



Research article

The analysis of the RBL-STEM application in improving student financial literacy in controlling consumptive behavior

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ABSTRACT

This study aims to analyze the application of the RBL-STEM learning model in improving students' financial literacy to control their consumptive behavior. The method used in this study combines qualitative and quantitative methods by involving 110 students of Riau University. The data of this study were analyzed using SEM PLS on nine Hypotheses that link the application of the RBL-STEM model, student literacy, and student consumptive behavior. The results showed that one hypothesis was rejected, namely the relationship between Risk management and consumptive behavior. The results of the outer model show that each indicator has a composite reliability (CR) value of >0.7 and an average variance extracted (AVE) value of >0.5 . It concludes that the outer model used in this study is good. Based on the analysis results, in general, the application of the RBL-STEM learning model has a significant influence on increasing student financial literacy, which has an impact on controlling student consumptive behavior.

1. Introduction

The financial literacy of the Indonesian people still needs to improve. The results of a survey by the Indonesian Financial Services Authority (IFSA) in 2019 showed that the national financial literacy rate was still 38.03 %. Likewise, for students, as revealed from the research results, the level of financial literacy of Yogyakarta State University students could be a lot higher. It corroborates the findings of a similar study conducted in Indonesia [1]. Financial literacy is one of the important aspects of personal, organizational, and even national financial success to manage their finances effectively and efficiently [2]. Financial blindness negatively affects not only the personal well-being of people but also the financial sphere as a whole. Therefore, increasing the financial literacy of the public in general will significantly impact the nation's financial health in the future [3]. On the other hand, the consumptive behavior of the Indonesian people is still relatively high, as is the consumptive behavior of students. Results of research by Ref. [4] at the Faculty of Education, Padang State University, show that student consumptive behavior tends to be based on wants, not needs, where friends, promotions, current trends, or discounts influence their buying behavior. Financial literacy negatively affects consumptive behavior [5], meaning that consumptive behavior can be suppressed by increasing financial literacy. One of the critical factors in improving financial literacy and, at the same time, controlling consumptive behavior is entrepreneurship education because entrepreneurship lectures are directly connected with financial management to be productive or efficient [6].

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Entrepreneurship education is a whole content, method, and activity that provides individual experience and supports the development of entrepreneurial mindsets, attitudes, motivations, knowledge, and ability [7,8]; entrepreneurs can seize opportunities, start businesses, and develop them to provide added value for themselves and or others [6,9]. In this sense, it is contained in the meaning that entrepreneurship education carried out through entrepreneurship lectures provides knowledge and business ability. This is in line with the opinion of Lackéus, who states that the main objective of entrepreneurship education is to develop entrepreneurial competencies that include knowledge, ability, and attitudes that affect the willingness and ability engage in entrepreneurship. The entrepreneurial expertise and ability aimed at starting or developing a business covers aspects of knowledge and ability related to finance. This means that entrepreneurship lectures will affect students' financial knowledge and ability, as Cull et al. [10], revealed that financial knowledge can be obtained through entrepreneurship lectures. Financial expertise and ability constitute financial literacy because financial literacy is using knowledge and managing one's financial resources effectively [11–15]. Consumptive behavior in buying a product has various motives and reasons, for example, because it provides benefits that meet their primary needs. However, consumer behavior is based only on desire [16]. This behavior is called impulsive purchase, an unplanned purchase made without evaluating the purchased product. Consumptive behavior refers to the purchase or use of products that do not meet the consumer's needs or satisfy the consumer's primary needs [17]. This may be due to external factors, such as the influence of the seller, or internal factors, such as personal preferences [18]. Academic ability is one factor that influences consumptive behavior [19]. One way to improve students' financial literacy to reduce consumptive behavior is to apply research-based learning with a STEM approach.

The Research-Based Learning (RBL) learning model is a teaching model with six important syntaxes. RBL requires a contextual and realistic problem and includes at least four scientific studies: science, technology, engineering, and mathematics [21,]. Research-based learning integrates theoretical knowledge with suitability in data collection and analysis procedures to examine, verify/study the phenomenon. RBL is supposed to help teachers and students be more interested in practicing and following the given subjects and be more beneficial for the study program [22,23]. In this study we applied the RBL syntax in Economy class. Each step of the syntax will motivate students to be active in the learning process [24]. Students are actively involved in the learning process to collect information related to financial literacy and student consumptive behavior [25–27]. The RBL model syntax can be seen in Fig. 1 [20,28,29].

Integrating learning models with STEM approaches is one of the critical elements of the learning process because STEM combines several disciplines [30]. STEM can be viewed as either an integrated idea (interdisciplinary and transdisciplinary) into an engineering design process and open investigation of real-world problems and cases or as an instructional approach with its disciplinary content being a group of sciences, i.e., science, technology, engineering, and mathematics (multidisciplinary) [23,31]. Previous research shows that STEM can improve financial literacy. This can be seen in the study conducted by Misiran et al. which shows that the effective use of STEM can improve communication skills between team members, the exploration of data, brainstorming ideas, and delivery to targeted participants, making service learning an effective material for sustainable personal financial literacy programs to improve the level of financial literacy in the community [32]. Another research was also conducted by Zykina [33].

STEM aspects in Economics learning to improve financial literacy are elaborated into four aspects: Science, Technology, Engineering, and Mathematics [34,35]. Explanation of the STEM aspect frameworks is described in Fig. 2 [36]. Implementing a research activity using RBL-STEM to improve financial literacy has some advantages. The research activity with the STEM approach in the classroom makes students more active in the learning atmosphere because the students can find the real problems in the financial system and fix the problem using technology as one of the aspects of STEM and using big data analytics as the mathematics part. In engineering, the student can visualize the model in financial problems and analyze the model.

Learning using the RBL-STEM model generally has several indicators, including: 1) Problem posing/arising from RG (Research Group) [37]; 2) Obtain Breakthroughs; 3) Data Information Collection; 4) Data Analysis; 5) Generalization/Interpretation; and 6) Discussion by involving RG members [29,38]. Assessing the impact of implementing a research-based learning model using the STEM approach on financial literacy and consumptive behavior in the field of educational research has several important objectives. The

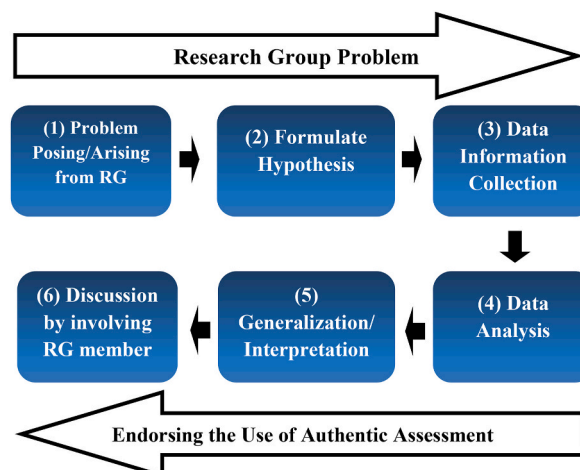


Fig. 1. RBL learning model [20].

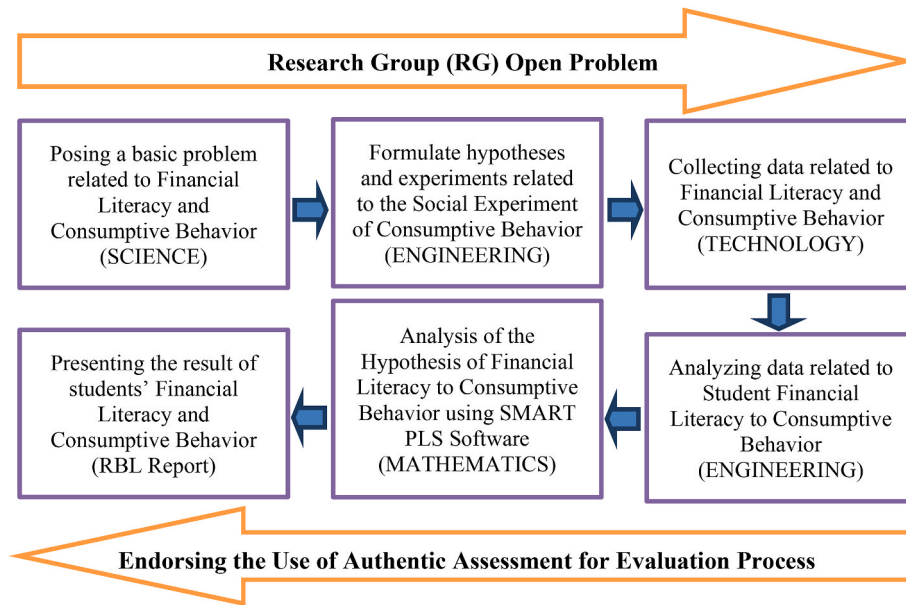


Fig. 2. Framework RBL-STEM financial literacy.

RBL-STEM model enhances students' comprehension of financial concepts by fostering analytical and problem-solving skills related to finance. It also raises awareness about the significance of financial management in conducting business activities. The role of STEM in finance presents financial learning through scientific and technological approaches, making it more engaging and relevant. The RBL-STEM approach can enhance learners' critical and analytical thinking skills by applying STEM concepts in a financial context. In education, the RBL-STEM learning model can also aid in developing a more contextualized and relevant curriculum that meets current financial needs. The indicators and sub-indicators of RBL-STEM implementation are described in Table 1.

Implementing the RBL-STEM learning model in Financial Literacy yielded the following four hypotheses.

- H1. RBL-STEM has a positive influence on basic knowledge of financial management
- H2. RBL-STEM has a positive influence on credit management
- H3. RBL-STEM has a positive influence on savings and investment management
- H4. RBL-STEM has a positive influence on Financial Literacy risk management

Financial literacy positively correlates with entrepreneurial ability [1]. Delgadillo also expresses the notion of financial literacy, that is, knowledge of financial concepts and how that knowledge is used to make financial decisions [40]. Knowledge in financial literacy about financial products (such as savings and means of payment), knowledge of financial concepts (interest, credit, insurance), while ability pertains to the ability necessary for effective financial decision-making and engaging in economic activity [11]. Financial literacy indicators are fully described in Table 2.

The relationship between Financial Literacy and consumptive behavior produces the following four hypotheses.

- H5. Basic knowledge of financial management has a positive influence on consumptive behavior
- H6. Credit management has a positive influence on consumptive behavior
- H7. Savings and investment management has a positive influence on consumptive behavior
- H8. Risk management has a positive influence on consumptive behavior

Table 1
Indicators and sub-indicators of RBL-STEM

Indicator	Sub-Indicator
RBL-STEM [39]	RS1: Problem posing/arising from RG (Research Group) RS2: Formulate hypotheses and experiment RS3: Data Information Collection RS4: Data Analysis RS5: Generalization/Interpretation RS6: Discussion by involving RG member

Table 2
Financial literacy indicators.

Indicator	Sub-Indicator
Basic personal finance [41]	BP1: Knowing about basic banking BP2: Knowing about compound interest BP3: Knowing about asset liquidity BP4: Knowing about Inflation
Credit Management [42]	CM1: Knowing about the credit process CM2: Knowing the credit management process CM3: Knowing the efficient use of credit CM4: Knowing credit service facilities
Saving and investment [41]	SI1: Knowing the savings management process SI2: Knowing financial planning SI3: Knowing the advantages of saving and investing
Risk management [41]	RM1: Identifying risks RM2: Creating Risk Assessment and Response Indicators RM3: Develop a Financial Risk Management Plan RM4: Implementing, supervising, and evaluating the Strategy That Has Been Prepared

2. Consumptive behavior

According to experts, the definition of consumptive behavior is explained as follows: According to Lubis, Consumers now act more on their wants than on logical thinking, and these wants have transcended beyond what can be termed as irrational. Setiaji stated that consumptive behavior is the tendency of a person to behave excessively when buying something or unplanned buying. As a result, they then spend their money unthinkingly and irrationally, to get things that they think can be a symbol of privilege. According to Ancok in Nuances of Development Psychology (1995), consumptive behavior is the behavior of an individual who cannot resist his desire to buy unneeded goods without seeing the primary function of the goods. The definition suggests that consumptive individuals purchase goods based on desires rather than needs. Peter & Paul stated that consumptive behavior is a dynamic interaction between influences, behavioral conditions, and events around the environment in which humans carry out aspects of exchange. The Sane Society (2008) explains that a person is said to be consumptive if he has more goods due to status considerations. A consumptive person buys the desired goods, not the ones needed, excessively and unnaturally to show his status. Indicators of consumptive behavior are fully described in Table 3.

The following hypothesis explains the relationship of applying the RBL-STEM Learning Model directly to consumptive behavior.

H9. RBL-STEM has a positive influence on consumptive behavior

3. Research framework

We analyze the application of RBL-STEM in improving students' financial literacy in controlling consumptive behavior. The indicators in this study include RBL-STEM indicators, basic knowledge of management, credit management, savings and investment management, risk management, and consumptive behavior. The research framework can be seen in Fig. 3.

4. Research methodology

4.1. Research type

This research uses both quantitative and qualitative methods in its research activities. The data collection method uses the questionnaire to get student responses to the influence of the application of RBL-STEM in improving student financial literacy in controlling consumptive behavior. Combining qualitative and quantitative methods in educational research can offer several advantages. One of the main benefits of using qualitative and quantitative methods is that it can provide a comprehensive understanding of the subject matter while allowing for the generalization of the results. This is achieved through triangulation, which involves comparing and verifying findings from both methods. When the results from both methods support each other, confidence in the

Table 3
Indicators and sub-indicators of consumptive behavior.

Indicator	Sub-Indicator
Consumptive Behavior [19]	CB1: Buying products due to special offers. CB2: Buying a product because of its attractive appearance. CB3: Buying products to maintain self-appearance and prestige. CB4: Buying a product based on price (not based on its benefits or usefulness) CB5: Buying a product to show the status symbol. CB6: To try two or more similar products

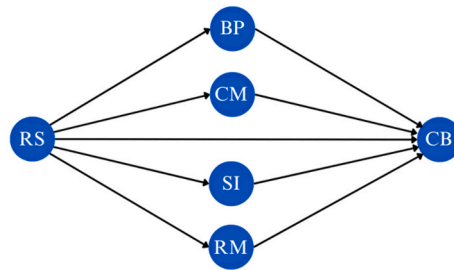


Fig. 3. Research framework.

validity of the findings increases. Using mixed methods provides better interpretation and explanation of patterns or trends found in quantitative analyses, which may be challenging to understand without proper context. Combining qualitative and quantitative methods allows researchers to approach complex phenomena more comprehensively and contextualistically, resulting in a better understanding and improved quality of education research.

4.2. Samples

The total respondents that were tested used 30 questionnaire samples to ascertain the validity and reliability of the instrument. Furthermore, the questionnaire was distributed to 3 classes, which are Class A with 35 students, class B with 38 students, and Class C with 37 students, with a total of 110 students in semester 3 of the 2022/2023 Academic Year FKIP-Riau University, Pekanbaru, Indonesia. The respondents are students who join the introductory economy course, namely Macroeconomics, Microeconomics, public economy, and economy education. The sample size of 110 students is proper for this research because all students are specific economy class members from the University of Riau. The Research Ethics Committee permitted the selection of this sample - Faculty of Teacher Training and Education, Riau University, Indonesia. The sample selection uses a proportional random sampling for determining each class respected to the research proposal, which has been reviewed by an independent ethics commission, namely SREC (Social Research Ethic Committee) FKIP-Riau University, Indonesia, number: 9147/UN19.5.1.1.5/PP.July 01, 2022. All the collected data will be analyzed by using structural equation modeling. The student Demographics at FKIP-Riau University are shown in Table 4 below.

4.3. Instruments

Before the questionnaire is shared, indicators describing each variable need to be consulted to obtain the validity and reliability of the questionnaire? Measurements of each variable use a Likert scale of 1–5. Sampling is done randomly because data for each variable is available. The questionnaire in this study was distributed online using Google Forms. The data collection method uses a questionnaire to view samples. This study uses the SEM (structural equation modeling) model to calculate validity and reliability. The reason for using SEM-PLS is because this study aims to evaluate the relationship between variables and when the analysis is related to testing the research framework. In addition, to better understand the increasing complexity by exploring the theoretical extension of existing theories. The earlier stage ensures that the data is distributed normally and then tests the predetermined model using the SEM-PLS approach.

4.4. Data collection procedures

The data collection procedure in this study used questionnaires and data collection. The questionnaires in this study were distributed online using Google Forms. Before the questionnaire is distributed, the indicators of each variable need to be validated by the validator. Measurements of each variable use a Likert scale of 1–5.

Table 4
The student Demographic at FKIP-Riau University.

Information	Characteristics	Frequency	Percentage
Gender	Male	65	59 %
	Female	45	41 %
Race	Java	20	18 %
	Malay	72	65 %
	Chinese	18	17 %
Status	Single	110	100 %
	Married	0	0 %

4.5. Data analysis procedure

The first step is measuring instruments (structured questionnaires), which are validated by evaluating external models, which are the external Contributing Factor Analysis (CFA) model and hypothetical structural equation models (also called internal models) using partial least squares (PLS-SEM). Both analyses were performed using SmartPLS software. The second step is to find the normality of the data. There are many advantages to using PLS-SEM over traditional SEM. For example, the data does not assume a normal distribution, uses smaller data sets, and is suitable for constructions with several indicators. The second step of the data analysis procedure is using RA (Relative Asymmetry) analysis to test the integrity of students' financial literacy phase portrait. The last step of the data analysis procedure is to use NVIVO to determine the differences and similarities of sub-indicators owned by student samples with high, medium, and low financial literacy categories.

5. Results and discussion

5.1. Results

The data collection procedure in this study uses a research-based learning scale measurement questionnaire, basic knowledge of management, credit management, savings and investment management, risk management, and consumptive behavior. We use SmartPLS software to analyze structural equation models (SEM) from RS (RBL-STEM), (basic knowledge of management), (credit management), (savings and investment management), (risk management), and (consumptive behavior). The results of the SmartPLS can be seen in Figs. 4 and 5.

The first analysis on SMART-PLS uses the SEM-PLS algorithm to determine the feasibility of the model, indicators, and sub-indicators of the model. Based on Fig. 4, we analyzed standard algorithms for calculating existing components' reliability and Average Variance Extracted (AVE). Another parameter we use is the loading factor value. The loading factor value determines whether the sub-indicator has a good convergent validity value. A sub-indicator has an excellent convergent validity score if the loading factor value of the sub-indicator is greater than 0.7. The loading factor values are given in Table 5.

Based on Table 5, the loading factor value of all models sub-indicators is more significant than 0.7, so it can be concluded that the convergent validity value of the sub-indicator is good. A good convergent validity score indicates that the sub-indicator can estimate the components of the indicator. In addition to analyzing convergent validity values, there are other parameters when testing the model: Cronbach's Reliability-Alpha, Composite Reliability, and Average Variance Extracted Values.

Cronbach's alpha and composite reliability determine whether the indicator is reliable. The criteria for reliable indicators are when Cronbach's alpha and composite reliability values are more significant than 0.7. Table 5 shows these indicators are reliable and reliable for measuring SEM models. The second parameter is AVE. The AVE value is used to analyze whether or not the indicator has a good

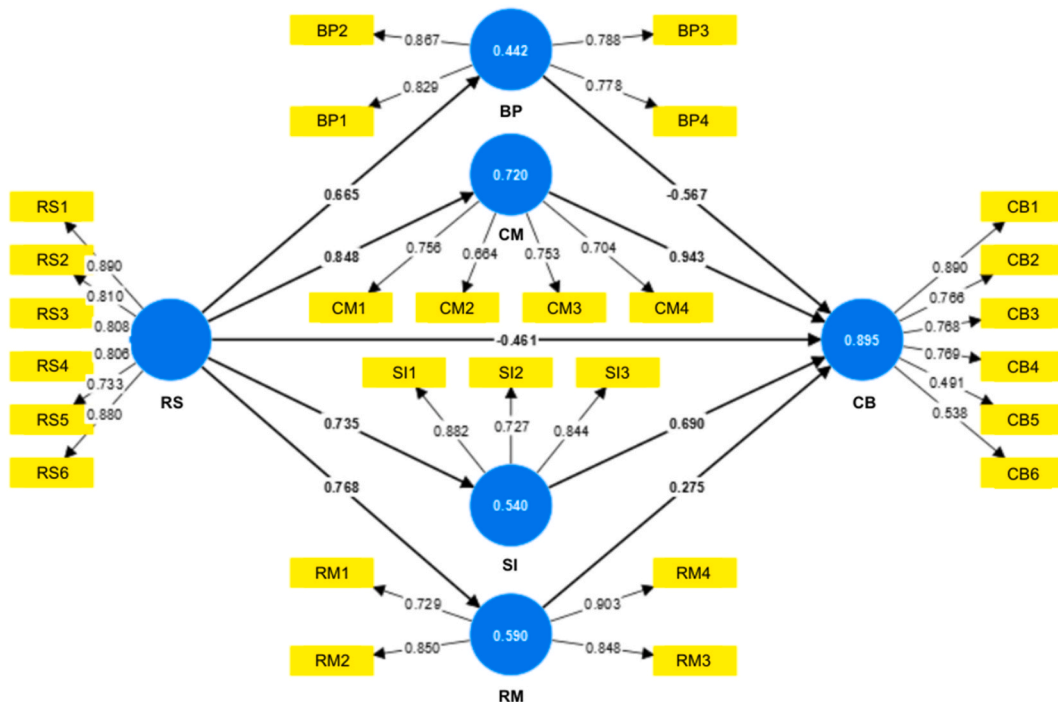


Fig. 4. SEM-PLS algorithm.

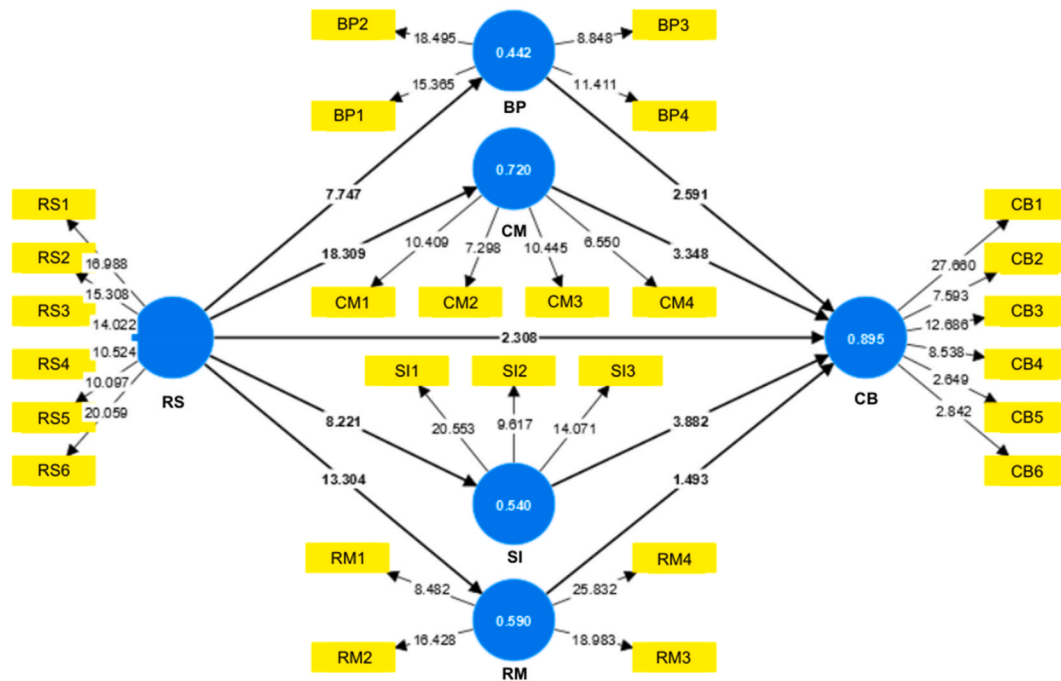


Fig. 5. Bootstrapping SEM-PLS

Table 5
Outer loading SEM-PLS

Indicator	Sub indicator	Loading factor	Reliability Cronbach's Alpha	Composite Reliability	Average Variance Extracted
RBL-STEM	RS1	0.890	0.903	0.909	0.677
	RS2	0.810			
	RS3	0.808			
	RS4	0.806			
	RS5	0.733			
	RS6	0.880			
Basic Knowledge	BP1	0.829	0.834	0.842	0.666
	BP2	0.867			
	BP3	0.788			
	BP4	0.788			
Credit Management	CM1	0.756	0.711	0.705	0.519
	CM2	0.764			
	CM3	0.753			
	CM4	0.704			
Savings and Investment Management	SI1	0.882	0.752	0.752	0.673
	SI2	0.727			
	SI3	0.844			
Risk Management	RM1	0.729	0.853	0.866	0.697
	RM2	0.850			
	RM3	0.848			
	RM4	0.903			
Consumptive Behavior	CB1	0.890	0.804	0.836	0.515
	CB2	0.766			
	CB3	0.768			
	CB4	0.769			
	CB5	0.791			
	CB6	0.538			

convergent validity value. An indicator has a good convergent validity score if the AVE value is more significant than 0.5. Based on Table 5, all indicators of the SEM model show good convergent validity values. Table 6 shows the cross-loading factor for each indicator. The value of the cross-loading coefficient tests the validity of the discriminant, which ensures that the value of each latent model is different from other indicators.

Table 6
Cross loading factor.

Indicators	RBL-STEM	Basic Knowledge	Credit Management	Savings and Investment Management	Risk Management	Consumptive Behavior
RBL-STEM	0.816	0.000	0.000	0.000	0.000	0.000
Basic Knowledge	0.800	0.816	0.000	0.000	0.000	0.000
Credit Management	0.798	0.698	0.720	0.000	0.000	0.000
Savings and Investment Management	0.767	0.753	0.698	0.820	0.000	0.000
Risk Management	0.700	0.777	0.592	0.635	0.835	0.000
Consumptive Behavior	0.734	0.599	0.699	0.749	0.793	0.711

The second analysis on SMART-PLS is the bootstrapping analysis found in Fig. 5 to determine the relationship between latent variables in the SEM model and test the hypothesis. This study tested nine hypotheses. Based on Fig. 5 and Table 7, there was one hypothesis that had no significant effect, that is, H8: Risk Management (RM) - > Consumptive Behavior (CB) ($p = 0.138 > 0.05$, $t = 1483 < 1.96$). The other seven hypotheses have significant influence with t-statistics bigger than 1.96 and a p-value less than 0.05. H1 has a strong relationship between RBL-STEM having a positive influence on basic knowledge of financial management ($p = 0.000 < 0.05$, $t = 7747 > 1.96$), H2 indicates that RBL-STEM has a close relationship with credit management ($p = 0.000 < 0.05$, $t = 13,309 > 1.96$), H3 shows that RBL-STEM has a close relationship with savings and investment management ($p = 0.000 < 0.05$, $t = 3221 > 1.96$), H4 has significant influence between RBL-STEM and risk management ($p = 0.000 < 0.05$, $t = 13.304 > 1.96$), H5 has the significant effect between Basic knowledge of financial management and consumptive behavior ($p = 0.010 < 0.05$, $t = 2591 > 1.96$), H6 has a significant influence between credit management and consumptive behavior ($p = 0.001 < 0.05$, $t = 3343 > 1.96$), H7 has a significant influence between savings and investment management and consumptive behavior ($p = 0.000 < 0.05$, $t = 3332 > 1.96$), and H9 has a significant influence between RBL-STEM and consumptive behavior ($p = 0.021 < 0.05$, $t = 2308 > 1.96$).

5.2. Phase portrait

In this study, we present phase portraits as supporting information; the phase portraits displayed show the description of the phase portraits of representatives of three students, S41LF, S16LF, and S75LF, with different levels of student financial literacy. Fig. 6 portrays the thinking phase of student 41 (S41LF) with low financial literacy ability. Fig. 6 shows that the first stage students do is the RS1 to RS2, then RS3. After that S41LF jumps to the BP3, BP4, CM2, CM3, CM4 stages. Next, M1 jumps to the SI2, RM2, RM3 stages, then jumps to the CB1, CB2, CB3, CB4, CB5 stages, and the last one is CB6. The neighborhood matrix of the S41LF student phase portrait can be seen in Fig. 7.

The matrix adjacency of the students; financial literacy of one distance.

In the next stage, we will analyze the Total Depth (TD), Mean Depth (MD), and Relative Asymmetry (RA) of the M1 financial literacy ability flow. The benefit of such analysis is to find out the financial literacy ability of S41LF from the perspective of pipeline configuration. Total Depth (TD) is the total trajectory lengths of the observed sub-indicators. Mean Depth (MD) = $TD/(n-1)$, Relative Asymmetry (RA) = $(2(MD-1))/(n-2)$. From this formulation, the distribution of values in Table 8 is obtained.

Based on Table 8, the highest TD value is owned by the CB6 sub-indicator, 136, which means that many S41LF students must pass the thinking step in the CB6 sub-indicator. Therefore, S41LF students need the AM3 sub-indicator to improve their financial literacy ability. However, when viewed from the RA value in Table 7, the CB6 sub-indicator has an RA value of 1. A sub-indicator has a good RA value if the value gets smaller with a record located in the $0 \leq RA \leq 1$ range, not negative. The best RA value lies in the CM3 sub-indicator with an RA value of 0.04. This indicates that S41LF students greatly benefit from improving their financial literacy.

Fig. 8 is a portrait of the thinking phase of student 2 (S2) with moderate financial literacy ability. Fig. 8 shows that the first stage students do is the RS1 to RS2 stage, then RS3, RS4, and jump to BP2. Next M2 goes to stage BP3, goes back to RS5, RS6, jumps to BP4, goes to CM2, CM3, CM4. Then M2 goes to the stages of SI1, SI2, SI3, then to RM1, RM2, and RM3. After that, M2 goes to the CB2, CB3, CB4, and CB5 stages; the last stage is CB6. The neighborly matrix of the S16LF student phase portrait can be seen in Fig. 9.

Table 7
Path coefficients.

Path	Direct effect	
	p-values	T-values
H1: RBL-STEM - > Basic knowledge of financial management	0.000	7.747
H2: RBL-STEM - > Credit Management	0.000	13.309
H3: RBL-STEM - > Savings and Investment Management	0.000	3.221
H4: RBL-STEM - > Risk management	0.000	13.304
H5: Basic knowledge of financial management - > consumptive behavior	0.010	2.591
H6: Credit management - > consumptive behavior	0.001	3.343
H7: Management of savings and investments - > consumptive behavior	0.000	3.332
H8: Risk management - > consumptive behavior	0.138	1.483
H9: RBL-STEM - > consumptive behavior	0.021	2.308

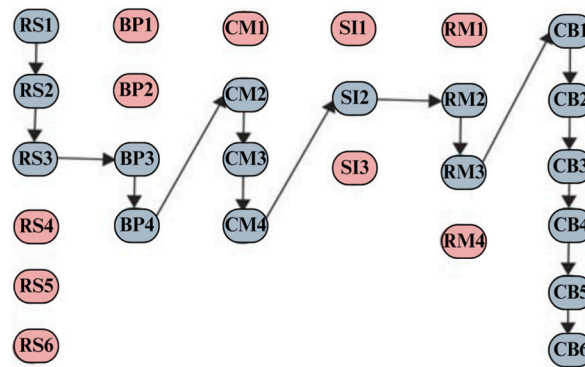


Fig. 6. The phase portrait of low financial literacy ability of student S41LF of the low category with 27 nodes and 16 edges.

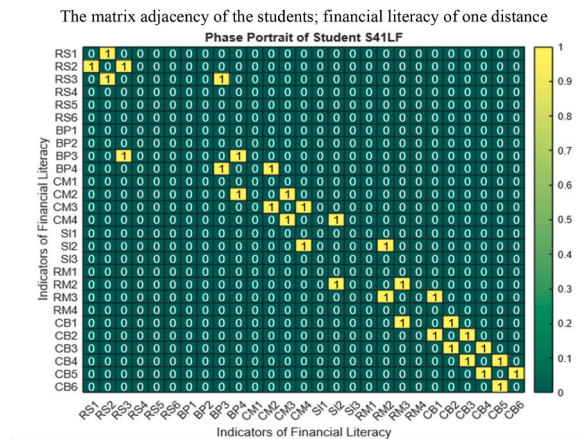


Fig. 7. The matrix adjacency of low financial literacy ability of the student S41LF.

Table 8

Total Depth, Mean Depth, and Relative Asymmetry S41LF values.

Sub indicator	TD	MD	RA	Sub indicator	TD	MD	RA
RS1	0	0.00	-0.13	RM2	45	2.81	0.24
RS2	1	0.06	-0.13	RM3	55	3.44	0.33
RS3	3	0.19	-0.11	CB1	66	4.13	0.42
BP3	6	0.38	-0.08	CB2	78	4.88	0.52
BP4	10	0.63	-0.05	CB3	91	5.69	0.63
CM2	15	0.94	-0.01	CB4	105	6.56	0.74
CM3	21	1.31	0.04	CB5	120	7.50	0.87
CM4	28	1.75	0.10	CB6	136	8.50	1.00
SI2	36	2.25	0.17				

The next stage is that we will analyze the Total Depth (TD), Mean Depth (MD), and Relative Asymmetry (RA) of the S16LF financial literacy ability flow. The benefit of such analysis is to find out S16LF's financial literacy ability from a pipeline configuration perspective. Total Depth (TD) is the sum of the total trajectory lengths of the observed sub-indicators. Mean Depth (MD) = $TD/(n-1)$, Relative Asymmetry (RA) = $(2(MD-1))/(n-2)$. From this formulation, the distribution of values in Table 9 is obtained.

Based on Table 9, the highest TD value is owned by the CB6 sub-indicator, which is 253, which means that many S16LF students still need to pass the thinking step to be on the CB6 sub-indicator. Therefore, S16LF students need the CB6 sub-indicator to improve their financial literacy ability. However, when viewed from the RA value in Table 8, the CB6 sub-indicator has an RA value of 1.10. A sub-indicator has a good RA value if it gets smaller with a record in the $0 < RA \leq 1$ range, not negative. The best RA value lies in the BP4 sub-indicator with an RA value of 0.07. This indicates that S16LF students feel great benefits in improving their financial literacy. In Table 8, the highest TD value is owned by the CB6 sub-indicator, which is 253, which means that many S16LF students do not pass the thinking step on the CB6 sub-indicator. Therefore, it can be concluded that S16LF students need the CB6 sub-indicator to improve their financial literacy ability. However, when viewed from the RA value in Table 8, the CB6 sub-indicator has an RA value of 1.10. A sub-

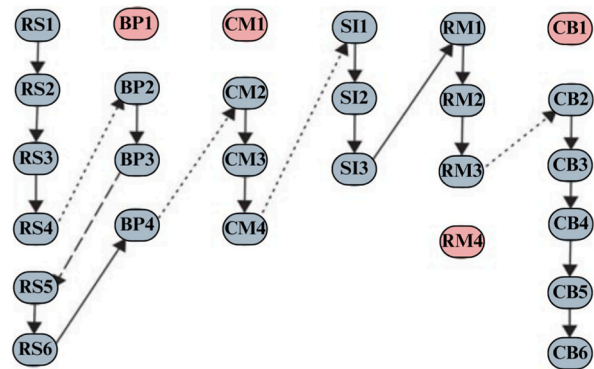


Fig. 8. The phase portrait of medium financial literacy ability of student S16LF of the medium category with 27 nodes and 22 edges.

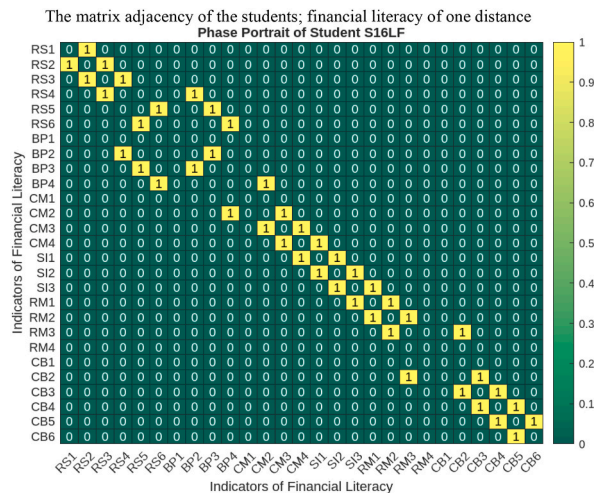


Fig. 9. The matrix adjacency of medium financial literacy ability of the student S16LF.

Table 9
Total Depth, Mean Depth, and Relative Asymmetry S16LF values.

Sub-indicator	TD	MD	RA	Sub-indicator	TD	MD	RA
RS1	0	0.00	−0.10	SI1	78	3.71	0.27
RS2	1	0.05	−0.10	SI2	91	4.33	0.33
RS3	3	0.14	−0.09	SI3	105	5.00	0.40
RS4	6	0.29	−0.07	RM1	120	5.71	0.47
RS5	21	1.00	0.00	RM2	136	6.48	0.55
RS6	28	1.33	0.03	RM3	153	7.29	0.63
BP2	10	0.48	−0.05	CB2	171	8.14	0.71
BP3	15	0.71	−0.03	CB3	190	9.05	0.80
BP4	36	1.71	0.07	CB4	210	10.00	0.90
CM2	45	2.14	0.11	CB5	231	11.00	1.00
CM3	55	2.62	0.16	CB6	253	12.05	1.10
CM4	66	3.14	0.21				

indicator has a good RA value if it gets smaller with a record in the $0 \leq RA \leq 1$ range, not negative. The best RA value lies in the BP4 sub-indicator with an RA value of 0.07. This indicates that S16LF students feel great benefits in improving their financial literacy.

The next phase is a portrait of student 3 (S75LF) with high financial literacy ability. Fig. 10 is the stage taken by S75LF. The first stage carried out by students is the RS1 stage leading to the RS2, RS3, and RS4 stages. Next S75LF jumps to the BP3 stage, then back to BP2, retreats to RS5, then jumps to BP4, CM1, CM2, SI1, back to CM2, CM3, CM4, SI2, and SI3. Then, M3 goes to the stages of RM1, RM2, RM3, RM4, heading to CB1, CB2, CB3, CB4, CB5, and CB6. The neighborly matrix of the S75LF student's thinking phase portrait can be seen in Fig. 11.

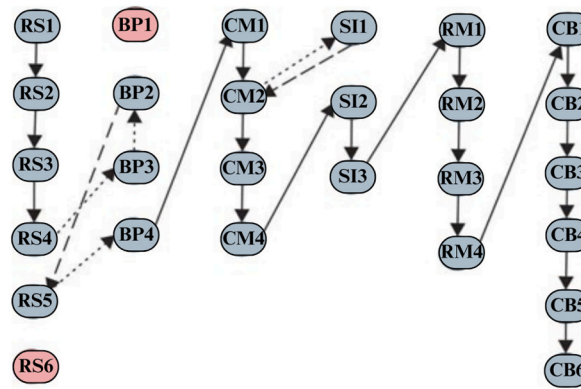


Fig. 10. The phase portrait of high financial literacy ability of student S75LF of high category with 27 nodes and 25 edges.

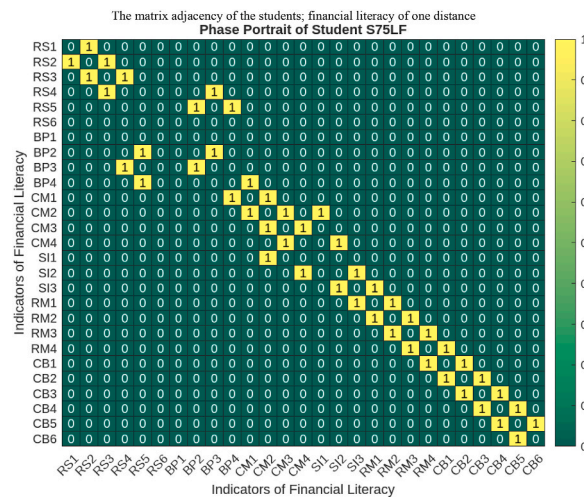


Fig. 11. The matrix adjacency of high financial literacy ability of the student S75LF.

The next stage is that we will analyze the Total Depth (TD), Mean Depth (MD), and Relative Asymmetry (RA) of the S75LF financial literacy ability flow. The benefit of such analysis is to find out the financial literacy ability of S75LF from a pipeline configuration perspective. Total Depth (TD) is the sum of the total trajectory lengths of the observed sub-indicators. Mean Depth (MD) = $TD/(n-1)$, Relative Asymmetry (RA) = $(2(MD-1))/(n-2)$. From this formulation, the distribution of values in Table 10 is obtained.

Based on Table 10, the highest TD value is owned by the CB6 sub-indicator, which is 291, which means that many M3 students do not pass the thinking and still need to be the CB6 sub-indicator. Therefore, the CB6 sub-indicator is needed by S75LF students to improve their financial literacy ability. However, when viewed from the RA value in Table 8, the CB6 sub-indicator has an RA value 0.97. A sub-indicator has a good RA value if it gets smaller with a record in the $0 \leq RA \leq 1$ range, not negative. The best RA value lies in the BP4 sub-indicator with an RA value 0.01. This indicates that M3 students greatly benefit from improving their financial literacy. Based on the phase portraits of the three S41LF, S16LF, and S75LF students, the best relative symmetry score was 0.01, which came from students with high levels of financial literacy ability.

The last analysis is a qualitative exploration of differences in students' financial literacy using NVIVO software. One of NVIVO's tools for visualizing text is the Word Frequency Query. This feature allows researchers to monitor the frequency with which words of interest appear in the transcripts of their in-depth student interviews. The search results obtained with this feature compiled a list of frequently occurring terms in the data. The set of terms is shown in Fig. 12.

Text Search Query is the second feature available in NVIVO. This tool is used to interpret the meaning of the words in the word cloud. We chose the word 'financial' as one of the most frequent terms in the interview data for this study. Next, the search results are shown as a word tree in Fig. 13. Fig. 13 shows us that RBL-STEM materials help them understand the consequences of their financial decisions, effectively teaching impulse control and unwise consumptive behavior. The other information is the importance of financial literacy in helping students become wiser financial decision-makers. RBL-STEM is a practical material for achieving this goal.

Next, we will examine the comparative information provided by the three interviews. Comparative information is a valuable feature of NVIVO. This section divides the climate change literacy indicators into several sub-indicators. The first indicator, RBL-STEM,

Table 10

Total Depth, Mean Depth, and Relative Asymmetry S75LF values.

Sub-indicator	TD	MD	RA	Sub-indicator	TD	MD	RA
RS1	0	0.00	-0.09	SI2	82	3.42	0.21
RS2	1	0.04	-0.08	SI3	96	4.00	0.26
RS3	3	0.13	-0.08	RM1	111	4.63	0.32
RS4	6	0.25	-0.07	RM2	127	5.29	0.37
RS5	21	0.88	-0.01	RM3	144	6.00	0.43
BP2	15	0.63	-0.03	RM4	162	6.75	0.50
BP3	10	0.42	-0.05	CB1	181	7.54	0.57
BP4	28	1.17	0.01	CB2	201	8.38	0.64
CM1	36	1.50	0.04	CB3	222	9.25	0.72
CM2	45	1.88	0.08	CB4	244	10.17	0.80
CM3	57	2.38	0.12	CB5	267	11.13	0.88
CM4	69	2.88	0.16	CB6	291	12.13	0.97
SI1	55	2.29	0.11				



Fig. 12. Common terms used in the information.

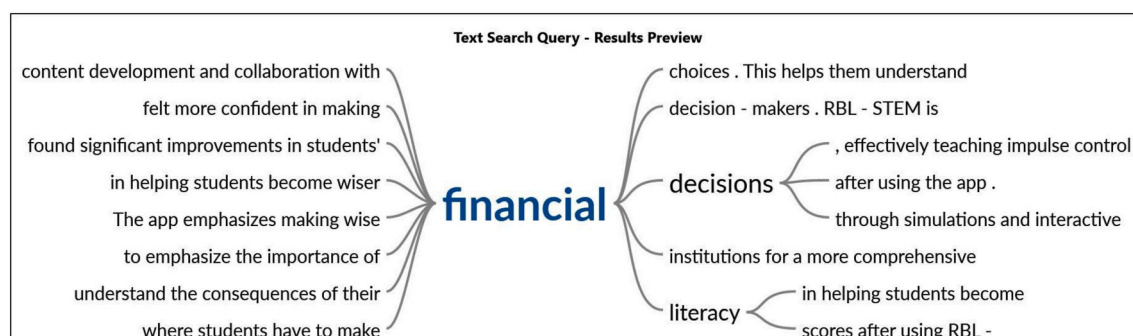


Fig. 13. Word tree of the word “financial”.

has six sub-indicators, namely problem posing/arising from research group (RS1), formulate hypotheses and experiments (RS2), data information collection (RS3), data analysis (RS4), generalization interpretation (RS5), and discussion by involving research group member (RS6). The second indicator, basic personal finance, consists of four sub-indicators, namely, knowing about the credit process

(BP1), knowing about compound interest (BP2), knowing about asset liquidity (BP3), and knowing about inflation (BP4). The third indicator, credit management, consists of four indicators, namely, knowing about the credit process (CM1), knowing the credit management process (CM2), knowing the efficient use of credit (CM3), and knowing credit service facilities (CM4). The fourth indicator, saving and investment, is divided into several sub-indicators, namely, knowing the savings management process (SI1), knowing financial planning (SI2), and knowing the advantages of saving and investing (SI3). The fifth indicator, risk management, is divided into several sub-indicators, namely, identifying risks (RM1), creating risk assessment and response indicators (RM2), developing a financial risk management plan (RM3), and implementing, supervising and evaluating the strategy that has been prepared (RM4). The last indicator, consumptive behavior, is divided into several sub-indicators, namely Buying products due to special offers (CB1), Buying a product because of its attractive appearance (CB2), Buying products to maintain self-appearance and prestige (CB3), Buying a product based on price (not based on its benefits or usefulness) (CB4), Buying a product to show the status symbol (CB5), and To try two or more similar products (CB6).

Fig. 14(a) illustrates the discrepancies in the S16LF and S75LF can pass sub-indicators. S16LF and S75LF are able to skip the following sub-indicators: RS1, RS2, RS3, BP3, BP4, CM2, CM3, CM4, SI2, RM2, RM3, CB2, CB3, CB4, CB5, CB6, RS4, RS5, BP2, SI1, SI3, and RM1. Specifically, sub-indicators CB1, CM1, and RM4 can only be skipped by S75LF, while sub-indicator RS6 can only be skipped by S16LF. Fig. 14(b) illustrates the discrepancies in the S16LF and S41LF can pass sub-indicators. S16LF and S41LF are able to skip the following sub-indicators: RS1, RS2, BP3, CM2, CM3, CB2, CB3, CB5, RS3, CM4, BP4, CB6, RM3, and CB4. Specifically, sub-indicators RS4, RS5, RS6, BP2, SI1, SI3, and RM1 can only be passed by S16LF, while sub-indicator RS6 can only be passed by S41LF. Fig. 14(c) illustrates the discrepancies in the sub-indicators that S41LF and S75LF can pass. S41LF and S75LF are able to skip the following sub-indicators: RS1, RS2, RS3, BP3, BP4, CM2, CM3, CM4, SI2, RM2, RM3, CB1, CB2, CB3, CB4, CB5, and CB6. Specifically, S75LF has the ability to skip sub-indicators RS4, RS5, BP2, SI1, SI3, RM1, CM1, and RM4, whereas S41LF does not have this capability.

Next, we will compare the students' total data and how it relates to the pre-established categorization. We'll also show the classification results from the interviews. Fig. 15 shows the Project Map feature of NVIVO. Based on Fig. 15, we know the overall portrait of what sub-indicators were passed by the three students. In addition, we can see that S41LF is classified as having a low financial skill level, S16LF is classified as having a medium financial skill level, and S75LF is classified as having a high financial skill level.

6. Discussion

The results of this study show the relationship between RBL-STEM, basic knowledge of financial management, credit management, savings and investment management, risk management, and consumptive behavior. This study aims to determine how much RBL-STEM affects students' consumptive behavior. Based on [41,42], four indicators of a student's financial literacy will affect the level of consumptive behavior of students. The four indicators are students' ability in Basic Knowledge of Financial Management, Credit Management, Savings and Investment Management, and Risk Management. Peter & Paul state that consumptive behavior is a dynamic

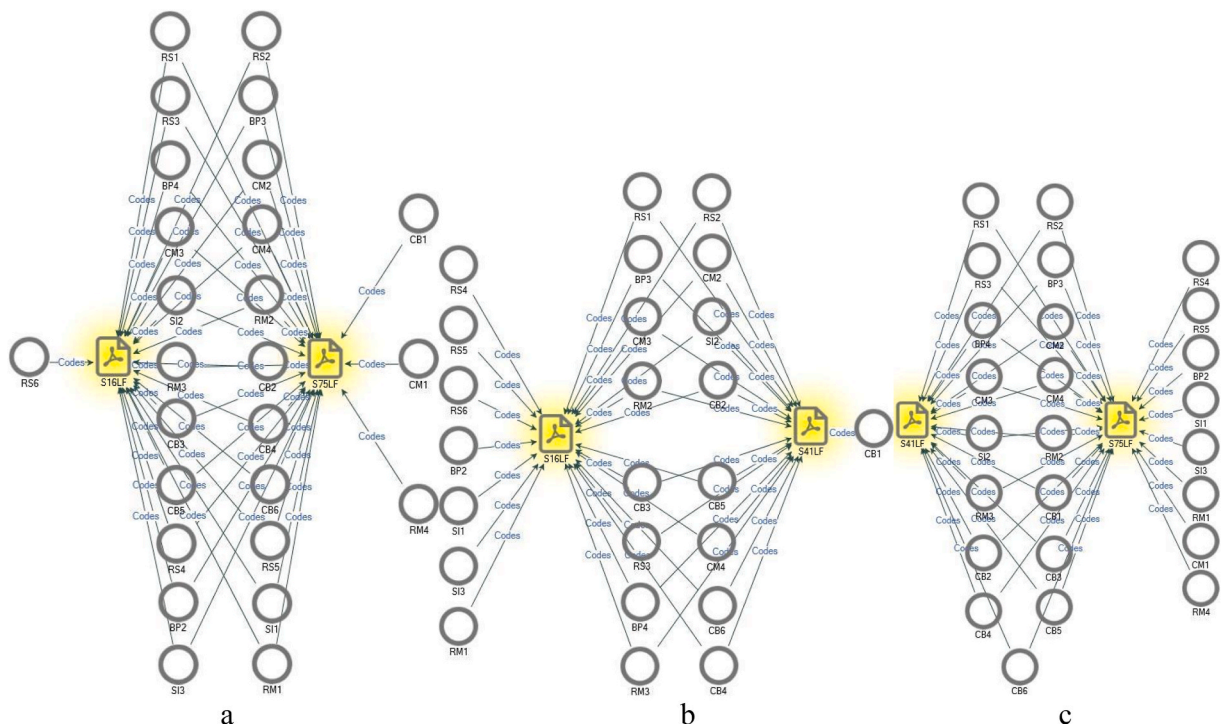


Fig. 14. Comparison between (a) S16LF and S75LF, (b) S16LF and S41LF, (c) S41LF and S75LF.

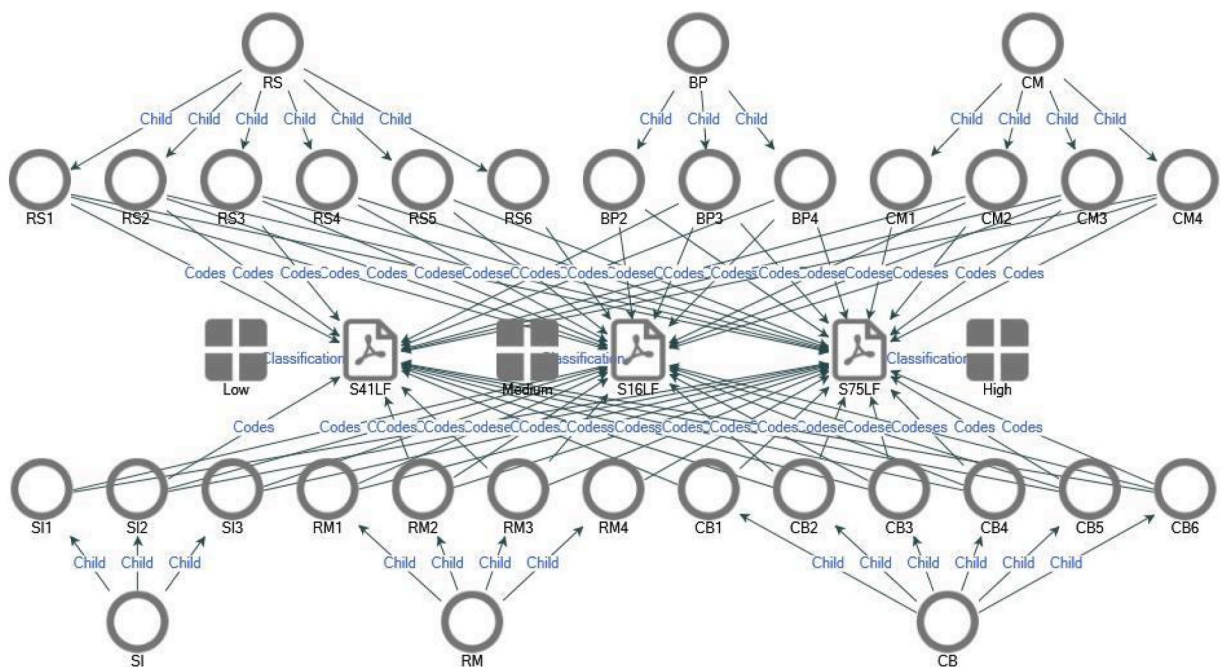


Fig. 15. Project Map of financial literacy on S41LF, S16LF, and S75LF.

interaction between influences, behavioral conditions, and events around the environment in which humans carry out aspects of exchange. Fromm in *The Sane Society* (2008) explains that a person is said to be consumptive if he has more goods due to status considerations. A consumptive person buys the desired goods, not the ones needed, excessively and unnaturally to show his status. Financial literacy negatively affects consumptive behavior [5,43], meaning that consumptive behavior can be suppressed by increasing financial literacy. One of the critical factors in improving financial literacy and, at the same time, controlling consumptive behavior is entrepreneurship education because entrepreneurship lectures teach about financial management to be productive or efficient [6,44].

This study tested nine hypotheses; there is one hypothesis that has no significant effect, that is [H8](#), [H8](#) between risk management (RM) to consumptive behavior (CB) has no significant effect because it has a value of $p = 0.138 > 0.05$ and $t = 1.483 < 1.96$. The rejection of one hypothesis, specifically the relationship between Risk Management and consumptive behavior, is noteworthy. Further clarification on the reasons behind this rejection would strengthen this study, helping in understanding the factors that influence consumptive behavior in the context of financial literacy. The other seven hypotheses have significant influence with t -statistics greater than 1.96 and a p -value less than 0.05. In [H1](#) examining the relationship between RBL-STEM to Basic knowledge of financial management having significant influence with p values = 0.000 and $t = 7.747$. [H2](#) showed that RBL-STEM has close relationship with credit management with p values = 0.000, and $t = 13.309$. [H3](#) shows that RBL-STEM has close relationship with savings and investment management with p value = 0.000 and $t = 3221$. [H4](#) has significant influence between RBL-STEM and risk management with p value = 0.000 and $t = 13.304$. [H5](#) has significant effect between basic knowledge of financial management and consumptive behavior with values with p values = 0.010 and $t = 2591$. [H6](#) has significant influence between credit management and consumptive behavior with p values = 0.001 and $t = 3343$. [H7](#) has significant influence between savings and investment management with consumptive behavior with p values = 0.000 and $t = 3332$. Finally [H9](#) has significant influence between RBL-STEM and consumptive behavior with p values = 0.021 and $t = 2308$. Based on the results of the study, RBL-STEM has a significant influence on improving students' financial literacy in controlling consumptive behavior. This is evidenced by the p -value and t -test values on Bootstrapping SEM-PLS. The p -value of RBL-STEM to each indicator of financial literacy and consumptive behavior is less than 0.05, and the t -value is more than 1.96. Based on this, applying RBL-STEM effectively increases student financial literacy and can improve the control of student consumptive behavior.

The discovery that the RBL-STEM learning model significantly enhances financial literacy carries significant implications for teaching practices. It suggests a potential integration of financial literacy into STEM education, encouraging a holistic learning approach. Educators may focus on developing practical life skills and academic knowledge, particularly financial management. The observed impact on controlling consumptive behavior underscores the potential application of behavioral economics principles in education. Long-term implications include investigating the model's influence on individuals' adult financial decisions and exploring connections between improved financial literacy and economic empowerment. Further research opportunities lie in comparative studies with other educational models, examining contextual factors, measuring sustained behavioral changes, and optimizing teacher training and implementation strategies for the RBL STEM model in diverse educational settings. These endeavors aim to deepen our understanding of the lasting effects of the model on financial literacy and its broader implications for education and personal

development.

This paper is valuable because it explores how a specific educational material, RBL-STEM, helps students better understand and manage their money. It connects STEM education (Science, Technology, Engineering, and Mathematics) with practical aspects of handling finances, making it more relevant for students. The research examines how this material influences students' spending habits and focuses on important skills like digital marketing. It also adds a cultural touch by including local traditions, making financial knowledge more relatable. Moreover, the study shows how these financial skills can be applied in real-life situations, particularly in craft businesses. Doing this supports the idea of teaching students to think like entrepreneurs. The research validates the effectiveness of the RBL-STEM learning model. It contributes to the broader concept of a well-rounded STEM education that prepares students for various challenges they might face in their future careers.

There are several practical applications of our findings for educators or policymakers. We suggest some practical ideas for teachers and policymakers. They can recommend that teachers incorporate the RBL-STEM app into their lessons to help students practically learn about money. Teachers may also benefit from specialized training on how to use this material effectively. In addition, the paper also suggests adding local cultures and traditions into finance lessons, making them more exciting and easier to understand. Policymakers can encourage schools to focus on theory and practical skills, such as starting a small business. They could also support digital literacy programs to teach students about online marketing. Tracking how students manage their money over time is essential to ensure these changes have a lasting impact. Finally, all parties involved, including businesses and financial institutions, can work together to create real-world experiences for students. Overall, the goal is to make learning about money more engaging, practical, and connected to everyday life.

7. Conclusion

Based on the analysis of the relationship between six aspects in this study, which involved RBL-STEM, Basic Knowledge of Financial Management, Credit Management, Savings and Investment Management, Risk Management, and Consumptive Behavior. It can be concluded that RBL-STEM has a positive influence on basic knowledge of financial management with a score of 0.442, RBL-STEM has positive influence on credit management with score of 0.720, RBL-STEM has positive influence on savings and investment management with score of 0.540, RBL-STEM has positive influence on risk management with score of 0.590, basic knowledge of financial management, Credit management, Savings and investment management, Risk management, and RBL-STEM has positive influence on consumptive behavior with a score of 0.895. Furthermore, the model was also analyzed to test the causality relationship between influencing and influenced variables, obtaining Composite Reliability (CR) values > 0.7 and Average Variance Extracted (AVE) > 0.5 . Based on these results, the outer model used is suitable. This study tested nine hypotheses; one hypothesis has no significant effect, H8. At the same time, the other eight hypotheses have a significant influence with a p-value of < 0.05 and a t-statistic of > 1.96 .

Implementing the RBL-STEM of a teaching model aimed at improving student financial literacy and controlling consumptive behavior can contribute significantly to developing responsible financial habits among students. Implementing the RBL-STEM model can increase students' awareness of financial concepts, budgeting, and the consequences of consumptive behavior. This awareness is essential for making informed and responsible financial decisions. By incorporating strategies from behavioral economics, the teaching model can influence students' behavior towards more prudent financial practices. Understanding the psychological factors that drive consumptive behavior allows educators to design interventions that promote positive financial habits. Financial literacy involves understanding and managing financial risks. The teaching activities with the RBL-STEM model can contribute by equipping students with skills to assess and mitigate risks associated with financial decisions, such as investments or loans. One of the significant contributions of the model is in teaching students how to create and stick to a budget. This skill is crucial for managing income and expenses and saving for future goals, fostering a sense of financial discipline. Ultimately, the contribution of the teaching model extends to the broader economic and social landscape. Well-informed individuals are more likely to contribute positively to the economy, and the reduction in consumptive behavior can have societal benefits, including improved financial stability and reduced economic inequality. In summary, implementing a teaching model for improving student financial literacy is crucial in shaping responsible financial behaviors, providing practical skills, and contributing to the overall financial well-being of individuals and society.

Implementing RBL-STEM to enhance students' financial literacy and control their consumptive behavior can have significant implications for academia. Adjustments to existing curricula would be necessary to introduce courses or modules focused on personal finance, budgeting, and responsible consumptive behavior. Financial literacy education often involves various disciplines, such as economics, mathematics, and behavioral psychology. Academic institutions should encourage interdisciplinary collaboration to provide a comprehensive understanding of the subject. Implementing the RBL-STEM teaching model should emphasize developing practical skills, including budgeting, investing, and making informed financial decisions. Academic institutions should incorporate real-world case studies and hands-on activities to enhance students' practical knowledge. The implementation of the RBL-STEM teaching model has a significant impact on society. Improving financial literacy can contribute to economic empowerment. Well-informed individuals are likelier to make sound financial decisions, leading to more excellent personal and societal economic stability. By understanding the consequences of consumptive behavior, individuals may be less likely to accumulate debt unnecessarily. This, in turn, can lead to a reduction in societal debt burdens. Finally, individuals with financial literacy are better equipped to plan for their future, improving their quality of life. This can have positive effects on overall societal well-being.

Further research suggestions are that comparing the effectiveness of RBL-STEM with other pedagogical approaches in the same context may provide insights into the relative advantages and limitations of different instructional methods; extending the study to different levels of education, from secondary to higher education, may shed light on the adaptability and effectiveness of RBL-STEM

across different academic environments.

Limitation

One limitation of this study is the potential challenge of generalizing the findings to a broader and more diverse student population. This study may have focused on a particular demographic, educational institution, or socio-economic group, which may limit the external validity of the results. Variations in cultural background, economic status, or education system may affect how students engage with the RBL-STEM application and, consequently, the observed improvements in financial literacy and consumptive behavior. Therefore, caution is needed in applying the conclusions of this study to student populations with different characteristics or backgrounds. Future research that includes a more diverse sample may improve the generalizability of the findings.

Data availability statement

The data supporting this study's findings are available on the repository data with the following link (<https://bit.ly/researchdatasumarno>).

CRediT authorship contribution statement

Sumarno Sumarno: Methodology, Formal analysis, Data curation, Conceptualization. **Gimin Gimin:** Resources, Project administration, Methodology. **Eddy Noviana:** Funding acquisition, Formal analysis, Data curation. **Dafik Dafik:** Validation, Supervision, Software, Project administration, Methodology, Investigation. **Zainur Rasyid Ridlo:** Visualization, Validation, Software, Project administration, Formal analysis, Conceptualization. **Indah Lutfiyatul Mursyidah:** Visualization, Resources, Methodology, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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