Jurnal Pendidikan Matematika RAFA
p-ISSN :2460-8718
e-ISSN : 2460-8726

Available online at:
http://jurnal.radenfatah.ac.id/index.php/jpmrafa
June 2024, 10(1): 1-11

Learn to be wise in making decision through studying financial mathematics

M. Hasbi Ramadhan[1)], Zulkardi[2*)], Ratu Ilma Indra Putri[3)], Yulia Resti[4)]
[1)2)3)] Program Studi Pendidikan Matematika, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Sriwijaya, Sumatera Selatan, Indonesia
[4)] Program Studi Matematika, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Sriwijaya, Sumatera Selatan, Indonesia
[*]email correspondence: zulkardi@unsri.ac.id
(*Received 27-04-2024, Reviewed 21-05-2024, Accepted 30-06-2024*)

Abstract

In everyday life, we were asked to be careful in making decisions, especially regarding financial matters. This research aimed to design a financial mathematical task to train students to be wiser in making decisions regarding financial matters. The method used in this research was design research with type of development studies. The approach used in this research was Realistic Mathematics Education (RME) or in Indonesia is better known as Pendidikan Matematika Realistik Indonesia (PMRI). For the context, this research used buying a house with credit or banking context. This research was conducted at Vocational High School 01 Jambi City with the subjects were eleventh-grade students with major of accounting. This research produced a financial mathematical task in the context of buying a house that was valid, practical, and has potential effect for financial mathematics learning. The research results also found that students became wiser in making decisions regarding financial matters. This research can also be a reference for vocational high school teachers to make financial mathematics teaching materials.

***Keywords**: Financial Mathematics, PMRI, RME, Design Research*

Abstrak

Dalam kehidupan sehari-hari, kita diminta cermat dalam mengambil keputusan khususnya terkait masalah keuangan. Penelitian ini bertujuan untuk mendesain soal matematika keuangan untuk melatih siswa menjadi lebih bijaksana dalam mengambil keputusan terkait permasalahan keuangan. Metode yang digunakan dalam penelitian ini adalah *design research* tipe *development studies*. Pendekatan yang digunakan dalam penelitian ini adalah *Realistic Mathematics Education* (RME) atau di Indonesia lebih dikenal sebagai Pendidikan Matematika Realistik Indonesia (PMRI). Untuk konteks, penelitian ini menggunakan konteks membeli rumah dengan kredit atau secara perbankan. Penelitian ini dilakukan di SMKN 01 Kota Jambi dengan subjek yaitu siswa kelas sebelas jurusan akuntansi. Penelitian ini menghasilkan latihan matematika keuangan dengan konteks membeli rumah yang valid, praktis, dan memiliki efek potensial bagi pembelajaran matematika keuangan. Hasil penelitian juga menemukan bahwa siswa menjadi lebih bijak dalam mengambil keputusan terkait masalah keuangan. Penelitian ini juga dapat menjadi referensi bagi guru SMK untuk membuat bahan ajar matematika keuangan.

Kata kunci: Matematika Keuangan, PMRI, RME, *Design Research*

INTRODUCTION

Mathematics is one of influential rules in learning activities to improve student achievement (Bulukaya et al., 2020). Mathematics can also be called as a foundation for learning other disciplines to solve problems in our daily life (Junpeng et al., 2020; Kesorn et al., 2020). Nevertheless, mathematics textbooks isolate practice-oriented mathematics education and it makes students face difficulties in applying mathematics in real-life situations (Jones et al., 2015; Shute et al., 2016; Ke & Clark, 2020). To overcome this, an approach that is oriented to the real world is needed. An approach that is oriented in a real -world situation is Realistic Mathematics Education (RME) or in Indonesia it is called Pendidikan Matematika Realistik Indonesia (PMRI).

RME developed by Hans Freudenthal in the Netherlands is a learning theory that views mathematics as a human activity (Zulkardi et al., 2020; Wijaya et al., 2021; Sya'bani et al., 2021). In Indonesia, RME is better known as PMRI and it has been going since 2001 (Zulkardi, 2002). PMRI has five characteristics, namely 1). using real world contexts as a starting point, 2). using models as a bridge between abstract mathematics and the real world, 3). using students' own production or strategies, 4). interaction between teacher and students, as well as fellow students, and 5). connections between scientific disciplines (Zulkardi & Putri, 2019). So by using these five characteristics especially for studying financial mathematics, it will be more meaningful since it uses a real context and students use their own strategies in solving the problems given. Moreover, this approach also effectively increases a student's academic achievement, student's mathematical abilities, and the quality of mathematics education (Zakaria & Syamaun, 2017; Tamur et al., 2020; Aksu & Colak, 2021).

In formal activities, learning mathematics not only at primary school level, but also at higher school levels, including vocational high schools (VHS). Based on regulation of the Minister of Education and Culture of the Republic of Indonesia No. 22 of 2020 concerning the Strategic Plan of the Ministry of Education and Culture for 2020-2024 explains that in the context of revitalizing for VHS to improve the quality and competitiveness of Indonesia's human resources, the Ministry of Education and Culture making several efforts to ensure high quality vocational school graduates and relevant for business-industrial fields and also can respond to global and regional competition, such as the implementation of the ASEAN Economic Community. It means that VHS graduates must master their field in order to contribute actively.

There are some specific fields at VHS. Accounting major (AM) is one of them that specifically discusses financial matters. In eleventh-grade of AM, financial mathematics

topic is the application of sequences and series including growth, decay, single interest, compound interest and annuity (Ediyanto & Harsasi, 2022). These topics are often encountered and applied in everyday life problems. It means that financial mathematics problems given must be oriented towards everyday life problems so it will contribute to student's learning outcomes (Almaida & Gallego, 2023; Latifah et al., 2023; Nuryadi et al., 2023).

But Sutiaharni & Armiati (2020) found in previous research that the implementation of financial mathematics learning was still too general for VHS programs. In addition, it is not oriented by daily activities and it's not require special skills for solving the problems. Next, Sutiaharni et al., (2021) also found that the context used was irrelevant from daily problems. Based on these findings, in this research real context was used as the basis for the PMRI approach. The financial problem topic used is buying a house using credit or banking. This aims to train students to be wise in making decisions regarding financial matters.

METHOD

The method used in this research is design research with type of development studies. Development studies in design research has two stages i.e: the preliminary stage and formative evaluation stage for developing the prototype. At the preliminary stage, the researcher determines the place and time of the research, then analyzes the curriculum and textbooks used, also reviewing the student's needs. Next at the formative evaluation stage, it has several stages from low to high resistance to revision namely self-evaluation, expert review, one-to-one, small group, and field test. Formative evaluation stage can be seen in Figure 1. (Zulkardi, 2002; Plomp, 2013; Bakker, 2018).

During the self-evaluation stage, prototype 1 was designed by the researcher and teachers as learning activities based on curriculum, student's needs, and the approach used. For collecting the data, this research uses Miles-Huberman technique which combines with the formative evaluation stage. Then prototype 1 will be validated in the expert review stage, covering aspects such as content, language, and activity construction. It was also tested at the one-to-one stage involving 3 students to get revision. After prototype 1 becomes valid, it will produce prototype 2 that will be tested in a small group stage involving 6 students. After revision and commentary from students, finally it produced prototype 3 that will be tested in a field test stage including students in one class. The data were carried out through observation, documentation, interviews, questionnaires, and tests.

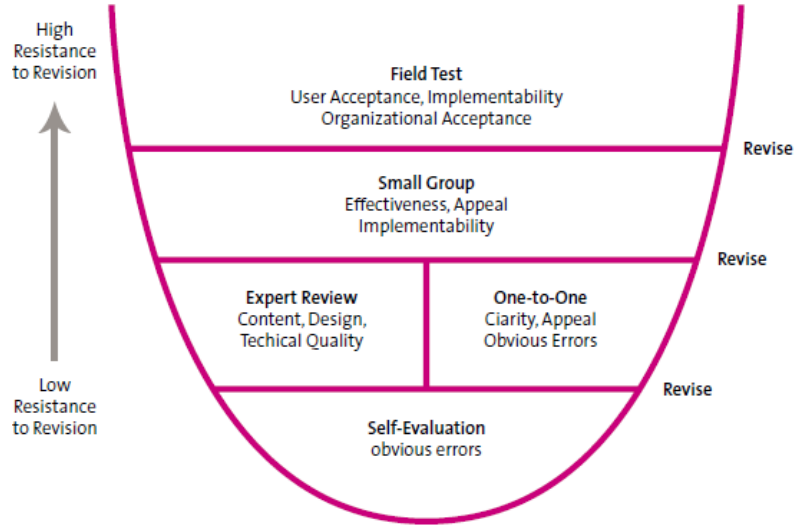


Figure 1. Formative evaluation stage

RESULTS AND DISCUSSION

This research produces valid, practical, and potential effects of financial mathematics teaching materials obtained at the prototyping stage using the formative evaluation stage. Validity is obtained at the expert review and one-to-one stage, practicality is obtained at small group stage, and potential effect can be seen in field test stages. However, before proceeding to the prototyping stage, researchers still carry out the preliminary stage and self-evaluation stage in accordance with the design research stage.

Preliminary Stage

At the preliminary stage, researchers determine the location, time, and research subjects. This research was conducted at VHS 01 Jambi City in March 2023 with the subjects were eleventh-grade students with a major of accounting (XI of MA). For one-to -one stage, it involved 3 students from XI of MA 3, next for small group stage, it involved 6 students from XI of MA 2, and last for the field test stage, it involved all of the students in XI of MA 1 with a total of 35 students. Firstly, researcher (R) discusses with mathematics teacher (T) about curriculum used, learning materials, the PMRI approach, and so on to get information and design the task.

Transcript 1 Discussion of researcher (R) with mathematics teacher (T)

R : For accounting, what curriculum is used for learning mathematics?

T : We still use curriculum 13 (or K13) for eleventh-grade students.

R : For learning material, is the financial mathematics material given designed using the context of everyday problems?

T : No, that's only using a textbook without real context.

R : Have you ever used the PMRI approach?

T : No, I don't.

From the discussion, it was found that the curriculum used was still K13. For learning material of financial mathematics, teachers still used textbooks that do not contain the context of everyday problems. Teachers also never used the PMRI approach. Based on these findings, researcher and teacher designed a financial mathematical task using the PMRI approach with the context of buying a house with credit or banking.

Formative Evaluation Stage

In this stage, firstly researchers and teachers made financial mathematical tasks based on the curriculum and the PMRI approach. To search the data for context, researchers used the Miles-Huberman technique (Miles et al., 2014). Researchers use google search engine to collect the data. Researcher uses the keyword "buying house with credit" and also searches for "bank installment brochure". After getting some data, the data will be reduced if it does not match. If the data is appropriate, then the data will be designed based on the learning material. Next, this data collection technique will be combined with a formative evaluation technique that can be seen in **Figure 2**. For the first, this section produces prototype 1.

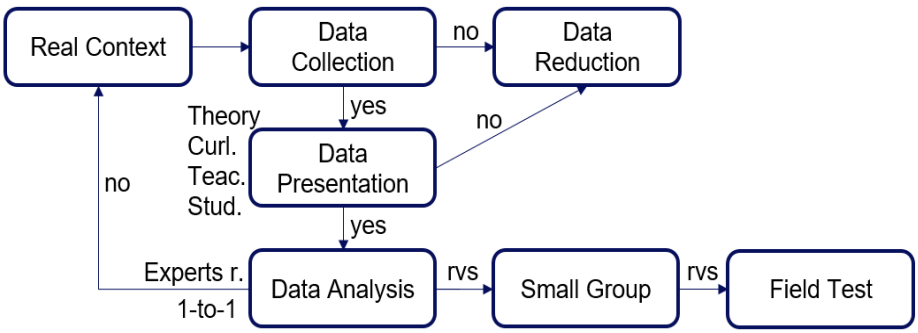


Figure 2. Miles-Huberman formative evaluation technique

After prototype 1 was made, it was validated by experts including content, language, and construction. Content assessment ensured appropriateness of activities. Language assessment focused on compliance with the Enhanced Indonesian Spelling Guidelines (EYD). Lastly the appropriateness of questions was evaluated in construct assessment. Commentary and suggestions from experts can be seen in **Table 1**.

Table 1. Commentary and suggestions from expert review

Commentary/Suggestions	Revised
1. Giving illustrations that are educational not hedonistic or consumerist.	1. Designing appropriate illustration.
2. Giving questions with language that is easier to understand for students.	2. Revising the question to be simpler and easier for students to understand.
3. Add the required information.	3. All the information needed is in the picture given.

Simultaneously, one-to-one stages were conducted with 3 students from XI of MA 3 to gather feedback for revision. After revision based on commentary and suggestion from expert review and one-to-one stage, prototype 1 was deemed valid and it produced prototype 2.

Next, prototype 2 was tested at the small group stage. This stage was carried out to determine the practicality of prototype 2. This stage involved 6 students from XI of MA 2. After it was tested and got revision based on commentary, prototype 2 turns into prototype 3 and will be tested at the field test stage.

Prototype 3 was tested for all students in XI of MA 1 as the field test stage. It aimed to see the potential effects of the learning materials made. Below is prototype 3 that was tested at the field test stage that can be seen in Figure 3. The questions given are related to buying a house on credit or banking. The first picture in figure 3 is the amount of installments at a bank, and the second one is the price of the house along with the installments offered. This aimed for students to become wiser in making decisions regarding financial matters.

Plafond	Jangka Waktu									
	1	2	3	4	5	6	7	8	9	10
10.000.000	887.318,79	469.568,09	330.950,31	262.112,55	221.183,21	194.204,30	175.193,17	161.157,94	150.436,01	142.029,46
20.000.000	1.774.637,58	939.136,18	661.900,63	524.225,10	442.366,42	388.408,60	350.386,33	322.315,88	300.872,03	284.058,92
30.000.000	2.661.956,37	1.408.704,26	992.850,94	786.337,65	663.549,63	582.612,90	525.579,50	483.473,82	451.308,04	426.088,38
40.000.000	3.549.275,15	1.878.272,35	1.323.801,26	1.048.450,19	884.732,84	776.817,20	700.772,67	644.631,76	601.744,06	568.117,84
50.000.000	4.436.593,94	2.347.840,44	1.654.751,57	1.310.562,74	1.105.916,04	971.021,50	875.965,84	805.789,70	752.180,07	710.147,30
60.000.000	5.323.912,73	2.817.408,53	1.985.701,89	1.572.675,29	1.327.099,25	1.165.225,80	1.051.159,00	966.947,63	902.616,09	852.176,76
70.000.000	6.211.231,52	3.286.976,62	2.316.652,20	1.834.787,84	1.548.282,46	1.359.430,10	1.226.352,17	1.128.105,57	1.053.052,10	994.206,21
80.000.000	7.098.550,31	3.756.544,71	2.647.602,52	2.096.900,39	1.769.465,67	1.553.634,40	1.401.545,34	1.289.263,51	1.203.488,12	1.136.235,67
90.000.000	7.985.869,10	4.226.112,79	2.978.552,83	2.359.012,94	1.990.648,88	1.747.838,70	1.576.738,50	1.450.421,45	1.353.924,13	1.278.265,13
100.000.000	8.873.187,89	4.695.680,88	3.309.503,15	2.621.125,48	2.211.832,09	1.942.043,00	1.751.931,67	1.611.579,39	1.504.360,15	1.420.294,59
120.000.000	10.647.825,46	5.634.817,06	3.971.403,78	3.145.350,58	2.654.198,51	2.330.451,60	2.102.318,01	1.933.895,27	1.805.232,18	1.704.353,51
140.000.000	12.422.463,04	6.573.953,24	4.633.304,41	3.669.575,68	3.096.564,92	2.718.860,20	2.452.704,34	2.256.211,15	2.106.104,21	1.988.412,43
160.000.000	14.197.100,62	7.513.089,41	5.295.205,04	4.193.800,78	3.538.931,34	3.107.268,80	2.803.090,68	2.578.527,03	2.406.976,24	2.272.471,35
180.000.000	15.971.738,19	8.452.225,59	5.957.105,66	4.718.025,87	3.981.297,76	3.495.677,40	3.153.477,01	2.900.842,90	2.707.848,26	2.556.530,27
200.000.000	17.746.375,77	9.391.361,77	6.619.006,29	5.242.250,97	4.423.664,18	3.884.086,00	3.503.863,34	3.223.158,78	3.008.720,29	2.840.589,19
230.000.000	20.408.332,14	10.800.066,03	7.611.857,24	6.028.588,61	5.087.213,80	4.466.698,90	4.029.442,85	3.706.632,60	3.460.028,34	3.266.677,56
250.000.000	22.182.969,71	11.739.202,21	8.273.757,87	6.552.813,71	5.529.580,22	4.855.107,50	4.379.829,18	4.028.948,48	3.760.900,37	3.550.736,48
280.000.000	24.844.926,08	13.147.906,47	9.266.608,81	7.339.151,36	6.193.129,85	5.437.720,41	4.905.408,68	4.512.422,30	4.212.208,41	3.976.824,86
320.000.000	28.394.201,23	15.026.178,83	10.590.410,07	8.387.601,55	7.077.862,68	6.214.537,61	5.606.181,35	5.157.054,05	4.813.952,47	4.544.942,70
350.000.000	31.056.157,60	16.434.883,09	11.583.261,01	9.173.939,20	7.741.412,31	6.797.150,51	6.131.760,85	5.640.527,87	5.265.260,51	4.971.031,07
360.000.000	31.943.476,39	16.904.451,18	11.914.211,33	9.436.051,74	7.962.595,52	6.991.354,81	6.306.954,02	5.801.685,81	5.415.696,53	5.113.060,53
375.000.000	33.274.454,57	17.608.803,31	12.410.636,80	9.829.220,57	8.294.370,33	7.282.661,26	6.569.743,77	6.043.422,72	5.641.350,55	5.326.104,72

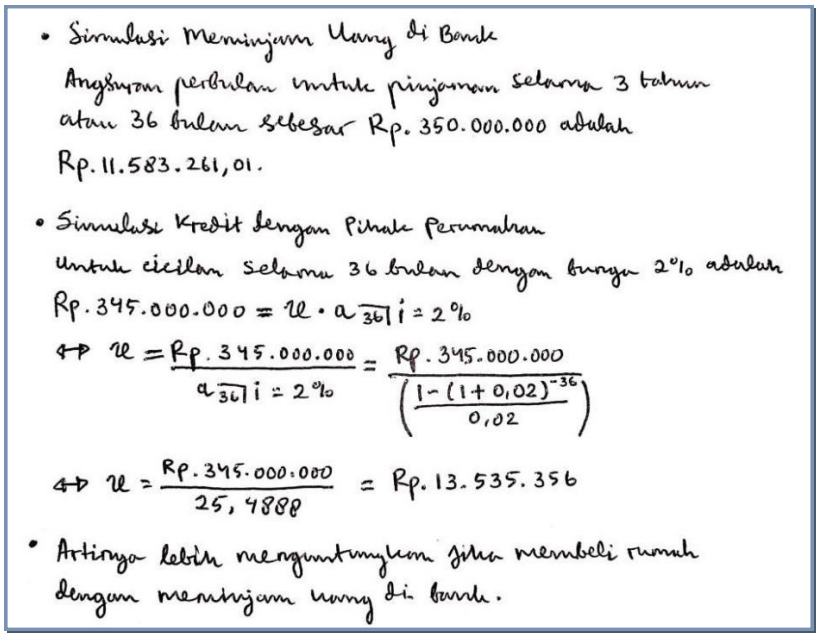
Pak Budi ingin membeli rumah secara kredit. Dengan tempo yang ditawarkan, manakah yang lebih menguntungkan antara meminjam uang di bank untuk membeli rumah secara *cash* (kontan) atau melakukan simulasi kredit seperti yang ditawarkan pihak perumahan?

Translation: Mr. Budi wants to buy a house on credit. With period offered, which is more profitable, borrowing money from the bank to buy a house in cash or doing a credit simulation like that offered by the housing company?

Figure 3. Buying a house on credit or banking problem

To answer these questions, students need understanding and strategies. First, students must understand the information regarding the installment amount if they borrow money from the bank. Second, students are able to calculate the credit simulation

offered by the housing company in their own way. After students have solved these two problems, students are asked to conclude which is more profitable, borrowing money from the bank to buy a house in cash, or taking the credit simulation offered by the housing company. The following is the student's answer that can be seen in **Figure 4**.



Translation:

- Simulation of borrowing money at the bank
  Monthly installments for a loan of 3 years or 36 months amounting to IDR 350,000,000 is IDR 11,583,261.01.
- Simulation of credit with housing company
  For installments of 36 months with 2% interest is IDR 345,000,000 = $x \cdot a_{36|i=2\%}$
  $\leftrightarrow x = \frac{\text{IDR } 345{,}000{,}000}{a_{36|i=2\%}} = \text{IDR } 13{,}535{,}356.$
- It means that more profitable to buy a house by borrowing money from the bank.

Figure 4. Student's answer regarding buying a house

From the students' answers, it can be concluded that students understand the amount of installments if they borrow money from the bank and are able to calculate the amount of installments offered by the housing company. In addition, students are also able to conclude which one is more profitable in buying a house, credit or banking.

To answer financial mathematics problems, students need to know every information given (Dituri et al., 2019). Students must also have strategies for answering financial problems (Hikmah et al., 2021). In this research, we used real context as learning material for financial mathematics. By using real context, it will be more meaningful and make students more responsible in future about financial concepts

(Ferreira & Bisognin, 2020). In addition, Makonye (2019) stated that learning financial mathematics with real context can make someone wiser in making decisions. Moreover, a learning approach with real context is needed to make students more understand about problems in everyday life, one of them is the PMRI approach (Zulkardi & Putri, 2019).

CONCLUSIONS

This research produces financial mathematics tasks with the context of buying a house that is valid, practical, and has potential effects. Valid can be seen and reviewed by experts covering content, language, and activity construction. Practicality can be seen in how students can answer questions with their own strategies. Next, the potential effect is reviewed in how students become wiser in making decisions regarding financial problems. This can also be seen in how students are able to compare between borrowing money from a bank or credit to buy a house. This research can also be a reference for vocational high school teachers to make financial mathematics teaching materials. Furthermore, for next research, namely how financial mathematics learning is viewed from the perspective of Islam. It's an interesting topic.

REFERENCES

Aksu, H. H. & Colak, S. O. (2021). The effect of realistic mathematics education on student achievement in 8th grades geometric objects teaching. *African Educational Research Journal, 9*(1), 20-31. https://doi.org/10.30918/AERJ.91.20.205

Almaida, J. D. & Gallego, D. C. (2023). Dynamic and multipurpose teaching models at the first international exhibition of mathematics teaching material. *Education Sciences, 13*(3), 265. https://doi.org/10.3390/educsci13030265

Bakker, A. (2018). *Design research in Education: A practical guide for early career researchers*. London: Routledge. https://doi.org/10.4324/9780203701010

Bulukaya, S. K., Ismail, Y., & Zakiyah, S. (2020). Pengembangan pembelajaran berbasis WEB pada materi tingkat bunga sederhana dan tingkat bunga majemuk. *Jurnal Ilmiah Matematika, Sains, Dan Teknologi (Euler)*, *8*(2), 70–82. https://doi.org/10.34312/euler.v8i2.10426

Dituri, P., Davidson, A., & Marley-Payne, J. (2019). Combining financial education with mathematics coursework: Findings from a pilot study. *Journal of Financial Counseling and Planning, 30*(2), 313-322. https://doi.org/10.1891/1052-3073.30.2.313

Ediyanto, A. & Harsasi, M. (2022). *Matematika 2 Rumpun Teknologi untuk SMK/MAK Kelas XI (K-Merdeka)*. Jakarta: Erlangga.

Ferreira, S.M. & Bisognin, V. (2020). Construction of mathematical and financial concepts based on realistic mathematics education. *ACTA SCIENTIAE, 22*(5), 226-253. https://doi.org/10.17648/acta.scientiae.5925

Hikmah, N. H., Siswono, T. Y. E., & Zahri, M. (2021). Profile of collaborative problem solving among XI students in solving financial mathematics problems. *Journal of Mathematical Pedagogy, 2*(2), 82-91. https://doi.org/10.26740/jomp.v2n2.p82-91

Jones, I., Swan, M., & Pollitt, A. (2015). Assessing mathematical problem solving using comparative judgement. *International Journal of Science and Mathematics Education, 13*(1), 151–177. https://doi.org/10.1007/s10763-013-9497-6

Junpeng, P., Marwiang, M., Chiajunthuk, S., Suwannatrai, P., Chanayota, K., Pongboriboon, K., Tang, K. N., & Wilson, M. (2020). Validation of a digital tool for diagnosing mathematical proficiency. *International Journal of Evaluation and Research in Education, 9*(3), 665–674. https://doi.org/10.11591/ijere.v9i3.20503

Ke, F., & Clark, K. M. (2020). Game-based multimodal representations and mathematical problem solving. *International Journal of Science and Mathematics Education, 18* (1), 103–122. https://doi.org/10.1007/s10763-018-9938-3

Kesorn, N., Junpeng, P., Marwiang, M., Pongboriboon, K., Tang, K. N., Bathia, S., & Wilson, M. (2020). Development of an assessment tool for mathematical reading, analytical thinking and mathematical writing. *International Journal of Evaluation and Research in Education, 9*(4), 955–962. https://doi.org/10.11591/ijere.v9i4.20505

Latifah, N., Fahrurrozi, M.S., Z., Sumantri, M. S., & Setiawan, B. (2023). Elementary school teachers' perceptions of Indonesian elementary school textbooks: A case study. *Journal of Higher Education Theory and Practice, 23*(1). https://doi.org/10.33423/jhetp.v23i1.5782

Makonye, J. P. (2019). Towards a culturally embedded financial mathematics PCK framework. *Research in Mathematics Education, 22*(2), 98-116. https://doi.org/10.1080/14794802.2020.1752788

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook (3rd Edition)*. Washington DC: SAGE Publications. https://doi.org/10.1177/239700221402800402

Nuryadi, A, Fitiradhy, A., Marhaeni, N. H., Purwoko, R. Y., & Rumasoreng, M. I. (2023). The effects of puppet ethnomathematics applications as mathematics teaching materials for character education Based. *Pegem Egitim ve Ogretim Dergisi, 13* (2), 153–160. https://doi.org/10.47750/pegegog.13.02.19

Plomp, T. (2013). *Educational design research: An introduction. In T. Plomp & N. Nieveen (Eds)*. Enschede: Netherlands Institute for Curriculum Development. https://ris.utwente.nl/ws/portalfiles/portal/14472302/

Shute, V. J., Wang, L., Greiff, S., Zhao, W., & Moore, G. (2016). Measuring problem solving skills via stealth assessment in an engaging video game. *Computers in Human Behavior, 63*, 106–117. https://doi.org/10.1016/j.chb.2016.05.047

Sutiaharni, S. & Armiati, A. (2020). Development of mathematics learning devices based on realistic mathematics education for financial accounting expertise program in vocational high school. *Journal of Physics: Conference Series, 1554*(1), 012060. https://doi.org/10.1088/1742-6596/1554/1/012060

Sutiaharni, Armiati, & Permana, D. (2021). Practicality of realistic mathematics education based learning design of linear programming for financial accounting major in

vocational high school. *Journal of Physics: Conference Series. 1940*(1), 012104. https://doi.org/10.1088/1742-6596/1940/1/012104

Sya'bani, F., Armiati, Permana, D., Arnawa, I. M., & Asmar, A. (2021). The practicality of learning design based on realistic mathematics education for probability topic of grade VIII junior high school. *Journal of Physics: Conference Series, 1742*(1), 012036. https://doi.org/10.1088/1742-6596/1742/1/012036

Tamur, M., Juandi, D., & Adem, A. M. G. (2020). Realistic mathematics education in Indonesia and recommendations for future implementation: A meta-analysis study. *JTAM (Jurnal Teori dan Aplikasi Matematika), 4*(1), 17-27. https://doi.org/10.31764/jtam.v4i1.1786

Wijaya, A., Elmaini, & Doorman, M. (2021). A learning trajectory for probability: A case of game-based learning. *Journal on Mathematics Education, 12*(1), 1–16. https://doi.org/10.22342/jme.12.1.12836.1-16

Zakaria, E. & Syamaun, M. (2017). The effect of realistic mathematics education approach on students' achievement and attitudes towards mathematics. *Mathematics Education Trends and Research, 1*(1), 32-40. https://doi.org/10.5899/2017/metr-00093

Zulkardi. (2002). *Developing a learning environment on realistic mathematics education for indonesian student teachers [PhD Thesis]*. Enschede: Twente University. https://research.utwente.nl/en/publications/developing-a-learning-environment-on-realistic-mathematics-educat

Zulkardi & Putri, R. I. I. (2019). *New school mathematics curricula, PISA and PMRI in Indonesia. In: Vistro-Yu, C.P., & Toh, T.L. (Eds.). School Mathematics Curricula: Asian Perspectives and Glimpses of Reform (pp.39-49)*. Singapore: Springer. https://doi.org/10.1007/978-981-13-6312-2_3

Zulkardi, Putri, R. I. I., & Wijaya, A. (2020). *Two decades of realistic mathematics education in Indonesia*. Singapore: Springer. https://doi.org/10.1007/978-3-030-20223-1_18