feng, X. (2024). Computer-aided technology based on graph sample and aggregate attention network optimized for soccer teaching and training. *Journal of Big Data*, 11(1), 48.
10. Faruk, A.; and Cahyono, E.S. (2018). Prediction and classification of low-birth-weight data using machine learning techniques. *Indonesian Journal of Science and Technology*, 3(1), 18-28.
11. Shamim, S.M.; Miah, M.B.A.; Angona, S.M.R.; and Al Jobair, A. (2018). Handwritten digit recognition using machine learning algorithms. *Indonesian Journal of Science and Technology*, 3(1), 29-46.
12. Thongnop, T.; Perpaman, T.; Kansiri, P.; Nuchda, W.; and Peungsungwan, S. (2021). Quality sorting of green coffee beans from wet processing by using the principle of machine learning. *ASEAN Journal of Science and Engineering*, 1(2), 63-66.
13. Obiwusi, K.Y.; Olatunde, Y.O.; Afolabi, G.K.; Oke, A.; Oyelakin, A.M.; and Salami, A. (2023). Evaluating the performance of supervised machine learning algorithms in breast cancer datasets. *ASEAN Journal of Science and Engineering*, 3(2), 179-184.
14. Thapwiroch, K.; Kumlue, A.; Saoyong, N.; Taprasa, P.; and Puengsungewan, S. (2021). Online assessment of electric circuit based on machine learning during covid-19 pandemic situation. *Indonesian Journal of Teaching in Scienc*e, 1(2), 105-112.
15. Song, H.; and Cai, L. (2024). Interactive learning environment as a source of critical thinking skills for college students. *BMC Medical Education*, 24(1), 270.
16. Gresse Von Wangenheim, C.; Alves, N.D.C.; Rauber, M.F.; Hauck, J.C.; and Yeter, I.H. (2022). A proposal for performance-based assessment of the learning of machine learning concepts and practices in K-12. *Informatics in Education*, 21(3), 479-500.
17. Hashim, S.; Masek, A.; Mahthir, B.N.S.M.; Rashid, A.H.A.; and Nincarean, D. (2021). Association of interest, attitude and learning habit in mathematics learning towards enhancing students' achievement. *Indonesian Journal of Science and Technology*, 6(1), 113-122.
18. Solihah, P.A.; Kaniawati, I.; Samsudin, A.; and Riandi, R. (2024). Prototype of greenhouse effect for improving problem-solving skills in science, technology, engineering, and mathematics (STEM)-education for sustainable development (ESD): Literature review, bibliometric, and experiment. *Indonesian Journal of Science and Technology*, 9(1), 163-190.

19. Angraini, L.M.; Susilawati, A.; Noto, M.S.; Wahyuni, R.; and Andrian, D. (2024). Augmented reality for cultivating computational thinking skills in mathematics completed with literature review, bibliometrics, and experiments for students. *Indonesian Journal of Science and Technology*, 9(1), 225-260.
20. Akinoso, S.O. (2023). Motivation and ICT in secondary school mathematics using unified theory of acceptance and use of technology model. *Indonesian Journal of Educational Research and Technology*, 3(1), 79-90.
21. Radiamoda, A.A. (2024). Difficulties encountered by the students in learning mathematics. *Indonesian Journal of Educational Research and Technology*, 4(1), 63-70.
22. Farokhah, L.; Herman, T.; Wahyudin, W.; and Abidin, Z. (2024). Global research trends of mathematics literacy in elementary school: A bibliometric analysis. *Indonesian Journal of Educational Research and Technology*, 4(3), 279-290.
23. Broderick, A.C.; Glen, F.; Godley, B.J.; and Hays, G.C. (2002). Estimating the number of green and loggerhead turtles nesting annually in the Mediterranean. *Oryx*, 36(3), 227-235.
24. Pasini, F.W.; Busch, A.N.;Ináč, J.; Padmanabhan, K.; and Muller, L. (2023). Algebraic approach to spike-time neural codes in the hippocampus. *Physical Review*, 108(5), 054404.
25. Chappell, D.S.; and Schermerhorn Jr, J.R. (1999). Using electronic student portfolios in management education: A stakeholder perspective. *Journal of Management Education*, 23(6), 651-662.
26. Al Ardha, M.A.; Nurhasan, N.; Nur, L.; Chaeroni, A.; Bikalawan, S.S.; and Yang, C.B. (2024). Analysis of android-based applications in physical education and sports: Systematic review. *Retos*: *Nuevas Tendencias en Educación Física, Deporte y Recreación*, 57, 390-398.
27. Suyanto, E.; Fuad, M.; Antrakusuma, B.; Suparman, and Shidiq, A.S. (2023). Exploring the research trends of technological literacy studies in education: A systematic review using bibliometric analysis. *International Journal of Information and Education Technology*, 13(6), 914-924.
28. Ammatulloh, M.I.; Permana, N.; Firmansyah, R.; Sa'adah, L.N.; Izzatunnisa, Z.I.; and Muthaqin, D.I. (2022). Strengthening character education of students through civics caring apps based on m-learning during the covid-19 pandemic. *Indonesian Journal of Educational Research and Technology*, 2(2), 87-96.
29. Jadhav, S.D.; and Pawa, N.B. (2022). A study of customer awareness of payment apps in rural areas with special reference Satara district. *ASEAN Journal of Community Service and Education*, 1(2), 121-126.
30. Hendrayanto, A.R.; Muktiarni, M.; and Mupita, J. (2022). Perception of junior high school students in using ipusnas app as medium for increase literacy social studies subject. *Indonesian Journal of Educational Research and Technology*, 2(3), 149-154.
31. Li, J. (2021). Application of mobile information system based on internet in college physical education classroom teaching. *Mobile Information Systems*, 2021(1), 1481070.

32. Bartolome, D.J. (2023). Utilization of ICT in teaching mathematics in public secondary schools at San Mateo, Isabela. *Quantum Journal of Social Sciences and Humanities*, 4(5), 111-125.
33. Arciosa, R.M. (2022). Information communication technology (ICT)-based instructional software and its effectiveness in teaching high school geometry. *Indonesian Journal of Teaching in Science*, 2(1), 51-60.
34. Lathifah, N.N.; and Maryanti, R. (2021). Basic arithmetic learning through math online games for elementary school students during the pandemic. *Indonesian Journal of Multidiciplinary Research*, 1(2), 379-384.
35. Thoriq, M.; Sakti, A.W.; Azizah, N.N. (2023). Learning mixed arithmetic operations using whatsapp groups for Islamic elementary school students. *Indonesian Journal of Teaching in Science*, 3(1), 17-22.
36. Rusyani, E.; Ratnengsih, E.; Putra, A.S.; Maryanti, R.; Al Husaeni, D.F.; and Ragadhita, R. (2022). The drilling method application using abacus to arithmetic operations skills in student with hearing impairment at special school. *Indonesian Journal of Community and Special Needs Education*, 2(1), 1-10.
37. Xie, W.; and Zhang, H. (2023). Patterned reed-muller sequences with outer a-channel codes and projective decoding for slot-controlled unsourced random access. *Sensors*, 23(11), 5239.
38. Alam, K.H.; Rohen, Y.; Saleem, N.; Aphane, M.; and Rzzaque, A. (2024). Convergence of Fibonacci-Ishikawa iteration procedure for monotone asymptotically nonexpansive mappings. *Journal of Inequalities and Applications*, 2024(1), 81.
39. Jin, Y.; Xiao, X.; Pan, Y.; Zhou, X.; Hu, K.; Wang, H.; and Zou, X. (2024). A Novel Method for the Object Detection and Weight Prediction of Chinese Softshell Turtles Based on Computer Vision and Deep Learning. *Animals*, 14(9), 1368.
40. Weinhuber, M.; Lachner, A.; Leuders, T.; and Nückles, M. (2019). Mathematics is practice or argumentation: Mindset priming impacts principle and procedure orientation of teachers' explanations. *Journal of Experimental Psychology*: *Applied*, 25(4), 618.
41. Alrehaili, E.A.; and Al Osman, H. (2022). A virtual reality role-playing serious game for experiential learning. *Interactive Learning Environments*, 30(5), 922-935.
42. Veeber, E.; Syrjäläinen, E.; and Kokko, S. (2023). Estonian and Finnish teachers' experiences of textile craft purposes in basic education. *FormAkademisk*, 16(1), 1-13.
43. Hernández, A.F.V.; Padilla, D.S.B.; and Newball, A.A.N. (2024). Videogames and open feedback systems to enhance probabilistic reasoning and engagement. *International Journal of Serious Games*, 11(1), 3-24.
44. Franklin, T. (2011). Mobile learning: At the tipping point. *Turkish Online Journal of Educational Technology-TOJET*, 10(4), 261-275.
45. Saikat, S.; Dhillon, J.S.; Wan Ahmad, W.F.; and Jamaluddin, R.A.D. (2021). A systematic review of the benefits and challenges of mobile learning during the COVID-19 pandemic. *Education Sciences*, 11(9), 459.

46. Criollo-C, S.; Guerrero-Arias, A.; Jaramillo-Alcázar, Á.; and Luján-Mora, S. (2021). Mobile learning technologies for education: Benefits and pending issues. *Applied Sciences*, 11(9), 4111.
47. Ferri, F.; Grifoni, P.; and Guzzo, T. (2020). Online learning and emergency remote teaching: Opportunities and challenges in emergency situations. *Societies*, 10(4), 86.
48. Frohberg, D.; Göth, C.; and Schwabe, G. (2009). Mobile learning projects–a critical analysis of the state of the art. *Journal of Computer Assisted Learning*, 25(4), 307-331.
49. Jones, A.C.; Scanlon, E.; and Clough, G. (2013). Mobile learning: Two case studies of supporting inquiry learning in informal and semiformal settings. *Computers and Education*, 61, 21-32.
50. Lagcao, Y.G.D.; Dechavez, J.P.A.D.; Goleng, D.J.G.; Lagca, Y.G.D.; Tangkli, K.Y.M.; and Vicera, W.J.C. (2023). Math readiness and its Effect on the online academic performance of science, technology, engineering, and mathematics students. *ASEAN Journal for Science Education*, 2(1), 33-38.
51. Awofala, A.O.A.; and Olaniyi, A.O. (2023). Assessing teachers' formative evaluation strategy as related to senior secondary school students' achievement in mathematics. *ASEAN Journal for Science Education*, 2(2), 77-86.
52. Obafemi, K.E.; Saadu, U.T.; Yahaya, O.; Obafemi, T.O.; and Yakubu, F.M. (2024). Exploration of the effect of scaffolding instructional strategy on pupils' academic performance in mathematics. *ASEAN Journal for Science Education*, 2(2), 121-128.
53. Awofala, A.O.A.; and Agbolade, F.O.O. (2024). Effect of peer-tutoring strategy on senior secondary school students' achievement in mathematics. ASEAN Journal for Science Education, 3(1), 1-12.
54. Padmore, E.A.; and Ali, C.A. (2024). Exploring effective differentiated instruction in the teaching and learning of mathematics. *ASEAN Journal for Science Education*, 3(1), 41-54.
55. Lasisi, A.K.; Hassan, A.A.; and Abdulkareem, H.B. (2024). Impact of single parenting on academic performance of junior secondary school students in mathematics. *ASEAN Journal for Science Education*, 3(2), 129-138.
56. Angraini, L.M.; Kania, N.; and Gürbüz, F. (2024). Students' Proficiency in Computational Thinking Through Constructivist Learning Theory. *International Journal of Mathematics and Mathematics Education*, 45-59.
57. Kania, N.; and Juandi, D. (2023). Does self-concept affect mathematics learning achievement? *Journal of Education and Learning* (*EduLearn*), 17(3), 455-461.