Chang, M. et al. (Eds.) (2019). Proceedings of the 27th International Conference on Computers in Education. Taiwan: Asia-Pacific Society for Computers in Education

Influence of Financial Course on Eighth Grade Students' Financial Concepts, Math Motivation, Math Anxiety in Taiwan

Yu-Ching HSU, Mei-Wen NIAN, Chang-Hsuan YANG, Yuan-Hsuan Lee, Jiun-Yu WU*
Yu-Ching Hsu, National Chiao Tung University, Taiwan
Mei-Wen Nian, National Chiao Tung University, Taiwan
Chang-Hsuan Yang, National Chiao Tung University, Taiwan
Yuan-Hsuan Lee, National Tsing Hua University, Taiwan
Jiun-Yu Wu, National Chiao Tung University, Taiwan
**jiunyu.rms@gmail.com*

Abstract: In the generation of educational reform, we have always wondering what kind of important ability has been taught in the curriculum? Financial literacy is an essential life skill (OECD, 2017). No matter what kinds of occupation will a person have, he or she must know how to manage his or her asset. In this research, we explored that if students' math motivation, math anxiety, and financial concept would change or not after they received the hybrid financial courses in 4 weeks. We used math motivation and math anxiety as grouping variables, then use *k*-mean clustering to separate students into two groups. Two-way mixed-design ANOVAs were conducted to test the mean differences and change of math motivation, math anxiety, and financial concept across time points between different groups. We found only the significant change of math anxiety from students after they received the financial courses, while math motivation and financial concept kept constant.

Keywords: Math motivation, math anxiety, financial literacy

1. Introduction

What should the curriculum in junior high school be? What should students learn in school? There is an important issue needs to be mentioned first—after graduate from high school, no matter what kinds of occupation will a person have, he or she must know how to manage his or her own properties. Therefore, financial literacy is an essential life skill (OECD, 2017). However, the contemporary awareness of how to cultivate children's financial concepts has not yet matured in Taiwan. Thus, how to educate financial concepts is an important issue. Furthermore, what is the influence of financial education on student learning achievement? It is also an issue that we urgently need to explore.

Skagerlund, Lind, Strömbäck, Tinghög & Västfjäll (2018) found that math anxiety can predict financial literacy of adults. Therefore, the researchers in this study believe that the exploration of financial education on math motivation and anxiety should be completed first because the financial concepts can be regarded as an application of mathematics in daily life. For students who have serious anxiety about mathematics, expecting to reduce their anxiety through a financial course, which was based on the mathematics in daily life. The connection between motivation, anxiety, and mathematical achievement has been explored for a long time (McDonough & Ramirez, 2018; Wang et al., 2015). Although the promotion of the financial concepts is also a matter in recent years, the researchers in this study believe that the effect of financial education combined with the mathematics curriculum is a matter of great concern. If there is a way to promote students' math motivation and reduce math anxiety while promoting financial education. Furthermore, it will also increase the students' financial concepts or the possibility of improving mathematics achievements. Therefore, the research question is how different math motivation, math anxiety, and financial concepts are before and after the financial courses for students with different types of math motivations and math anxieties?

2. Literature Review

2.1 Financial Literacy and its emerging importance

Faced with the diversification of financial products, people learn how to manage their own money is an important skill. The OECD pointed out in the 2014 report that Financial literacy is an essential life skill. The Office of Financial Education (OFE) in the United States advocates that schools are the best places to provide financial education (OFE, 2002). OECD also pointed out that the sooner you get into financial education, the better (OECD, 2005). In recent years, countries have attached importance to financial education and have put forward proposals for financial education. The United States proposed the National Standards in Personal Finance with Benchmarks, Applications and Glossary for K-12 Classrooms (OFE, 2002). Australia also proposed the National Consumer and Financial Literacy Framework (NCFLF, Consumer and Financial Literacy Working Party, 2005).

After the global financial crisis, it once again caused international awareness of financial concepts. Since 2006, the Financial Supervisory Commission of Taiwan has actively entered the campus and community for financial knowledge promotion activities, and established the Risk Management and Insurance Education Promotion Portal (https://rm.ib.gov.tw/Pages/ SiteMap.aspx) to promote domestic financial education. Also in 2012, Basic Learning Framework for Financial Education was proposed and clearly pointed out the financial education priorities and learning objectives of Citizenship Education. Both foreign countries and Taiwan have actively promoted financial education in recent years. For this reason, this study hopes to improve the financial concepts and the importance of it.

2.2 Math Motivation, Math Anxiety and Achievement

Motivation has a positive impact on learning achievement, while anxiety negatively affects learning achievement (Wang, Shakeshaft, Schofield, & Malanchini, 2018). It is often taken by both to consider the impact on students' performance. In addition, some scholars have explored the impact of learning anxiety on future behaviors in daily life (Skagerlund et al., 2018).

McDonough & Ramirez (2018) pointed out that if students have higher math anxiety and math self-concept, they will initiate their own defense mechanism, which will make it easier for students to forget the learning content and affect the learning outcomes. For students with high anxiety in mathematics, the achievements of mathematics usually do not perform well. Thus, those students also evade mathematics classes, indicating that math anxiety may affect mathematics achievements in different ways. Wang et al. (2018) found that people who have high anxiety about mathematics exams spend more time on studying. However, Wang et al. (2015) found that the relationship between math anxiety and math performance varies with the math motivation of students. For students with high math motivation, math anxiety and math performance have an inverted-U relation, while students with low math motivation have a negative linear relation between math anxiety and mathematics.

The relation between motivation, anxiety and learning outcomes is complex. Scholars often discuss motivation and anxiety at the same time to predict achievement (Wang et al., 2015). Wang et al. (2018) used math motivation and math anxiety to do the cluster analysis for exploring the differences in motivation and anxiety between different levels of learning time and outcome in math. Skagerlund et al. (2018) explored the relation between adult financial literacy and math anxiety. They found that math anxiety negatively affects financial literacy, so people may also evade financial behavior because of math anxiety.

Skagerlund et al. found that the impact of financial literacy on math anxiety. Although there are many studies that indicate the impact of motivation and anxiety on learning, there is no research indicates the influence of math motivation, math anxiety on the financial concepts for the junior high school students. Therefore, this study expects to use math motivation and math anxiety for grouping and discuss whether our financial courses can effectively enhance students' learning motivation, or change students' learning anxiety and improve students' financial concepts.

3. Method

In this study, the financial courses were used as an intervention for a four-week study to explore the changes of Taiwanese junior high school students in math motivation, math anxiety, and financial concepts. In order to explore the influence of financial courses on students with different levels of motivation and anxiety, this study further used math motivation and math anxiety to divide students into two groups. We expected that after the financial course, students' math motivation and financial concepts will increase, math anxiety will decrease, and students with different combinations of motivation and anxiety will have different financial concepts.

3.1 Participants

The participants of this study were 48 eighth grade students (22 males and 26 females) in Hsinchu, Taiwan. Those participants used one hour of mathematics alternative learning period per week to learn financial concept from an instructor for four weeks.

3.2 Experimental Design and Procedure

This study is mainly concerned with the changes in student's math motivation (MM), math anxiety (MA), and financial concept (FC) before and after the financial class. In the first week, the participants completed the questionnaires of math motivation (MM_pre), math anxiety (MA_pre), and financial concept (FC_pre). Next, the instructor introduced various financial tools (i.e. demand deposit, time deposit, and stock) and brought the students financial concepts. During the second and third week, the students used a public website of stock simulation to conduct investment actions (https://www.cmoney.tw/vt/). At the same time, the instructor brought the concept of math and finance.

Figure 1. The public website of stock simulation (https://www.cmoney.tw/vt/).

In the last week, the instructor summarized the simulation of these two weeks and carried out the post-test of math motivation (MM_post), math anxiety (MA_post), and financial concept (FC_post) to the students. Finally, the research teams merged the student's math motivation, math anxiety, and financial concept to do the analysis.

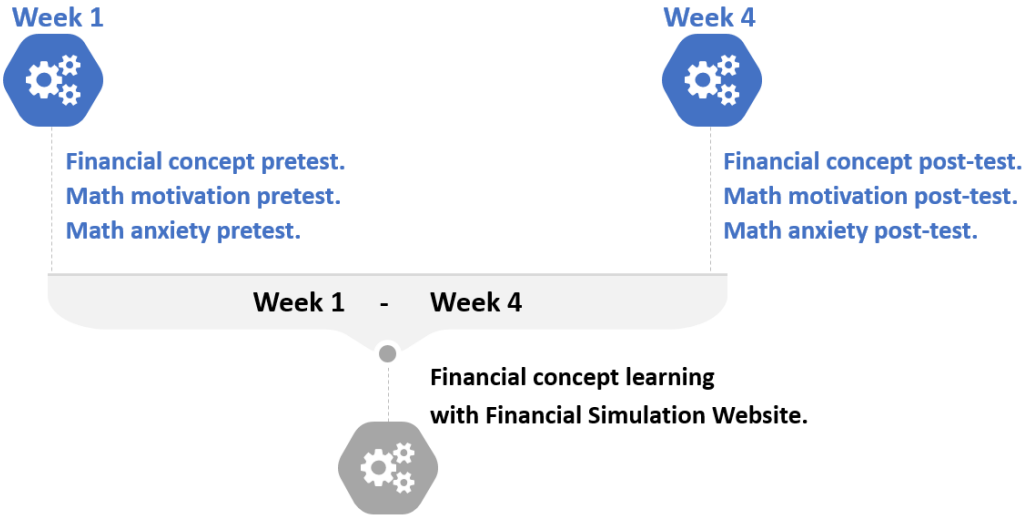

Figure 2. The procedure of financial course for four weeks.

3.3 Measure and Instrument

3.3.1 Math Motivation

The questionnaire of math motivation was based on Motivational Strategies in Calculus Learning Questionnaire for Taiwan Technology University Students (MSCLQ-TTU, (Hsin, Lin, & Yeh, 2005)). This study rewrote the calculus as mathematics. In addition, this study used 18 items in the motivation part of MSCLQ-TTU. Each item is Likert 5-point scale. Finally, the researchers summed up all the scores of the math motivation questionnaire and converted it into z-score. The higher the score is, the higher the motivation is.

3.3.2 Math Anxiety

The questionnaire of math anxiety was based on Modified Abbreviated Math Anxiety Scale (mAMAS, (Carey, Hill, Devine, & Szűcs, 2017)). There are 9 items. Each item is 5-point Likert scale. Participants assessed the level of anxiety experienced by each event in the math class (1 = low anxiety to 5 = high anxiety). The researchers summed up all the scores and converted it into z-score. The higher total score is, the higher anxiety that participants felt in math class is.

3.3.3 Financial conceptions

The questionnaire of financial were designed by researchers, extended from course materials. There are 10 items in the financial concept questionnaire, all of which are the true-false test. For example, *the interest rate of time deposit is always higher than demand deposit*. The researchers calculated the rate of right answers and converted it into z-score. The higher score, the better the concept of finance.

3.4 Statistical Analysis

This study used IBM SPSS Statistics 20 and R & Rstudio v.3.4.4 for statistical analysis. First, the researchers used MM_pre and MA_pre as grouping variables, performed the K-mean analysis and divided students into two groups. Then, the researchers used Two-way mixed-design ANOVA to test the differences between the groups and time in math motivation, math anxiety and financial concepts.

4. Results

4.1 Non-hierarchical Cluster Analysis

Researchers used MM_pre and MA_pre to divide the 48 participants into two groups. Group 1 were made up of 26 students (10M, 16F), and Group 2 were 22 students (12M, 10F). After the examination of t-test, there were no statistically significant differences between group means and sample mean on MM_pre ($G1_{MM\_pre}: t(25) = -1.03, p = .314$; $G2_{MM\_pre}: t(21) = 1.22, p = .237$). Thus, the two groups' MM_pre are "average motivation(AM)". In math anxiety, those two groups had statistically significant difference between group means and sample mean on MA_pre ($G1_{MA\_pre}: t(25) = 7.51, p < .001$; $G2_{MA\_pre}: t(21) = -8.34, p < .001$). Therefore, we claimed that G1 is "high anxiety(HA)", and G2 is "low anxiety(LA)". Conclusively, we regarded G1 as "average motivation and high anxiety(AMHA)" group and viewed G2 as "average motivation and low anxiety(AMLA)" group. The z-scores of variables of these two groups are in Table 1.

Table 1

Z-score of Math Motivation, Math Anxiety and Financial Concepts in two groups.

Group	*N*	MM_pre	MA_pre	MM_post	MA_post	FC_pre	FC_post
G1 (AMHA)	26	-0.18	0.94	-0.20	0.31	0.17	0.07
G2 (AMLA)	22	0.28	-0.88	0.29	-0.56	0.23	-0.30

4.2 Two-way Mixed-design ANOVA

Accordingly, the differences in math motivation, math anxiety and financial concept between the two groups and between time are both noticeable. Thus, we used the following three mixed-design ANOVAs to examine the difference, with group and time as independent variables, math motivation, math anxiety and financial concept as dependent variables.

4.2.1 Math Motivation

We used group and time as I.V., math motivation as D.V., and carried out the two-way mixed-design ANOVA to test the influence of group and time on math motivation. The results showed that the main effects of the group and time were not significant ($F_G(1,46) = 3.426, p = .071, \eta^2 = .057$; $F_T(1,46) = 0.002, p = .969, \eta^2 < .001$). Besides, there were no interaction effect as well ($F_{G\times T}(1,46) = 0.012, p = .914, \eta^2 < .001$). Consequently, the math motivation did not differ between the two groups and there was no significant change and maintained at a certain level before and after the course.

Table 2

Two-way mixed-design ANOVA with math motivation as D.V., group and time as I.V.

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Between groups						
Group	5.312	1	5.312	3.426	.071	.057
Time	0.001	1	0.001	0.002	.969	<.001
Group*Time	0.004	1	0.004	0.012	.914	<.001
Within groups						
between subjects	71.322	46	1.550			
residuals	15.837	46	0.340			
Total	92.476	95				

4.2.2 Math Anxiety

Based on the MA as D.V., group and time as I.V.. The two-way mixed-design ANOVA results showed significant interactions with ($F_{G\times T}(1,46) = 23.16, p < .001, \eta^2 = .120$). Therefore, a simple main effect test was performed. The results showed that under the condition of G1(AMHA), MA_pre was significantly higher than MA_post($\mu_{MA\_pre-MA\_post} = 0.630, p < .001$). Under the condition of G2(AMLA), MA_post significantly higher than MA_pre ($\mu_{MA\_post-MA\_pre} = 0.320, p = .018$). The MA of G1(AMHA) was significantly greater than MA of G2(AMLA) regardless of pre or post test (MA_pre: $\mu_{G1-G2} = 1.83, p < .001$; $MA\_post: \mu_{G1-G2} = 0.88, p < .001$).

Further examination of the mean, we found that the MA_post mean difference between G1(AMHA) and sample was not significant ($t(25) = 1.91, p = .067$), but the mean difference was significant between G2(AMLA) and sample ($t(21) = -3.67, p = .001$). That is to say, G1(AMHA) has dropped from high anxiety to average anxiety, while the G2(AMLA) anxiety has increased, but it is still low.

Table 3

Two-way mixed-design ANOVA with math anxiety as D.V., group and time as I.V.

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Between groups						
Group	43.46	1	43.46	60.89	<.001***	.500
Time	0.57	1	0.57	2.47	.123	.013
Group*Time	5.38	1	5.38	23.16	<.001***	.120
Within groups						
between subjects	32.84	46	0.71			
residuals	10.68	46	0.23			
Total	92.93	95				

Table 4

Simple main effect test of mixed-design ANOVA with math anxiety as D.V., group and time as I.V.

Source	*SS*	*df*	*MS*	*F*	*p*	Post-hoc
Time at						
G1(AMHA)	5.16	1	5.16	22.43	<.001***	$\mu_{pre-post} = 0.630, p < .001$ ***
G2(AMLA)	1.34	1	1.13	4.91	.032*	$\mu_{post-pre} = 0.320, p = .018$ *
Residuals	10.68	46	0.23			
Group at						
Pre-test	39.71	1	39.71	83.95	<.001***	$\mu_{G1-G2} = 1.83, p < .001$ ***
Post-test	9.132	1	9.13	19.31	<.001***	$\mu_{G1-G2} = 0.88, p < .001$ ***
Residuals	43.52	92	0.47			

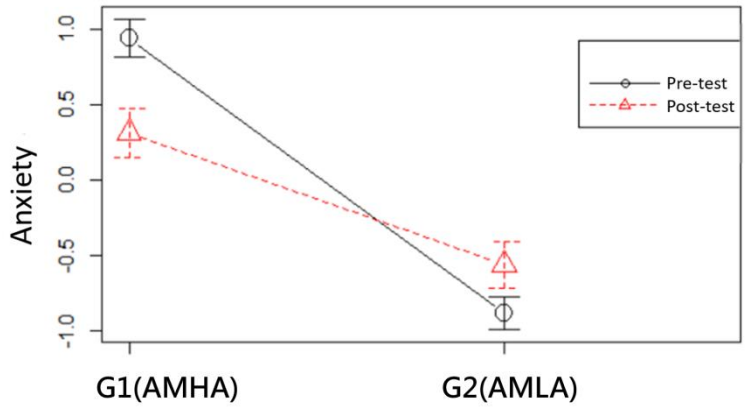

Figure 3. The plot mean of mixed-design ANOVA about MA .

4.2.3 Financial concepts

The mixed-design ANOVA was performed with FC as D.V., group and time as I.V.. As a result, it was found that the spherical test hypothesis was rejected (T: $Mauchly's\ W = 0.87, p = .038$; $T \times G$: $Mauchly's\ W = 0.87, p = .03$), so the following results were reported for the Greenhouse-Geisser correction. The main effects and interaction effect were not significant ($F_G(1,46) = 0.10, p = .001$; $GGe_T = 0.88, p = .107$; $GGe_{T\times G} = 0.88, p = .297$), indicating that the two groups did not have differences on FC. FC maintained a certain level at different times, and there was no interaction between groups and time.

5. Discussion and Conclusion

Researchers used math motivation and math anxiety as grouping variables to divide the 48 participants into two groups. Group 1 was regarded as a group with average math motivation and high math anxiety, Group 2 was a group with average math motivation and low math anxiety. Next, after the financial courses, the researchers explored the changes in students' math motivation, math anxiety and financial concepts.

Researchers found that there is a significant difference between the two groups in math anxiety, but there is no difference in math motivation and financial concepts. Before and after the financial course, students maintained certain math motivation and financial concepts, but anxiety changed after the course. The following are the discussions of the results.

From the perspective of analysis results, Group 1's anxiety has always been higher than Group 2's. It is worth noting that we can find significant changes in math anxiety of the two groups before and after the course. Group 1 had originally high anxiety, but after the financial course, math anxiety dropped to average anxiety. Group 2 had originally low anxiety, although it still remained low anxiety after course, the math anxiety was improved. As Wang et al. (2015) said, it was found that whether the anxiety remained extraordinary high or low will affect students' learning performance. That is to say, the extraordinary high anxiety may make students unable to concentrate on learning, and negative emotions may occur during the study, which may affect the grades. On the other hand, if students have low anxiety, it may represent that students do not pay attention to learning, do not care, or even ignore learning, resulting in poor learning. Therefore, under average anxiety, students can face up to learning but they do not interfere with negative learning emotions.

From the analysis of the financial concepts, there is no difference between two groups before and after the course, which is different from our initial assumptions. It may be because the grouping variables we used are motivation and anxiety about mathematics, not about financial concepts. Mathematics is a discipline for students, but the financial concepts is a life skill. Perhaps for this reason, the results of math motivation and anxiety grouping have little effect on the financial concepts. In addition, we also found that there is no difference between pre-test and post-test in financial concepts. It may be because this study only teaches on stocks and investment risks, and the period is only four weeks. Another possibility is that the number of questions in the test is not enough. Since it is a self-edited test in our study, the content of the topic bias concept is more. But there are fewer items in the judgment of financial behavior and financial affairs. Therefore, it is suggested that future research can increase the number of questions in the financial test and the breadth of the content to test the knowledge of students' financial concepts more comprehensively.

This study used math motivation and math anxiety to group students and examine the differences in math motivation, math anxiety, and financial concepts before and after the implementation of the financial course. The research results show that with such a financial course, it is beneficial to students' changes in math anxiety, from extreme high and low anxiety to the average anxiety. Math motivation and financial concepts also maintain a certain level. It also proves that such a life-oriented learning course, in addition to cultivating students' life skills, understanding financial concepts and investment risks, also helps students' learning anxiety changes in the discipline.

In the future, it is recommended that researchers, in addition to motivation and anxiety, can try to collect more student traits or increase the number of classification groups. Refer to Wang et al. (2018)

for a more detailed motivation and anxiety grouping to explore more combinations of different learning states, as well as a more comprehensive interpretation of learner traits and learning.

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