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Family background and financial literacy of Italian students: the mediating role of attitudes and motivations

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Abstract

The aim of this paper is to assess the determinants of financial literacy amongst Italian students and to evaluate the role of students' attitudes and motivations as mediators for the influence of family background. We focus on the process of financial knowledge development of 15-year-old Italian students by exploiting the large amount of OECD-PISA (Programme for International Student Assessment) data. Through the specification of a structural equation model (SEM), our results illustrate that the effect of family background on financial literacy is only partially mediated by the latent constructs that measure the students' attitudes and motivations. This suggests that the direct impact of the family context on financial literacy attainment still holds once the mediating effect of students' attitudes and motivations is accounted for. In addition, focusing on the gender gap, our findings indicate that the acquisition process of the financial competences, according to the hypothesised model, does not show significant differences between boys and girls.

1 Introduction

Increasingly, individuals are required to make financial decisions, such as those concerning retirement savings, education and health expenditures, and home purchases; as a consequence, financial literacy is an increasingly important and frequently investigated determinant of human capital formation and development. A wide body of literature has highlighted the relationship between financial literacy and a household's economic and financial wellbeing (Behrman et al., 2012; Lusardi and Tufano, 2015). Indeed, individuals with a high level of financial skills can make better decisions regarding savings and retirement planning (Cole et al., 2011; Lusardi and Mitchell, 2008), wealth accumulation (Behrman et al., 2012), mortgages (Lusardi and Tufano, 2015) and stock market participation (Van Rooij et al., 2011). Moreover, the improvement of students' financial knowledge is essential for successful participation in modern society (Lusardi et al., 2010) that can generate benefits for the economy and society as a whole (Gnan et al., 2007). Even though most financial decisions are made by adults, the Organisation for Economic Co-operation and Development (OECD) recommends that financial education should begin in the earliest stages of life to provide students with the skills needed to make conscious financial choices in adulthood (OECD, 2005), when they will encounter increasingly complex financial products and services.

In this light, we focus on the process of financial knowledge development of 15-year-old Italian students by exploiting the large amount of OECD-PISA (Programme for International Student Assessment) data. Our analysis is closely connected with the search of the determinants of educational production. In this framework, financial skills are described as the output of an educational process in which the effects of several factors at the individual, family and school levels interact with each other.

The starting point of our research is the multidimensional concept of financial literacy, which encompasses, as defined by OECD, the motivation to seek information and advice to engage in financial activities, the confidence to do so, and the ability to manage emotional and psychological factors that can influence financial decision making.

It should be noted that the Italian educational system does not provide financial education in any institutional curriculum; therefore, students must acquire financial competences outside the school from "external" sources such as family environment, personal interest and motivation. Following the seminal work by Coleman et al. (1966), several analyses on the PISA dataset (OECD 2014a) confirm that the family socio-economic context plays a role in the acquisition of the students' competences in financial literacy.

Moreover, previous studies have found a significant link between personality traits and financial literacy (Noon and Fogarty, 2007) and between mathematical skills and financial literacy (Lusardi et al., 2010).

Based on the conceptual framework, the aim of this study is to evaluate the role of students' attitudes and motivations as possible mediators for the influence of the family background on financial literacy attainment.

Given the latent nature of the factors reflecting the students' attitudes, a structural equation modelling (SEM) approach was used with the two-fold aim of measuring these latent constructs through a set of manifest indicators and, at the same time, estimating the structural effects amongst all involved variables.

Moreover, since the gender issue is particularly relevant in financial literacy achievement (OECD, 2014a), we further investigate whether there may be differences in the estimated parameters of the model between boys and girls through a multi-group analysis.

The remainder of this paper is organised as follows. The next section discusses the PISA data, particularly the results for Italian students and the variables used in the analysis. The

methodology is described in Section 3. Sections 4 reports the empirical results from the structural equation model. Section 5 presents the conclusions.

2   Data and variables

The PISA 2012 financial literacy assessment is the first large-scale international study to evaluate the financial literacy—learned in and outside of school—of 15-year-old students nearing the end of compulsory education. The PISA assesses the extent to which approximately 29,000 students in 18 countries have the knowledge and skills that are essential to make financial decisions and plan for their futures. The PISA results provide an overall picture of students' ability to apply their accumulated knowledge and skills to real-life situations involving financial issues and decisions. A complete definition of financial literacy is given by the OECD (2013): "*Financial literacy is knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life*".

Like other PISA domains, financial literacy assessment is designed to provide a rich set of comparative data that policy makers and other stakeholders can use to make evidence-based decisions.

This study focuses on the Italian subsample of the PISA dataset since Italy provides an interesting case study for two relevant idiosyncrasies.

First, Italy is the country with the largest sample size, both of the schools (n=1,158) and of students (n=7,068), which allows for a high reliability for econometric analyses. Second, Italian students' performance in financial literacy is the lowest amongst OECD countries (the average score is 466 points compared to the OECD average of 500 points).

More than one in five students in Italy (21.7%, compared with an average of 15.3% in OECD countries and economies) do not reach the baseline level of proficiency in financial literacy. At best, these students can recognise the difference between needs and wants, can make simple decisions on everyday spending, and can recognise the purpose of everyday financial documents, such as an invoice. Only 2.1% of students are top performers (compared with an average of 9.7% in OECD countries). These students can analyse complex financial products, solve non-routine financial problems and show an understanding of the wider financial landscape.

Moreover, the PISA scores of Italian students in financial literacy are lower than might be expected based on their scores in mathematics and reading (OECD, 2014a). Thus, although financial literacy skills are positively correlated with mathematics and reading skills, high performance in one of those core subjects does not necessarily signal proficiency in financial literacy. In fact, evidence suggests that the core skills that students acquire in school do not provide them with the skills to perform well in the financial literacy assessment (OECD, 2013). Another important issue is that financial education is still not part of the Italian national school curriculum[1], and as a result, the level of financial literacy of Italian students is predominantly influenced by the family environment and innate characteristics of students.

In light of these considerations, we aim to evaluate whether the influence of students' socio-economic background on financial knowledge always remains significant when we consider

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[1]In Italy, the Central Bank (Bank of Italy) and the Ministry of Education have implemented an experimental financial education programme to incorporate financial education into school curricula in primary and secondary education. The programme was piloted in the school year 2008/09 with about 630 students and was then made available nationwide, reaching about 60,000 students in 2014/15. The results of this monitoring were encouraging and highlighted how the participants' financial knowledge has increased significantly.

the impact of motivational and attitudinal variables, specifically, openness to problem solving and students' attitudes towards mathematics.

In the OECD-PISA framework, the performance in financial literacy (as the other PISA domains) is measured through five "test scores" (plausible values) estimated for each student. Plausible values are multiple random draws from the unobservable latent student achievement and cannot be aggregated at the pupil level. As recommended, all five plausible values have been used in this analysis to produce the final estimates of the parameters and their standard errors[2].

To account for the effects of socio-economic background, we use the ESCS (economic, social and cultural status) summary indicator provided by the OECD. By design, this indicator has an OECD mean of zero and a standard deviation of one and it captures students' family and home characteristics (i.e., possession of goods, parents' education and occupation) that describe their socio-economic background.

Focusing on motivational and attitudinal factors, we use a set of observed indicators that constitute judgements made by the students themselves about their openness to problem solving and self-efficacy. Therefore, openness to problem solving and math self-efficacy are treated as latent variables.

In the PISA, "Openness to Problem Solving" (OPEN) is defined as "an individual's capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediately obvious" (OECD, 2013). It was assessed using student responses to five questions about how well some statements describe them. They are measured by a five-point scale ranging from "very much like me" to "not at all like me". The five variables enter the analysis as indicators of the same latent construct representing the attitudes of the students towards problem solving.

The PISA definition of "Mathematics Self-Efficacy" (MAT_EFF) consists of the extent to which students believe in their own ability to handle mathematical tasks effectively and overcome difficulties. Mathematics self-efficacy is observed through eight indicators measured with a four-point scale, where 1 = very confident and 4 = not at all confident.

The PISA 2012 edition is characterised by a rotated design such that three forms of the student questionnaire contain a common part and a rotated part[3].

Several analyses were performed by the OECD (2014b) to assess the effects of rotated design on the reliability of the PISA results. The outcome of these tests was positive and allowed the OECD to emphasise that "the rotated design has negligible implications for proficiency estimates and correlations of proficiency estimates with context constructs" (OECD, 2014a).

Due to the PISA's rotated survey design, approximately 66% of the students in the original Italian sample provided responses to the questions about math self-efficacy and openness to problem solving. Therefore, our analysis is restricted to a reduced dataset of 4,669[4] Italian students.

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[2] Specifically, the final standard errors account for the imputation error according to Rubin's rule for handling multiple imputations (Rubin, 1987; Jerrim et al, 2017).

[3] The OECD used the rotated student context questionnaires for the first time in the 2012 edition. This was done to increase the content coverage of topics of interest to the PISA in the questionnaire without increasing the response time for students. The common part of student questionnaire contained questions to obtain information about gender, language at home, migrant background, home possessions, parental occupation and education. The rotated part contained questions about attitudinal and other non-cognitive constructs.

[4] A small proportion of units (3.8%) in the reduced sample show missing values in at least one variable included in the analysis. A sequential regression multivariate imputation (SRMI) has been applied to impute these missing values (Raghunathan et al., 2001).

Table I: Descriptive statistics (sample size=4,669 students in 1,123 schools)

Construct	Variable	Item	Mean	Std. Dev.	Min	Max
Openness to Problem Solving (OPEN)	st94q05	I can handle a lot of information	3.481	0.981	1	5
	st94q06	I am quick to understand things	3.573	0.997	1	5
	st94q09	I seek explanations for things	3.751	0.98	1	5
	st94q10	I can easily link facts together	3.687	0.988	1	5
	st94q14	I like to solve complex problems	2.613	1.29	1	5
Math Self-Efficacy (MAT_EFF)	st37q01	Using a train timetable to work out how long it would take to get from one place to another	3.068	0.764	1	4
	st37q02	Calculating how much cheaper a TV would be after a 30% discount	3.143	0.764	1	4
	st37q03	Calculating how many square meters of tiles would be needed to cover a floor	2.887	0.834	1	4
	st37q04	Calculating the petrol-consumption rate of a car; understanding graphs presented in newspapers	3.023	0.77	1	4
	st37q05	Solving an equation like 3x+5=17	3.343	0.832	1	4
	st37q06	Finding the actual distance between two places on a map with a 1:10000 scale	2.562	0.852	1	4
	st37q07	Solving equations like 3x+5=17 and 2(x+3)=(x+3)(x-3)	3.243	0.847	1	4
	st37q08	Calculating the petrol-consumption rate of a car	2.522	0.878	1	4
ESCS		Index of Socio Economic and Cultural Status	-0.024	0.966	-2.55	3.11
FINLIT		Financial literacy score	467.488	85.911	22.251	727.986

Source: Authors' elaboration from PISA 2012 dataset

To confirm the validity of the reduced sample, a t-test highlights that there is no evidence of a significant difference (between the full and reduced sample) with respect to either the students' scores in financial literacy (p-value= 0.315) or the ESCS (p-value= 0.442).

In table 1, the main descriptive statistics of the analysed sample are reported[5].

Amongst the indicators of math self-efficacy, the highest mean score is associated with the confidence in solving equations (st37q05 and st37q07 items). With reference to the problem-solving experience, the attraction to complex problems (st94q14 item) shows the lowest mean score together with the largest variability.

3   Methodology

In this paper, the structural equation modelling (SEM) approach is employed to test the complex interrelationships amongst variables affecting financial literacy, based on the theoretical background and the research questions discussed above. The structural equation approach is a statistical modelling technique widely used in most behavioural, educational, medical, and social studies.

The application of the SEM approach in educational research can be considered an essential tool to account for the problems of simultaneity, reciprocal causation and feedback that are pervasive in this field (Goldberger, 1991). Starting from the studies of Levin (1970) and

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[5] For the items of both latent constructs, the order of the responses has been reversed with the aim of attaching higher scores to both more positive attitudes towards problem solving and more confident feelings.

Boardman et al. (1977), many scholars have noted the interesting potentiality of the SEM approach in the study of the process of educational production. For example, this approach has been used to quantify students' ability assessed by tests or questionnaires (Schoonen et al., 2003; Silverman, 2010) or the effects of learner variables on proficiency or academic achievement (Marsh and Yeung, 1998; Ockey, 2011).

SEM can be viewed as a combination of regression analysis and factor analysis (Khine, 2013). However, it differs from the common multivariate regression model in that both the response and explanatory variables in SEM can be latent; the response variable in one regression equation may appear as a predictor in another equation, as the variables in SEM may influence one another reciprocally, either directly or through other variables as mediators.

The structural equation modelling approach consists of two steps: validating the measurement model and fitting the structural model. The measurement model addresses the extent to which the manifest variables are reliable indicators of the corresponding construct, whilst the structural model attempts to identify the paths amongst the variables.

In Figure 1, the latent variables—Mathematics Self-Efficacy (MAT_EFF) and Openness to Problem Solving (OPEN)—are enclosed by an oval. They are measured by several indicators, which together with other observed variables (ESCS and FIN_LIT), are represented as enclosed by rectangles.

In detail, through a careful review of the theory and research on this topic, we model the cognitive process of the acquisition of financial literacy skills through the following hypotheses that lead to the specification of the theoretical model.

- H1: The family socio-economic status of the students affects their school achievement and, therefore, their performance in financial literacy.
- H2: The family background affects the extent to which the students judge themselves to be able to resolve problem situations and to handle specific mathematical tasks.
- H3: Openness to generic problem solving is a latent factor that influences the specific attitudes towards mathematics.
- H4: Students' attitudes towards mathematics is a latent factor that directly impacts the score in financial literacy.

The conceptual model to be estimated amounts to a serial multiple-mediator model (Darlington and Hayes, 2016). The family background is the only exogenous variable, whilst the mediators are the two latent constructs (OPEN and MAT_EFF). We assume that OPEN has an indirect effect on the score in financial literacy via MAT_EFF (Figure 1).

Figure 1: Hypothesised research model
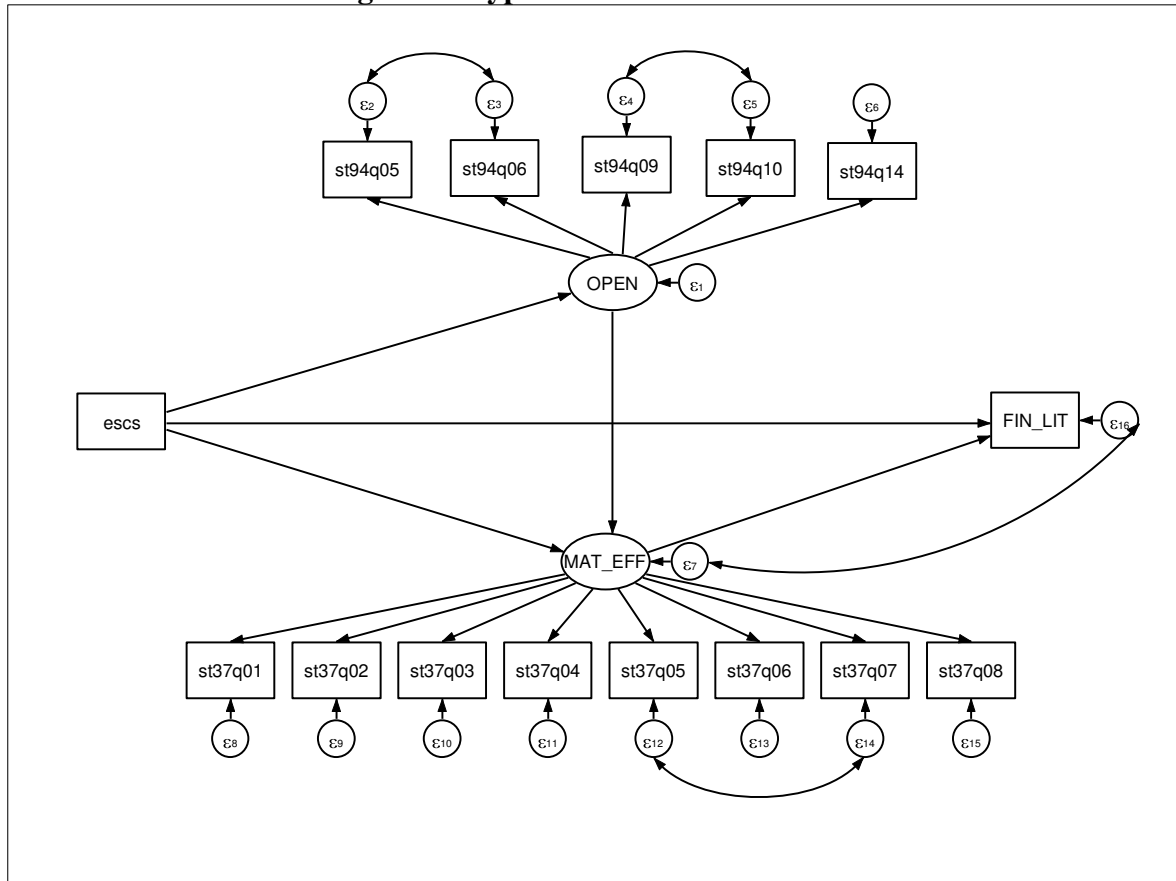
Note: the manifest variables appear enclosed by rectangles whereas the latent factors are enclosed by ovals.

Further specification issues refer to the use of weights and the treatment of such aspects as the effect of the hierarchical data structure on standard error estimates and the possible endogeneity problem when using the Mathematics Self-Efficacy as the predictor of the achievement in financial literacy.

As for the weights, the final student weights provided with the PISA dataset have been used. The loss in precision of the estimates due to the interdependence of first-level observations (the students) within clusters (the schools) was addressed by calculating cluster-robust standard errors through the Huber-White adjustment (Cameron and Miller, 2015).

When using MAT_EFF as a predictor of FIN_LIT, an endogeneity problem may occur due to an omitted variable (mathematical skills) that contributes both to higher confidence in handling mathematical tasks and to a higher score in financial literacy. The endogeneity issue was addressed through the estimation of the correlation between the cross-equation disturbances (ε_7 and ε_{16} in Figure 1). This ensures that the model is correctly specified and that the estimates are therefore consistent since this correlation accounts for a common unmeasured cause that affects both variables (Antonakis et al., 2010).

The fit between the structural model and data was evaluated by means of the standardised root mean squared residual (SRMR) index. This index is computed as the average difference between the observed and model-implied variance/covariance matrices. Values for the SRMR range from 0 to 1: a perfect fit corresponds to an SRMR of 0, and a good fit is signalled by

values not greater than 0.08 (Hancock and Mueller, 2006). The estimated model has an SRMR equal to 0.038; therefore, the findings indicate that the research model shows a good fit[6].

4   Results

For the validation of the measurement model, the values of Cronbach's alpha as a reliability index for each latent construct are estimated. A good level of internal consistency of the constructs was found since the alpha coefficients ranged from 0.783 (OPEN) to 0.803 (MAT_EFF) and exceeded the recommended 0.70 cut-off. In table 2, the estimates of the conceptual model are reported.

Table II: Estimates of structural equation model. n=4,669.

	Path			Unstandardised coefficients		Cluster-robust standard error	Standardised coefficients
Structural coefficients	FIN_LIT	<—	MAT_EFF	79.936	***	12.488	0.400
	FIN_LIT	<—	escs	14.898	***	2.081	0.168
	OPEN	<—	escs	0.103	***	0.015	0.170
	MAT_EFF	<—	OPEN	0.386	***	0.028	0.524
	MAT_EFF	<—	escs	0.063	***	0.011	0.141
Measurement coefficients for OPEN	st94q05	<—	OPEN	1.000	(constrained)	-	0.595
	st94q06	<—	OPEN	1.150	***	0.045	0.673
	st94q09	<—	OPEN	0.964	***	0.046	0.574
	st94q10	<—	OPEN	1.192	***	0.054	0.703
	st94q14	<—	OPEN	1.293	***	0.066	0.584
Measurement coefficients for MAT_EFF	st37q01	<—	MAT_EFF	1.000	(constrained)	-	0.562
	st37q02	<—	MAT_EFF	1.231	***	0.048	0.692
	st37q03	<—	MAT_EFF	1.391	***	0.063	0.716
	st37q04	<—	MAT_EFF	0.926	***	0.047	0.517
	st37q05	<—	MAT_EFF	0.943	***	0.057	0.487
	st37q06	<—	MAT_EFF	1.148	***	0.057	0.579
	st37q07	<—	MAT_EFF	0.901	***	0.058	0.460
	st37q08	<—	MAT_EFF	1.014	***	0.053	0.496
cov(e.FIN_LIT,e.MAT_EFF)				1.702		1.471	0.065

Note: The final coefficient estimates are the averages of the five separate estimates across the five plausible values. The final standard error estimates are calculated by combining the average sampling error across the five plausible values and the imputation error.
***: the coefficient is statistically significant (p-value<0.01).

Source: Authors' elaboration from PISA 2012 dataset.

Amongst the indicators for the latent factor OPEN, quickness in understanding (st94q06) and aptitude for linking facts together (st94q10) show the highest loadings, approximately equal to 0.70. Regarding the measurement of the latent factor MAT_EFF, the indicators with the highest standardised coefficients are the self-confidence in solving calculations for a discounted price (st37q02) and for the square metres of tiles needed to cover a floor (st37q03).
With reference to the structural model, all the estimated direct effects are positive and statistically significant. The latent construct MAT_EFF has the strongest direct effect on financial literacy; indeed, a 1 standard deviation change in MAT_EFF translates to a 0.4 standard deviation change in the score. Moreover, the socio-economic context has a positive influence on both latent factors OPEN and MAT_EFF. The non-significance of the correlation between the cross-equation disturbances indicates that MAT_EFF is not endogenous and that

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[6] The fit of the model benefited notably from the estimation of some covariances between the errors of different manifest variables that measure the same construct (namely, st94q05 and st94q06, st94q09 and st94q10, and st37q05 and st37q07).

no instruments are therefore needed. The mediation test for the effect of ESCS on the score in financial literacy reveals that the direct path remains significant when the relationship is mediated by motivational and attitudinal constructs, though it is reduced in absolute size with respect to the total effect. This result indicates a partial mediation. Specifically, the proportion of the total effect mediated (that is the ratio of the indirect effect to the total effect) is equal to 35.4%.

In the framework of financial literacy, the issue of gender deserves special attention. The consolidated stereotypes that females are less interested than males in finance and less likely than males to address financial issues may influence the girls' approach to financial education and, therefore, their achievement in this subject. Specifically, Italy is the only country where the PISA 2012 results in financial literacy show a significant gender gap to the disadvantage of girls (OECD, 2014a), even if the girls possess those endowments that would predict high scores (Longobardi et al. 2017). In this analysis, we address the gender issue by investigating whether there may be gender-based differences in the estimated parameters of the model through a multi-group analysis. In other words, we want to know whether the mediation model of Figure 1 works similarly for boys and girls.

First, we specify a multi-group model when all the parameters (coefficients and intercepts from both measurement and structural model plus the error variances) are unconstrained and therefore free to vary amongst boys and girls. Then, we test whether equality constraints should be added: i) the structural coefficients, and ii) the coefficients of the measurement model.

The null hypothesis that the structural coefficients can be constrained to be equal across groups can not be rejected, which means that the paths through which the family background affects the financial literacy score can be assumed to be equal for boys and girls. Conversely, for the coefficients of the measurement part of the model, we cannot accept the hypothesis of equality between boys and girls. This means that for boys and girls the indicators are not equally important to the understanding of the latent variables.

5   Conclusions

In exploring the mechanisms through which the socio-economic condition of 15-year-old Italian students influences their achievement in financial literacy, this paper found that the direct impact of the family context on financial literacy attainment still holds above and behind the mediating effect of students' attitudes and motivations. Attitudes and motivations are assumed to be latent variables, indirectly measured by a set of subjective indicators. Our findings bring the educational equity issue into play. If one of the aims of an educational system is to reduce the impact of students' background on their achievements to ensure equitable learning opportunities for every student regardless of their socio-economic condition, these results suggest that encouraging the attitudes of problem solving and math self-efficacy of the more disadvantaged students does not remove the direct influence of the family background, which is still a significant predictor of the financial literacy score.

The results from the multi-group model provide evidence that the structural parameters of the model can be considered to be equal between boys and girls, whereas the coefficients of the measurement model are jointly significantly different by gender.

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