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The Relationship between Previous Mathematics Performance, and Level of Financial Literacy and Financial Well-Being of University Students

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Abstract. Competency in mathematics lays a foundation for good analytical thinking and decision-making skills, which both can have a substantial influence on the sustainability of the individual life. The way mathematical skills are highly connected to most people is undoubtedly important in managing their money-related matters every day. Despite its importance as a core subject learned during the primary, secondary, and tertiary educations, the extension of the subject that plays a role in making someone in a better position of their personal financial welfares remain scarce. The objective of the study is to examine the relationship between 1) previous mathematics performance and financial literacy scores, 2) previous mathematics performance and financial well-being and 3) financial literacy and financial well-being among university students to shed light on the direction of the relationships. This research capitalizes the use of descriptive and correlation studies from survey responses among undergraduate students at Universiti Teknologi MARA Pahang (n= 239). The findings revealed that, despite having both high scores in mathematics and financial literacy, their overall financial well-being standing was just at par, an indicator of financial breakeven. Positive correlations were established between variables but none of the relationships was found to be significant ($p>0.05$). It was further identified that among three types of major university financing, scholarship holders showed a significant difference in the previous mathematics performance. They were also recorded as the highest achievers in both financial literacy and financial well-being. Further explanations and implications of the study are discussed in detail.

Keywords: Financial literacy, Financial well-being, Mathematics competency, university students

INTRODUCTION

Competency in mathematics is an essential successful living factor in today's modern society. The term mathematics competency or proficiency implies the ability of an individual to interpret and apply the knowledge in various fields of the living concept. It is a skill learned, acquired, and developed throughout an individual lifetime. According to National Research Council (NRC) Report, Everybody Counts [1]:

“Mathematics is the key to opportunity. No longer just the language of science, mathematics now contributes in direct and fundamental ways to business, finance, health, and defense. For students, it opens doors to careers. For citizens, it enables informed decisions. For nations, it provides the knowledge to compete in a technological community....”

The statement explained that mathematics competency is essential in the 21st century not only for individual success but also to contribute to a country's economic stability and prosperity. As supported by [2], that high achievement in mathematics will be able to enhance the individual level of education and has been proven as an open door to graduate employability [3]. It is notable here that mathematics competency is an increasingly important requirement in many professions and regarded as one of the core determinants of the current and future development of a nation. A critical requirement for building the success of a nation is highly depending on the quality of labors that possess a prominent level of skills like the ability to solve non-routine problems. Within this context, high achievement in mathematics education can produce workers with all those skills [4].

It is within the knowledge of everyone that a growing proportion of situation faced in a daily life requires an elevated level of understanding in mathematics that not only draws on more than just the ability to calculate but also focuses on other competencies such as problem-solving and decision-making process [5-6]. This includes the understanding of financial related concepts which have no doubt play a substantial influence on the sustainability of people's life [7]. With an advancement of the financial service sectors in the country, what offered to the public significantly will test on extended knowledge in both mathematics and financial skills to achieve more informed and wise decision-making outcomes.

Being at an early adult age, university students are assumed to experience and undertake their first financial management responsibility. Given that their parents are now more relaxed in terms of giving financial authority, the challenge of getting financially fits relies quite significantly on their own judgment and justification. Obviously, they had to prudently manage the limited financial resources given by education service providers in a form of scholarship or a study loan to cover their university and personal expenses which are very crucial for their education and financial success. However, in today's reality, the young adults are posed with a greater risk of bearing socially undesirable consequences due to their financial misbehaviors [8]. Rising in personal debts as a result of the world's social trending and materialism as well as the impact of the downside economics forces was among the public and government concern over the long-term future and life survival of this young generation [9-10].

Realizing how important is the issue facing our university students nowadays [11-12], this study is an effort to establish the relationship between the main variables of the study which are 1) achievement in mathematics, 2) financial literacy level and 3) financial well-being. Further analysis was carried out to focus on the differences between the variables for more meaningful sharing of the findings to those in concern such as the university students, current and future to be academicians, regulators, financial players, and prospective employers.

LITERATURE REVIEW

Mathematics Achievement and Financial Literacy

Financial literacy is associated with the ability to understand and manage financial and decision-making related to limited financial resources. It is how someone manages to earn or gain it, how that person manages and invests it, and how that person donates it to help others [13]. More specifically, it refers to the set of skills and knowledge that allows individuals to make informed and effective decisions with all their financial resources. Many studies have been conducted to understand the relationship between quantitative skills and financial literacy [14-17]. As operationalized in the academic literature, financial literacy has taken on a variety of meanings; it has been used to refer to the knowledge of financial products (concept of stock and bond; the difference between a fixed and an adjustable rate mortgage), knowledge of financial concepts (inflation, compounding, diversification, credit scores),

having the mathematical skills or numeracy necessary for effective financial decision making, and being engaged in certain activities such as financial planning [14]. Similarly, [15] found that it was hard for the students with less mathematical ability to acquire financial knowledge. In addition, [17] also examined the impact of implementing specific courses on basic financial concepts at schools on the students' ability to apply their accumulated knowledge and skills to the real-life situations involving financial issues and decisions. They found that basic financial concept is very helpful in understanding financial literacy and in turn, helps students make wise decisions. A study by [5] proved that greater understanding of quantitative literacy strongly affected the engagement of the financial literacy and practice. The study revealed that a person who had greater financial knowledge and mathematics achievements will pay bills on time, keep track of expenses, do budgeting, pay credit card bills in full each month, save out of each paycheck, maintain an emergency fund, diversify investments, and set financial goals.

However, [16] examined the factors influencing students' understanding of economics and financial concepts and investigate whether previous students' achievement is related to their understanding of economics and financial concepts. The respondents consisted of 5th-6th-grade students enrolled in public and charter schools in Orleans, Jefferson, Plaquemines, St. Bernard, and St. Tammany in the USA. The result revealed that there was no relationship between students' previous achievement and greater financial literacy. This was due to the fact that students' may not understand the concept of financial literacy deeply. Furthermore, [18] explored the relationships between academic ability and financial literacy of 2219 undergraduate students in public and private universities across Malaysia. The result advocated that one's academic ability or greater quantitative literacy does not necessarily determine financial literacy. They found that this might be due to other factors such as level of self-control, and social financial influences (e.g. peer, family, economic, community, and institutional), which can also affect financial literacy.

Relationship between Financial Literacy and Financial Well-being

Many researchers have examined the relationship between financial literacy and financial well-being [8][18] [19-20]. In [18], they found that financial literacy significantly influenced students' perceived financial well-being. The result also suggested that more knowledge of personal finances among students resulted in greater well-being in terms of saved money, current financial situation, and financial management skills. Similarly, [19] also investigated financial literacy among youth entrepreneurs in South Africa. The results revealed that financial literacy was very useful to increase financial well-being among youth entrepreneurs which in turn contributed implicitly to their entrepreneurship skills and decision making.

A study by [8] also found that financial literacy had a significant relationship with financial well-being. They investigated whether low financial literacy is associated with the use of risky mortgages and delinquency in the USA during the financial crisis. The results proved that a person with low financial literacy is more likely to take a risky mortgage and be delinquent on their mortgage payments and in turn low financial well-being. This proved that low financial literacy can affect good financial well-being. Furthermore, [7] also investigated the role of financial literacy in allowing and enabling responsible decisions to attain financial well-being among 534 university students attending public and private universities in southern Brazil. They found that financial knowledge and attitude have positive impacts on financial well-being and behavior.

In addition, financial literacy should begin in early childhood or during primary school. This was supported by [21] who explored the involvement in saving money (ISM) to better understand children's saving behavior and allow a deeper understanding of financial literacy processes among 103 first-grade students from seven schools in the central region of Israel. The result revealed that children with a high level of ISM expressed more positive attitudes towards saving and had a good financial literacy.

Mathematics Achievement and Perceived Financial Well-being

Researchers [6] explored the importance of basic mathematics competence needed to succeed in typical jobs in a modern economy and financial well-being among high school students in the UK. They found that previous high school knowledge in mathematics had a significant relationship with overall mathematics achievement. Early knowledge of the whole number division was also consistently related to later mathematics proficiency and also higher score on perceived financial well-being. Meanwhile, [22] examined the predictors of the financial well-being of college students living in Sao Paulo. The results suggested that financial self-confidence and social comparison

have an impact on financial well-being. Similarly, students' mathematics achievement was found to be the most strongly predicted by level of mathematics ability and financial well-being [23]. They investigated the relationships between interest, mathematical ability and achievement in mathematics among 108 respondents from two Chicago suburban high schools. The result revealed that grades and course level were the most strongly predicted by level of mathematics ability and financial well-being.

DATA AND METHODOLOGY

This study was conducted on a sample of 250 respondents chosen at random among a list of degree students of University Teknologi MARA Pahang. The sampling frame was obtained from the university's Academic Affair Department. Data were collected using questionnaires consisted of four parts: respondent's profiles, previous mathematics achievement, financial literacy questions and financial well-being measures.

Mathematics achievement is a single measure based on the score of mathematics at SPM level, a national education certificate highly recognized for its wide acceptance to most tertiary education enrolment and basic employment entry qualification. The grade of SPM in mathematics paper given by students was converted to midpoint percentage marks based on SPM Grade System by Kementerian Pelajaran Malaysia (KPM). The respondents' knowledge about the key financial concept was measured using 25 sets of true-false questions [24]. Meanwhile, the state of respondents' financial well-being was measured using ten questions with a ten-point continuum from the lowest to the highest level of financial well-being [25]. The socio-demographic information among others tapped the level of education of the respondents' father and mother, types of education sponsorship, age, gender, and their hometown. Data were analyzed using descriptive statistics by calculating the mean scores, standard deviations, and percentage counts. Besides, the study used correlation test to measure the relationship between the main variables in this study. Analyses of variance were conducted to establish any differences in the means between the previous mathematics performance with financial literacy level and financial well-being. The researchers were also interested to find any differences that exist in the level of achievement in mathematics, financial literacy, and financial well-being with respect to different types of financing sponsors.

RESULTS AND DISCUSSION

A total of 231 questionnaires were completely returned, giving a 92% response rate. All data were approximately normal as shown by the value of skewness ± 1 . Table 1 exhibits the details of respondents' demographics profile (N=231). Overall, almost one-third of the samples were at the age between 21 and 22 years (77%), while 20% were 23-24. Out of 231 students who responded to the survey, 25.5% were male and 74.5% female. The population of this study consisted of undergraduate students at Universiti Teknologi MARA Pahang. It comprised students of Bachelor of Chemistry (15.2%), Bachelor of Biology (41.6%), Bachelor of Sports Sciences (10.8%), Bachelor of Office Management (14.7%), Bachelor of Wood Technology (16.0%) and others (1.7%). Most of the students reported that they were from an urban area (54.5%), and received educational loan (69.3%) from the national higher education fund (PTPTN). The educational background of respondents' parents showed that most of them completed a secondary education (48.1% of their fathers and 57.6% of their mothers have a secondary education), while 37.3% of their fathers and 25.16% of the mothers were university graduates).

TABLE 1. Demographics profile of respondents

		Frequency	Percent
Age	25 and above	5	2.1
	23 – 24 years old	46	20.0
	21 – 22 years old	180	77.9
Gender	Male	59	25.5
	Female	175	74.5
Program	Chemistry	35	15.2
	Biology	96	41.6
	Sport	25	10.8
	Office Management	34	14.7
	Wood Technology	37	16.0
	Others	4	1.7
Place of origin	Urban	126	54.5
	Rural	105	45.5
Financial Resources	Family	57	24.7
	Study Loan	160	69.3
	Sponsorship	14	6.1
Fathers' educational level	Ph.D.	1	0.4
	Master	5	2.2
	Bachelor's degree	54	23.4
	Diploma	26	11.3
	SPM	111	48.1
	Others	34	14.7
Mothers' educational level	Ph.D.	1	0.4
	Master	5	2.2
	Bachelor's degree	32	13.9
	Diploma	20	8.66
	SPM	133	57.6
	Others	40	17.3

The overall results of means and standard deviation for each of the main variables are shown in Table 2. Students obtained quite a satisfactory performance in mathematics for their previous SPM result as well as their financial literacy test where their mean score between 78.45 and 73.18 indicating less than average knowledge about financial related concepts. It can be inferred that the respondents have approximated equal knowledge in both numeracy subjects with the average different range from 10.29 to 14.11. Meanwhile, the students' level of financial well-being recorded an average score of 5.28, an indicator of having average financial distress/financial well-being (based on the score interpretation by [25] with a standard deviation of 0.92).

TABLE 2. Mean (M) and standard deviation (SD) for variables

Variables	M	SD
Mathematics Performance	78.45	14.11
Financial Literacy	73.18	10.29
Financial Well-being	5.28	0.92

The first research question of this study examined the relationship between variables. According to Table 3, a positive correlation was found between 1) previous mathematics performance and financial literacy scores ($r = 0.05$); 2) previous mathematics performance and financial well-being ($r = 0.02$); and 3) financial literacy and financial well-being ($r = 0.07$). However, none of the correlations was found to have any significant difference (p-

value > 0.05). It can be suggested that these students who performed better in previous mathematics could understand better financial concepts which were consistent with the findings by [5]. However, higher performance in numeracy skills was not helping the students in experiencing better financial performance as their financial well-being was only at the average level. In this view, the result from the current study conflicted with the findings by [7-8] [18-19], where financial literacy was significantly shown to lead to a greater financial satisfaction among students.

TABLE 3. Correlation between variables

Variables	Financial Literacy	Financial Well-being
Mathematics Performance	0.05	0.02
Financial Well-being	0.07	

*p-value<0.05

Furthermore, the researchers continued to assess if there were any differences between financial literacy and financial well-being levels among the students with respect to various levels of mathematics performance. The students were divided based on mathematics performance into three distinct groups: high, medium, and low. The students with high grade had an average score of 86.67 while medium and low-grade students had the mean scores of 64.55 and 48.52, respectively. Table 4 shows the mean scores for financial literacy and financial well-being with respect to three distinct groups of mathematics performance. The table shows that the same results were achieved in by both the financial literacy and financial well-being regardless of the past grades in mathematics. This indicates that having different scores in mathematics did not give any significant advantage in terms of gaining a better result in financial knowledge and financial well-being. The assumption from the study by [16] and [18] might be true, where even if someone possesses a high numeracy performance such as in the mathematics subject and financial knowledge it does not necessarily mean that they really understand financial rules especially when it comes to the real financial practice. As pointed out by [18], other factors perceived to play a significant role were the level of individual self-control and financial socialization influences from peers and parents. Again, the evidence in a more recent study by [26] ascertained the fact that money management skills matter more than having good numeracy or quantitative skills.

TABLE 4. Financial literacy and financial well-being by level of mathematics performance

Mean (SD)	Grade		
	Low	Medium	High
Mathematics performance	48.52(2.79)	64.55(2.53)	86.67(5.50)
Financial Literacy	70.26(8.25)	70.26(9.56)	71.70(9.85)
Financial Well-being	5.14(1.04)	5.38(0.69)	5.28(0.96)

From the above observations, ensuring financial happiness seems to go beyond calculative sense as students nowadays face a great challenge to the modernization threats. One of the challenges is to cope with the materialism in lifestyles. According to [9], this materialism in the society contributes to the propensity to acquire more debts and thus weakening the individual savings. In both conditions, the level of financial distress, as opposed to financial well-being could be highly expected. Along with the high intensity of the influence of the Internet advertisements where online shopping has made it easy to click and shop, students in current generation face an immense challenge to control spending. Evidence prevailed as [10] raised a concern that the real danger of the Internet is not about facilitating online shopping but creating more debts. The students should be reminded as [27] recently discovered how that the young generation particularly the students easily and emotionally got connected when seeing advertisements through a Facebook – one of the most powerful social media in connecting people and the wide business. Therefore, it can be stated that the average results in the financial well-being of the students in this study can be related to these social trending.

TABLE 5. Financial literacy and financial well-being by type of university financing

Mean (SD)	Type of Sponsorship			Statistics
	Family	Loan	Scholarship	F-test
Mathematics performance	76.28(15.83)	78.35(13.84)	87.06(4.58)	3.73*
Financial Literacy	69.36(9.13)	71.65(9.62)	74.25(10.83)	2.01
Financial Well-being	5.28(0.95)	5.25(0.91)	5.66(0.91)	1.41

*p-value<0.05

In the last section of the analysis, this study intended to find any differences that may exist in the three main variables, namely the previous mathematics performance, financial literacy, and levels of financial well-being with respect to types of university financing. Based on Table 5, it was found that of the three different major university financing sources (family support, study loan, and scholarship) scholarship holders that most likely received their financial supports either from JPA or MARA (government-linked agencies) were previously recorded as the high achievers in mathematics at the SPM level. The differences in previous mathematics performance with regards to the type of university financing were found to be significant ($F=3.73$, $p\text{-value}<0.05$). They were also identified as a group with the highest score in the financial literacy test and average financial well-being.

It can be well predicted that students with high ability in mathematics will have a number of privileges particularly in securing good future such as excellent academic performance [28], career advancement [3] and betterment in overall life well-being [29]. Having their campus life fully sponsored could be heavenly enough for them to attain financial success as the average amount of money received is normally higher than study loan which the indebted-students must repay and remain as a financial burden for quite a number of years.

CONCLUSIONS

The results of the study signified the need for proper intervention programs both at school and university levels. Given the worldwide phenomenon of rising debts among the young adults, a program initiated by [30] can be introduced as part of university subject or short course project for giving practical guidance to a sound financial decision-making. Since financial literacy is an important condition for a healthy society, efforts need to be taken by the government and financially related organizations to assist and educate people, especially the young generation with regards to money management. Banks and financial institutions can also play an important role in organizing a campaign to educate the general public on how to control their expenditures and become informed consumers.

As more studies revealed that the future financial status of students leaving with education debts was somewhat disturbing (see example in [11]), the government should seriously take proactive measures in protecting the sustainability these young adults' well-being. They have been reported to have low personal net worth and struggle to afford for home and car ownership [12]. The implication for charging financing costs and flexibility in repayment schedule should be well studied and revised if the minimum social adverse impact due to the incidence of young adult indebtedness needs to be ensured.

More concern should also be directed to early financial education which should be taught in a systematic way by making parents, teachers, and institutional educators to become more participative in taking responsibility of the young adults to achieve financial happiness in their life. This one aspect of life needs to be well taken care because financial well-being is said as the determinants of many success factors in one's life including academic success, life satisfaction, psychological as well as physical health.

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