RESEARCH ARTICLE   **OPEN ACCESS**

FROM THEORY TO PRACTICE OF PROMOTING STUDENT INTEREST IN ECONOMETRICS: APPLICATION OF STRUCTURAL EQUATION MODEL

Fredrick Oteng Agyeman*[1], Agyemang Kwasi Sampene[1], Ma Zhiqiang[1], Cai Li[1], Mingxing Li[1], Brenya Robert[2] and John Wiredu[3]

[1]School of Management, Jiangsu University, Zhenjiang 212013, P.R. China; [2]Nanjing Agricultural University, Xiaolingwei Street, Xuanwu District, Nanjing City, Jiangsu Province 210018, China; [3]School of Management, Northwestern Polytechnical University, Xi'an Shaanxi, 710072, P.R.C. China

ARTICLE INFO

ABSTRACT

Studying econometrics is perceived by many students as challenging, although it helps make predictions and effective professional career decisions. The emergence of the coronavirus disease was seen as a season to reduce further students' interest, motivation, and confidence to study. This study conducted a thorough investigation from theory to the practice of promoting student interest in learning Econometrics. This study adopted Partial Least Squares (PLS) and the Structural Equation Modelling (SEM) methodologyfor analysis. Results from the survey show that most of the students who respondents (51%) are at an intermediate level in studying Mathematics and economics. Few of the respondents (23%) have advance knowledge in Mathematics and Economics, and 26% have basic knowledge in Mathematics and Economics.Analysis from the study indicated that the medium of instructions, thus online learning accounted for 22%, offline 10%, and hybrid 68%. Interestingly, the Path Coefficient and T- statistics showed that the correlation between anxiety and confidence was not supported. The study outcome revealed that anxiety and confidence have a negative relationship and that anxiety negatively affects the students' confidence in learning econometrics. The researchers suggest that much effort should be put in place by school authorities and curriculum planners to help learners have much more interest in studying Econometrics. Students are also expected to put in much effort to learn very hard to succeed in the study of Econometrics.

INTRODUCTION

Econometrics as a course is perceived as a challenging course among university students, especially those with a weak background in mathematics and economics.Econometrics can be defined as the quantitative application of evidence-based statistical and mathematical models to establish theories or test current economic hypotheses and predict future patterns from historical data (Swamy *et al*., 2007). Assessing the issues and structure of an effective curriculum in econometrics learning at the undergraduate and postgraduate level yields anessential insight during which a blended education and mode of delivery in econometrics may better be provided in different conditions (Peters *et al*., 2020; Sowey, 2007). It subjects statistical experiments to real-world evidence and compares and contrasts the findings with the ideas being tested. There has not been much research in this field to find out why students find this course challenging.

There are so many factors that may account for the perceived difficulty of this course.In higher education, student attrition is a long-standing source of concern and has created a vast literature on education. Several studies explore the teaching and learning of graduate Econometrics by focusing on learner backgrounds and personality style, teacher position and gender, student expectations, math skills, absenteeism, etc.There can, however, be several other factors that have a profound influence on the teaching and learning of Econometrics as a course. Some of these factors include; the choice of textbook, the choice of teacher, the choice of class time, the major of students, the level of knowledge of mathematics by instructors, and a host of other characteristics of class and students that have not been discussed in previous studies. However, few studies have discussed the connection between the interest of students in econometrics and the achievement of students in economics (Greimel-Fuhrmann *et al*., 2016; Jüttler & Schumann, 2019; Kotte *et al*., 2005; Seeber & Remmele, 2008). Based on theoretical frameworks, these studies are focused on various education concepts in economics or Econometrics,

but not all of them are geared towards statutory lesson requirements. The findings of these studies do not yield credible conclusions about the impact of student interest in learning Economics as a course. Now let's ponder these critical issues; could it be that the Econometrics instructors who teach these students have not known how well to guide their students to understand this course in patience so that the total perception made by these Econometrics instructors is blunting? Or, how much difference do students' interest and self-motivation make to the learning of Econometrics?.Many families worldwide feel the severity of the Covid-19 pandemic and its accompanying short-term disruption: homeschooling is a massive shock to parent's productivity and children's social life and learning. Lessons are conducted online on an untested and unprecedented scale. Learner's assessments are also undertaken online, with many trials and errors and uncertainty for all individuals.Student interest in lessons in Econometrics can be defined in the daily Econometrics lessons at school as a relatively stable and lasting personal emotion comprising affective and behavioural reactions to events. Little research has compared the significance of various factors influencing students' interest in Econometrics lessons. The main objectives of this research are the use of a novel that previous researchers have not examined in their study on the student's interest in learning Econometrics; we discussed how variables such as confidence and motivation affect student interest in learning Econometrics'. Also, we investigated how COVID-19 impacted the medium of instruction during this pandemic in the various Universities in Jiangsu Province. It is also important to note that this is the first research to investigate student interest in Econometrics in the various Universities in Jiangsu Province and China. The contribution of the present study was to close this gap using a Structural Equation Model (SEM) to analyze from theory to practices of student's interest in learning Econometrics as a course.

LITERATURE REVIEW

The theoretical framework of the research: The term 'theory' can be defined as relationships providing consistency and comprehensive explanations of the actual phenomena. The attribution theory discusses individuals' various traits, like knowledge, confidence, anxiety, and individual motivation.

Attribution Theory: (Kelley 1973; Semin, 1980) defined attribution as the "process by which an individual interprets events as caused by a particular part of an environment." The Attribution theory addresses a fundamental problem of phenomenology: how we attach meaning to other's behaviour or our own (Graham, 2020; Malle, 2011). Attribution theory is categorized into two types: internal (personal) and situational (external). Personal (internal) attribution explains unique attributes like aptitude, knowledge, personality, emotion, efforts, attitudes, or disposition, whereas situational (external) attribution describes circumstantial aspects like the task of other people etc. These two categories of theories have quite different perspectives on the person who is engaging in a behavior:

- People try to determine causes of their behaviour and behaviours of others;
- Individuals systematically assign causal explanations for behaviour; and
- Attributions that individuals make have consequences for future behaviour or interactions.
- (Kelley 1973; Semin, 1980) focused on the cause of behaviour by considering three factors, i.e., consensus (how shared the behaviours are), consistency (how consistent behaviour is across similar contexts and times), and distinctiveness (individual displays different behaviour in different situations) of the behaviour.

The fundamental attribution error, e.g., self-serving bias, wherein individuals attribute their successes to dispositional factors during self-assessment. And also, their failures to situational factors and vice versa while assessing others, e.g., "I did well on the test because I am smart and he scored well because it was an easy test." Similarly, two-

locus of control are emphasized (a belief in the extent to which they can control events). Figure 1 indicates attribution theory. Individuals' attribution to certain activities influencestheir motivation, expectations, self-esteem, risk-taking behaviour, and even the actual outcome of their actions. Most students who cannot perform well attribute it to their environment or background.

Source ((Kelley 1973; Semin, 1980)

Figure 1. Attribution theory

Internal or external Control Locus: When investigating the attributions of an individual, one must first examine the impact that the individual has on the result examined. The locus of control of a person may be externally or internally affected (Rotter, 1966).

Stable and Unstable Outcome Triggers: The second causal aspect of internal or external locus of control examines the consistency of the cause of the outcome of individuals actions (Lefcourt, 1966; Rotter, 1966; Schmitt & Branscombe, 2002). (Rotter, 1966; Schmitt & Branscombe, 2002) explained that, over time, each contributing factor has consistent stability. The continuity of the relationship between the causal factor and the outcome of the behaviour is known as stability. The distinction between the two causal variables is that ability is considered to be controlled internally, while task complexity is considered to be controlled externally. Also, initiative and chance are considered more unpredictable, meaning that the strength of the interaction between the causal factor and actions varies depending on the actual behavior.

Behaviors Controllable or Uncontrollable: The third causal dimension is the individual's capacity to influence the behavioural outcome. A behaviour can be regulated or unregulated by the individual. If the behaviour is controllable, the person can affect the result of a task or behaviour. In contrast, the individual cannot influence the study or behaviour if the behaviour is uncontrollable. Table 1 indicates the attribution styles, their impact, and practical examples.The theory attributes internal and external behaviour based on Internal or External Locus of Control,Stable and Unstable Outcomes, and TriggersBehaviors Controllable or Uncontrollable. All these factors affect individual interest in a particular field of study. This study adopted this theory to analyze how studying behaviour affects their interest in studying Econometrics as a course.

Empirical Review on factors affecting students' interest in learning a course: The benefits of offering positive feedback to students, such as motivation, self-confidence, self-efficacy, and other psychological and academic abilities, generate a better environment for students' results (Ani, 2019; Kennette & Chapman, 2021). Student interest and their interaction with the teacher contribute to successful academic achievement (Sauer, 2012). (Legault *et al*., 2006; Mata *et al*., 2012; Musso *et al*., 2012) looked into how students' attitudes about mathematics may be used to explain various aspects, including the environment, motivation, and social support.Students' perceptions and chances of getting a job after studying Econometrics demonstrate that class level, course level, class size, instructors, and course experience influence student course ratings (Kifle & Alauddin, 2016). (Otoo *et al*., 2018) SEM estimates and analyzes the interactions between two motivational variables, one attitude factor and one academic engagement factor, on mathematics and science achievement in the United States. According to their findings, the two motivating variables, attitude and educational time, positively impact

mathematics and science achievement.(Ugwuanyi *et al*., 2020; Ugwuanyi & Okeke, 2020) adopted SEM to assess elements such as confidence and motivation that influence students' interest in Mathematics. The findings revealed that students' confidence significantly impacts their interest in mathematics learning and directly links confidence and motivation. A student's understanding of mathematics' utility implicitly boosts the learner's interest in mathematics.The variables listed above were thought to have a direct impact on pupils' interest in mathematics. As labour markets become more competitive, more demanding, specialized, and require professionals. The selection of courses and professional requirements for a future career is geared towards advanced theoretical knowledge and practical abilities (Mare *et al*., 2013). Understanding the methodological assumptions concerning SEM before analyzing data is vital in attaining more robust results (Memon *et al*., 2017). SEM applications in research have widely increased in psychology, sociology, education, and economics (Teo *et al*., 2013).

The impact of COVID-19 on Learning: The researchers innovatively analyzed the impact of COVID-19 on student academic performance. The coronavirus pandemic has made most countries closed their borders, and international students find it challenging to get back to the countries where their universities are located. This paper examined the medium of instruction during the pandemic and its impact on learning. The focus was on how online, offline, and hybrid forms of study impacted the students during the pandemic. (Scagnoli *et al*., 2019) their paper concluded that the COVID-19 pandemic taught us the importance of online training for postgraduate pediatric students. The level of satisfaction of students with online learning was comparable to the previous study. In addition to acquiring information, the study revealed the influence of online education on students' morale which causes a distraction from the current pandemic.(Lavy, 2015), also conducted a similar investigation on the impact of online learning differences in instructional periods across countries. It was discovered that there are significant disparities in teaching hours between countries, which will have a negative impact on instruction times. Through the lens of the current crisis and its effect on these specific areas, a variety of opinions on the impact of COVID-19 have been expressed regarding online learning, digital strategy, artificial intelligence, information management, social interaction, cybersecurity, big data, blockchain, privacy, mobile technology, and process (Dwivedi *et al*., 2020).

The proposed research framework and hypotheses

Based on the previous literary works reviewed, the researchers can conclude that Interest (IN), Confidence (CI), Motivation (MO), Anxiety (AN), and Usefulness (US) have a direct relationship with students learning. Practical evaluation of these variableswill invariably improve students' assessment and performance in learning Econometrics as a course. Figure 2 describes the framework of the hypothesis developed for this study.

H1: *Anxiety will be positively related to confidence in learning Econometrics as a course.*

H2: Anxiety *will be positively related to motivation in learning Econometrics as a course.*

H3*: Confidence will be positively related to students' interest in learning Econometrics as a course*

H4*: Confidence will be positively related to motivation in studying Econometrics as a course.*

H5: *Motivation will be positively related to interest in learning Econometrics as a course.*

H6*: Usefulness will be positively related to confidence in learning Econometrics as a course.*

H7: *Usefulness will be positively related to motivation in learning Econometrics as a course.*

METHODOLOGY

Participants: The population is made up of students from five universities in China's Jiangsu Province. The study's sample includes 300 students from Jiangsu Province's five selected universities.At least one of the Universities in the Province was chosen to ensure accuracy and generalizability. The respondents for the study were selected using simple random sampling by the researchers. In a simple random sample, all responders have the same chance of being chosen.

Instruments: A well-structured questionnaire of 400 was distributed to the students in various Universities in the Jiangsu Province to fill them. On the other hand, three hundred (300) students completed the questionnaire, then analyzed it. There were three parts to the study. The first section was primarily concerned with student demographic information. The second section consisted of a 5-point Likert Scale with 24 closed-ended questions organized into six parts, lettered A-E. The first Section A on students' Interest in Econometrics (IN1-IN6) and section B questions also analyzed students' Confidence in Econometrics (CI1-CI5). Section C centred on motivation that students have in studying Econometrics (MO1-MO5). Anxiety in studying Econometrics (AN1-AN4) consistedof the fourth Section (D). Lastly, usefulness in studying Econometrics (UN1-UN4) was also investigated with the questions from section E on the questionnaire.

Data Analysis Procedure: The researchers administered the questionnaire; hence there was no need to train any persons during this research. After a short interaction, questionnaires were distributed, and explanations were given regarding how respondents should answer individual items. This ensured that respondents fully understood the task required of them. The data collection process took place at Five Universities in the Jiangsu Province of China. The questionnaire was administered online and offline as the primary data collection method to explore students' interest in learning Econometrics as a course.This paperused Partial Least Square (Smart PLS 3.0) to analyze the data gathered for this study. Research conducted by (Joseph F. Hair *et al*., 2019) indicated that the Partial Least Square model is currently the most generally recognized and accepted new methodology for analysis. PLS-SEMcananalyze relationships between latent variables and measurable variables, the use of SEM is generally justified in social sciences. The definition of human intelligence cannot be calculated like one might calculate height or weight to provide a clear example. Instead, psychologists create an intelligence theory and write measuring methods with things (questions) constructed according to their hypothesis to assess intelligence. Using data obtained from people who took their intelligence exam, researchers would then use SEM to test their hypothesis. PLS is a multivariate technique for developing latent variable or factor models. These variables are determined to optimize the covariance between an independent variable (X) and the dependent variable (Y) scores. The principal reason for choosing PLS-SEM as an appropriate method for this study, according to (Cheng *et al*., 2020), is that it offers the best assessment, resulting in detailed studies. SEM may also be used to examine linear relationships between latent and manifest variables. Many studies have used Cronbach's alpha (CA) as a measurement technique for determining the consistency of various factors in a construct (Abrahim *et al*., 201; Cheng *et al*., 2020; Hussain *et al*., 2018).

RESULTS

Descriptive Analysis: Table 2 indicates the descriptive statistics of the selected sample of the survey. Two hundred and forty-seven (247) respondents were males, and fifty-three (53) were females. Most of the respondent age falls between 25-35 years indicating a youthful class of student studying in China with 68%. The study results also suggest that most respondents were overseas or international students, with 88% out of the population.

Table 1. Attribution styles

| ATTRIBUTION STYLE	IMPACT	EXAMPLE
Optimistic	Based on internal (often stable) attribution for positive outcomes. External (often unstable) for adverse outcomes	A student who attributes personal success to intelligence and failure to poor teaching
Pessimistic	Based on internal (often stable) attribution for adverse outcomes. External (often unstable) for favourable outcomes	A student who attributes the personal failure to their lack of ability and success to luck
Hostile	Based on external stable, stable attribution for a negative outcome	A student who displays aggression when confronted with academic problems. Likely to blame others and seek revenge
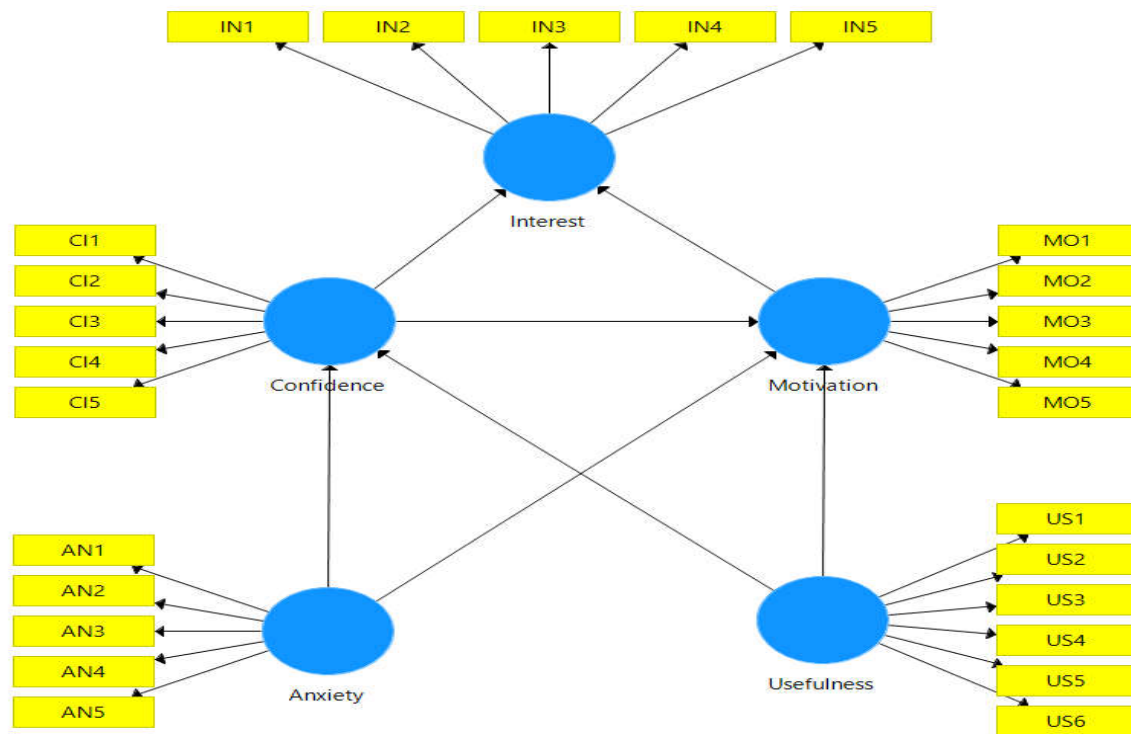
Fig 2. Proposed Conceptual Framework for the Hypothesis

		Frequency	Percentage
Gender	Male	246	82%
	Female	54	18%
Age Group	18 -24 years	23	8%
	25 -35 years	204	68%
	41 and above	73	24%
Overseas Student	Yes	265	88%
	No	35	12%
Educational Level	Bachelor	40	9%
	Master's Degree	86	33%
	PhD	174	58%
Program of Respondent	Management Science and Engineering	101	34%
	Economics and Finance	58	19%
	Master of Business Administration (MBA)	78	26%
	Agriculture Economics and Management	23	8%
	Others	40	13%
Respondent's University	Jiangsu University	98	33%
	The Nanjing University of Info. Sci. and Tech.	69	23%
	South East University	45	15%
	Nanjing Forestry University	40	13%
	Others	48	16%
Level of Knowledge in Mathematics and Economics	Basic	80	26%
	Intermediate	153	51%
	Advance	70	23%

Table 3. Analysis of COVID-19 Pandemic of Medium of Instruction

Medium of Instruction During COVID-19	Total Number n	Percentage %
Rate of Medium of Instruction		
Online Learning	66	22%
Offline	30	10%
Hybrid	204	68%
Impact of Using the following Medium of Instruction	300	100%
Online Learning	71	25%
Offline	51	17%
Hybrid	174	58%
Total Number	300	100
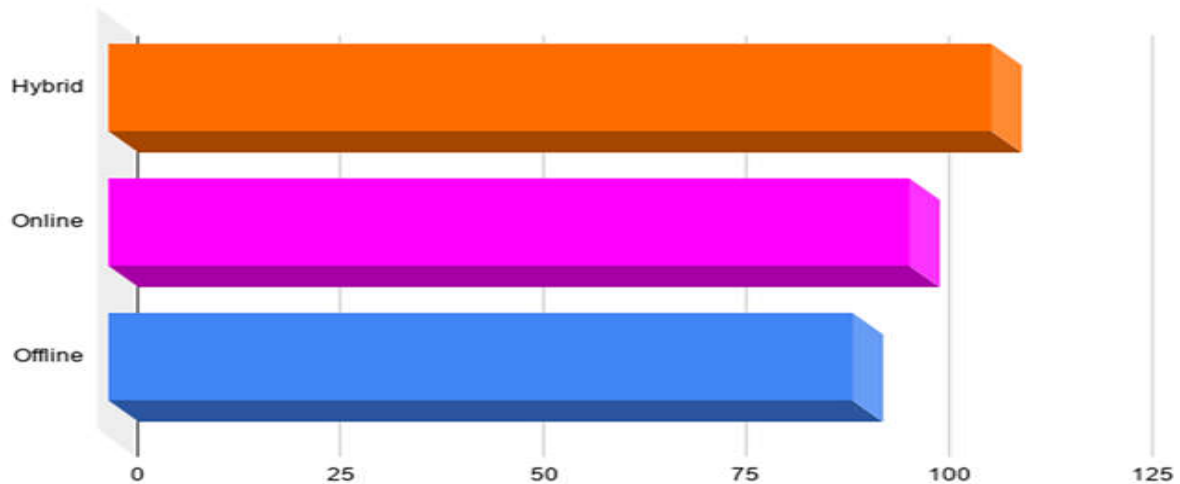
Figure 3. Mediums of instructions during the COVID-19 Pandemic

| Proxy	Items	Loadings	Cronbach's Alpha	Rho_A	Composite reliability(ρc)	Average variance extraction
	Interest		0.747	0.801	0.833	0.559
IN1	Econometrics is an interesting subject to me	0.877				
IN2	I prefer Econometrics to other subjects	0.679				
IN3	Too much thinking when learning Econometrics	0.632				
IN4	Use of Leisure time to study Econometrics	0.779				
	Confidence		0.762	0.785	0.839	0.567
CN1	I have confidence in purely numerical computation	0.672				
CN2	I can easily follow Econometrics lessons	0.814				
CN3	I am good at using Econometrics to solve problems	0.808				
CN4	I have confidence in problems that involve substituting numbers into formulas	0.710				
	Motivation		0.791	0.799	0.862	0.610
MO1	I often desire knowledge in Econometrics	0.811				
MO2	I would like to develop myself in learning Econometrics	0.769				
MO3	Learning Econometrics has developed my reasoning ability	0.769				
MO4	I do not feel comfortable during Econometrics lessons	0.774				
	Anxiety		0.802	0.812	0.868	0.622
AN1	I feel bored during Econometrics classes	0.793				
AN2	Econometrics is a difficult subject	0.843				
AN3	I do not want to meet Econometrics anymore in my further studies	0.797				
AN4	Language is a barrier to learning Econometrics	0.716				
	Usefulness		0.742	0.750	0.838	0.565
US1	Econometrics is not an important subject	0.661				
US2	I do not use Econometrics in everyday life	0.764				
US3	d. Econometrics knowledge is required to solve almost all problems	0.767				
US4	Econometrics knowledge is helpful to all students	0.808				
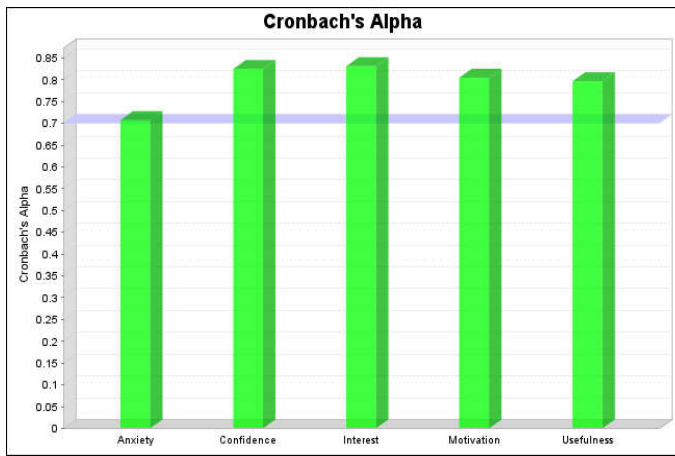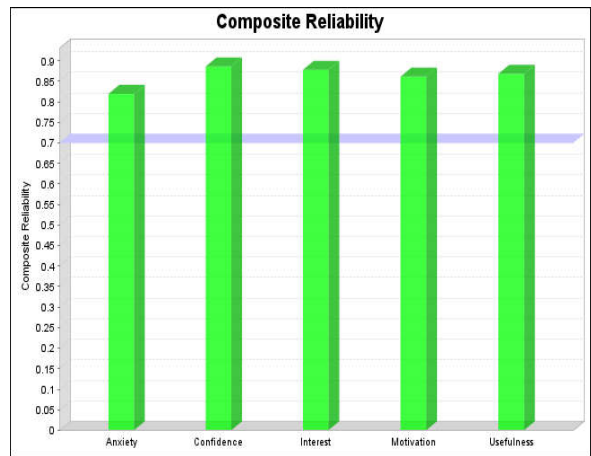
Fig. 4a. Conchbach's Alpha   Fig. 4b. Composite Reliability
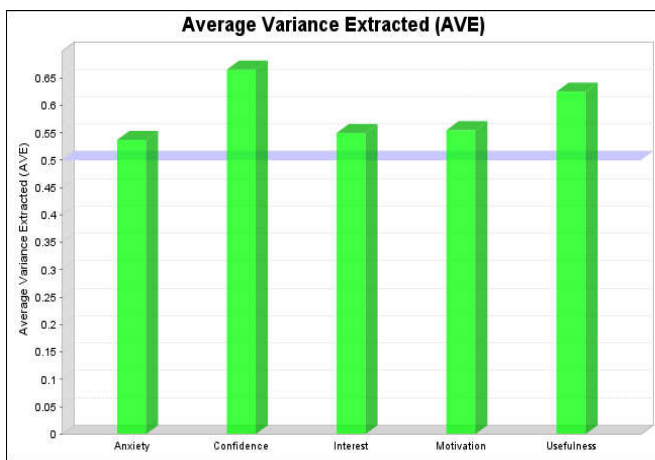
Fig. 5a. Average Variance Extracted (AVE)   Fig 5b. Rho_A
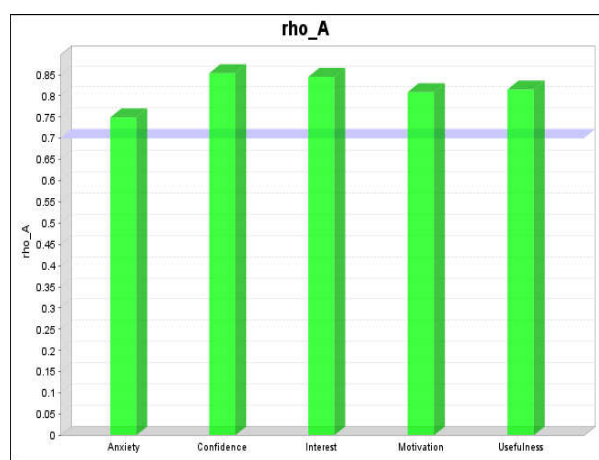
Figure 6. Graphical Representation of Path Co-efficient among the variables

Table 5. Discriminate validity (Fornell-Larcker Criterial)

Variables	Anxiety	Confidence	Interest	Motivation	Usefulness
Anxiety	0.733				
Confidence	0.230	0.816			
Interest	0.209	0.952	0.741		
Motivation	0.248	0.543	0.719	0.745	
Usefulness	0.204	0.736	0.708	0.451	0.791

Table 6. Correlation Coefficient of Latent Variables

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/S (stdevl)	P-Value
AN1 <- Anxiety	0.821	0.810	0.056	14.786	0.000
AN2 <- Anxiety	0.611	0.587	0.118	5.158	0.000
AN3 <- Anxiety	0.842	0.830	0.052	16.053	0.000
AN4 <- Anxiety	0.626	0.623	0.096	6.505	0.000
CI1 <- Confidence	0.602	0.596	0.052	11.670	0.000
CI2 <- Confidence	0.887	0.887	0.015	57.722	0.000
CI3 <- Confidence	0.885	0.885	0.015	59.889	0.000
CI4 <- Confidence	0.854	0.853	0.017	50.193	0.000
IN1 <- Interest	0.599	0.594	0.050	11.954	0.000
IN2 <- Interest	0.858	0.858	0.018	47.562	0.000
IN3 <- Interest	0.857	0.856	0.018	48.336	0.000
IN4 <- Interest	0.808	0.807	0.021	39.354	0.000
IN5 <- Interest	0.644	0.648	0.040	16.136	0.000
IN6 <- Interest	0.632	0.632	0.051	12.305	0.000
MO1 <- Motivation	0.690	0.696	0.033	20.887	0.000
MO2 <- Motivation	0.785	0.785	0.026	30.518	0.000
MO3 <- Motivation	0.749	0.744	0.039	19.263	0.000
MO4 <- Motivation	0.785	0.779	0.034	23.202	0.000
MO5 <- Motivation	0.708	0.705	0.038	18.499	0.000
US1 <- Usefulness	0.825	0.823	0.026	31.768	0.000
US2 <- Usefulness	0.881	0.879	0.016	55.608	0.000
US3 <- Usefulness	0.789	0.789	0.028	28.448	0.000
US4 <- Usefulness	0.650	0.653	0.048	13.458	0.000

Table 7. Regression weights for the conceptualized path model

Variables	Anxiety	Confidence	Interest	Motivation	Usefulness
Anxiety	1.000	0.230	0.209	0.248	0.204
Confidence	0.230	1.000	0.952	0.543	0.736
Interest	0.209	0.952	1.000	0.719	0.708
Motivation	0.248	0.543	0.719	1.000	0.451
Usefulness	0.204	0.736	0.708	0.451	1.000

Interest (IN), Confidence (CI), Motivation (MO), Anxiety (AN) and Usefulness (US); *p-value<0.05; ** p-value<0.01; ***p-value<0.001.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Decision
Anxiety -> Confidence	-0.020	-0.019	0.061	0.325	0.745	Not Supported
Anxiety -> Motivation	0.224	0.239	0.069	3.236	0.001	Supported
Confidence -> Interest	0.244	0.245	0.060	4.101	0.000	Supported
Confidence -> Motivation	-0.267	-0.266	0.085	3.147	0.002	Supported
Motivation -> Interest	0.208	0.221	0.067	3.089	0.002	Supported
Usefulness -> Confidence	0.752	0.755	0.052	14.362	0.000	Supported
Usefulness -> Motivation	0.278	0.277	0.099	2.816	0.005	Supported

Path coefficient bootstrapping. T Statistic > 1.96 for 5%; p< .005

Table 9. Summary of hypothesis Testing results

Hypothesis	Hypothesis Contents	Decision
H1	Anxiety will be positively related to confidence in learning Econometrics as a course.	Not Supported
H2	Anxiety will be positively related to motivation in learning Econometrics as a course.	Supported
H3	Confidence will be positively related to students' interest in learning Econometrics as a course	Supported
H4	Confidence will be positively related to motivation in studying Econometrics as a course.	Supported
H5	Motivation will be positively related to interest in learning Econometrics as a course.	Supported
H6	Usefulness will be positively related to confidence in learning Econometrics as a course.	Supported
H7	Usefulness will be positively related to motivation in learning Econometrics as a course.	Supported

The educational level of the majority of the respondent shows 58% of the reading PhD, 33% Master degree students, and 9% who are also undergraduate students. Interesting the study results shows that most of the respondent (34%) are reading Management Science and Engineering from the Various University that the research was conducted. Also,19% of the sample read Economics and Finance, and 8% read Administration (MBA). The survey revealed that most respondents (33%) studyat Jiangsu University while 23% also study at Nanjing University of Information Science and Technology. Students who responded to the survey from Nanjing Forestry University were 13%, and Otheruniversities within the Jiangsu Province were 14%. This research focuses on examining from theory to practice students' interest in the study of Econometrics as a course.

There is the need to find background information about the respondents concerning the level of knowledge in Mathematics and Econometrics. Results from the survey show that most of the students who respondents (51%) areatan intermediate level in studying Mathematics and economics. Few of the respondents (23%) have advance knowledge in Mathematics and Economics, and 26% have basic knowledge in Mathematics and Economics.

Measurement of Medium of Instruction amidst COVID19 pandemic

Hybrid, Online, and offline medium of studies: This study analyzed the effectiveness of the mediums of instructions used during

the COVID-19 pandemic intensive period to determine which medium is most commonly used for lesson delivery and its efficacy.

The analysis was performed using a 5-point Likert Scale from very dissatisfied to very satisfied. The study categorized the mediums into online, offline, and hybrid. This analysis was performed to determinewhether the usage rate or impact would further motivate or discourage students from learning econometrics. From Table 3, the study found that the most adopted source of lesson delivery is hybrid, where online and offline are blended. The rate of the medium of instructions used indicated that online learning accounted for 22%, offline 10%, and hybrid accounted for 68%. This suggests that as more lessons are delivered in hybrid form, the usage rate might not negatively affect and worsen their interest in studying. Analysis of the impact also indicated that online learning had 25%, offline 17%, and hybrid had 58%. This suggests that as the medium of instruction shifts online, most students might be impacted negatively. Most studies prove that practical lessons for the related mathematical lesson are best-understood face to face. However, this study found that although there is an increase in online studies, the hybrid form of delivery outweighs the other two forms that would help students maintain their interest. Figure 3 represents a graphical representation of the mediums of instructions during the COVID-19 pandemic. The figure demonstrates that a more significant portion of lessons is delivered in hybrid form. This suggests that the student's interest and confidence would not worsen as face-to-face lessons blended with online may boost their interest but not worsen their interest and motivation to learn.

Assessment of Measurement Model: (Joerg-Henseler, Christian M. Ringle, 2009) noted that PLS included a two-stage procedure involving evaluating the external model and assessing the internal structural model. Furthermore, PLS-SEM is known and chosen as a methodology best suited for multivariate analysis in social science studies. Coherence assessments are based on observed individual reliability tests and concurrent validity and discriminatory validity evaluations. When conducting a PLS study, it is essential to analyze the construct's validity and reliability. Internal quality in construction reliability was examined using Cronbach's Alpha (CA) and Composite Reliability (CR). Table 4 (Fig 4a and 4b) shows the CA and CR for the study. The construct's reliability and validity include interest in studying Econometrics 0.833, Confidence 0.839, motivation (0.862), Anxiety (0.868), and Usefulness (0.836) in studying Econometrics as a course 0.805. Each latent structure of the Average Extracted Variance (AVE) must be determined to verify the factors' internal consistency (Fornell & Larcker, 1981). AVE should be greater than 0.5 for all constructs. Table 4 (Fig 5a and 5b) shows that all AVE and Rho_Avalues were more significant than 0.5, indicating that the model was correct for convergence.This study proved that the measurement model has converged and has strong internal reliability. Figure 6 demonstrates the graphical representation of path co-efficient among the variables. According to (Joe F Hair *et al.*, 2012), discriminant validity means that any construct's manifest variable is different. In the latent variable, that structure's cross-load value is better than any other construct. The Fornell and Larcker criterion, as well as cross loads, were employed to assess discriminant validity.The proposed standard is that a framework should not be more than its value of AVE in the same variance as any other structure. Table 5 shows the criterion test for Fornell and Larcker in the model, which compared squared correlations to other latent constructs.The measurement items reveal that the latent variable in every structure in the model was discriminant valid.

Correlation Coefficient of Latent Variables: The latent variable correlation coefficient is shown in Table 6. The latent exogenous constructs and the latent endogenous construct have a significant association, as seen in Table 6. All of the hypotheses were statistically significant, and as a result, all of them were accepted. The findings of this study support a complete and more accurate picture of students' interest in Econometrics, both theoretically and practically.

Regression weights for the conceptualized path model: Table 7 displays the hypothesized model's direct and indirect influences (direct and indirect) factors. SEM is preferable to conventional regression and correlation analysis because it may determine indirect latent effects among variables.Table 7 shows the effects (regression weights) and their statistical significance.Results from the survey indicate that all the variable's selected studies were statically significant with a p-value of 0.05 at the 95% level. The implication is that Interest (IN), Confidence (CI), Motivation (MO), Anxiety (AN), and Usefulness (US) have a direct relationship with students learning Econometrics as a course.

Hypothesis Testing and Modelling

H1: Anxiety will be positively related to confidence in learning Econometrics as a course.
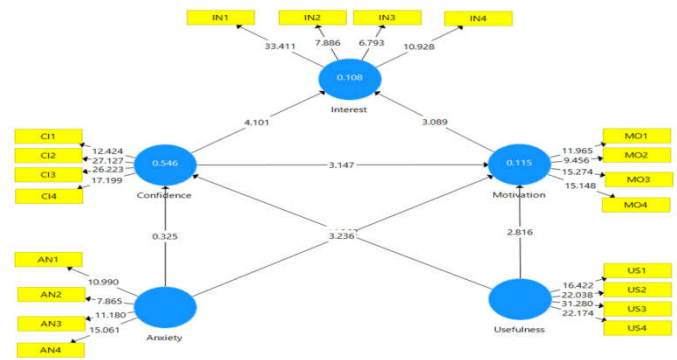

Figure 7. Bootstrapping association among the variables

Table 8 (Fig. 7) shows that the correlation between Anxiety and Confidence was not supported. It had an initial sample (β) = -0.020, statistics (t) = 0.325. However, an insignificant p-value of 0.745 (p-value greater than 0.05 shows that Anxiety and Confidence have a negative relationship and that anxiety affects the students' confidence).Hypothesis 1 did not support that anxiety and confidence are positively related to students' interest in studying Econometrics as a course.

H2: Anxiety will be positively related to motivation in learning Econometrics as a course.

The relation between Anxiety and Motivation is proven to be significant and supported. It had an initial sample (β) = 0.224, statistics (t) = (3.236), and a significant p-value 0.001, indicating that the Anxiety has a positive relationship with Motivation (p-value 0.05).Hypothesis 2 supported that anxiety will be positively related to motivation in studying Econometrics as a course.

H3: Confidence will be positively related to students' interest in learning Econometrics as a course

The relationship between the Confidence and Interest were supported and significant with an initial sample (β) = 0.244, statistics (t) = 4.101, and p-value of 0.000. This suggests a good relationship between Confidence and Interest in learning Econometrics as a course. Hypothesis 3 supported that confidence will be positively related to students' interestin studying Econometrics as a course.

H4: Confidence will be positively related to motivation in studying Econometrics as a course.

The relation between Confidence and Motivation was proven to be highly significant. It had an initial sample (β) = -0.267, statistics (t) = 3.147, and a positive p-value 0.002 (p-value 0.05 shows that Confidence has a positive relationship with Motivation). Hypothesis 3 supported that confidence will be positively related to motivation in studying Econometrics as a course.

H5: Motivation will be positively related to interest in learning Econometrics as a course.

The correlation between Motivation and Interest was found to be significant and supported. It had an initial sample (β) = 0.208, statistics (t) = 3.089, and a significant p-value of 0.002 (p-value < 0.05 indicates that Motivation and Interest have a positive relationship and the effect of motivation does not affect the interest of the students).Hypothesis 5 supported thatmotivation is positively related to student interest in learning Econometrics as a course.

H6: Usefulness will be positively related to confidence in learning Econometrics as a course.

The association between Usefulness and Confidence was confirmed in this study to be positively significant. It had an initial sample (β)) = 0.752, statistics (t) = 14.362, and a significant p-value of 0.000 (p-value 0.05 shows that the Usefulness and Confidence have a positive relationship and that Usefulness affect Confidence). Hypothesis 6 supported that usefulness is positively related to student confidence in learning Econometrics as a course.

H7. Usefulness will be positively related to motivation in learning Econometrics as a course.

The correlation between Usefulness and Motivation was realized to be significant. It had an initial sample (β) = 0.278, statistics (t) = 2.816, and asignificant p-value of 0.005(p-value less than 0.05 shows that Usefulness and Motivation have a positive relationship and that Usefulness affect students' Motivation). Hypothesis 7 supported that usefulness is positively related to motivation in learning Econometrics as a course.Figure 7 shows the bootstrapping association betweenvariables

DISCUSSION

This study aimed to examine from theory to practice of promoting student interest in Econometrics as a course. The authors looked at how learners' confidence and motivation influenced their interest in exploring econometrics. The Structural Equation Model (SEM) and Partial Least Squares (PLS) were utilized to analyze the impacts of anxiety, usefulness, confidence, and motivation on learners' interest in Econometrics as a course. Results from the survey indicated that two hundred and forty-seven (247) of the respondents were males, and fifty-three (53) were females. It was observed that most of the respondent age fall between 25-35 years, indicating a youthful class of students studying in China with 68% from the survey. The study results also suggest that most respondents were overseas or international students, with 88% out of the population. The majority of the respondents' educational level shows that 58% of the respondents are reading Ph.D., 33% Master degree students, and 9% are also undergraduate students. The researchers tried to find out the program of study of the respondents. This idea is emphasized because Econometrics is seen as a subject mainly studied by business students.Interestingly, the survey results show that most of the respondents (34%) are reading Management Science and Engineering from the various universities that the research was conducted.

The results show that the background information about the respondents concerning the level of knowledge in Mathematics and Econometrics are thecritical determinants of their interest in studying Econometrics as a course. Further results also show that most of the students who responded (51%) have a fair idea or intermediate level of mathematics and economics knowledge. Few of the respondents (23%) have advance knowledge in Mathematics and Economics, and 26% have basic knowledge in Mathematics and Economics. The discriminant validity test shows that any construct's manifest variablediffers(Joe F Hair *et al.*, 2012). The research outcome indicated that the criterion test for Fornell and Larcker in the model, which compared squared correlations to other latent constructs, is valid. This showed that the measurement items reveal the latent variable confirmed in every discriminant valid model structure. The

correlation coefficient of the latent variables suggests that the latent exogenous constructs and the latent endogenous construct have a close linkage. In this research, the factor loading assessment results revealed that students strongly agree that "Econometrics is an interesting subject," with the loading of (0.877) being the highest from all the other item construct. Also, most students have confidence in learning Econometrics as a course because they agreed that "I can easily follow Econometrics lessons" with a factor loading of (0.814). The researchers found out from the study's outcome that most students disagreed (0.672) with the statement,"I have confidence in purely numerical computation."

This indicates that most students are not interested in Econometrics because of their weak mathematics and economics backgrounds. A study by (Stephan *et al.*, 2021) concluded that only a few abstract thinkers regard Mathematics, coding, and statistics as "doable," whereas our society's mass considers them inaccessible. The Path Coefficient and t- statistics show that the correlation between Anxiety and Confidence was not supported. It shows that Anxiety and Confidence have a negative relationship and that anxiety negatively affects the students' confidence in learning econometrics (Brady & Bowd, 2005; Núñez-Peña *et al.*, 2013). The correlation between Motivation and Anxiety is proven to be significant and supported. It demonstrates that anxiety has a positive relationship with Motivation (Assor *et al.*, 2005; Gottfried, 1985; Su, 2016). The relationship between Confidence and Interest has a positive correlation. This suggests that a good connection between the Confidence and Interest of students leads to an increased desire to study econometrics (Chang & Chang, 2008). Also, the relation between Confidence and Motivation was proven to be highly significant. It demonstrates that confidence positively correlates with motivation, increasing students' desire to opt for Econometric as a course. This result is supported by research conducted by(LaForce *et al.*, 2017). The correlation between Motivation and Interest was found to be significant and supported. It indicates that Motivation and Interest have a positive association, and the effect of motivation positively affects the students' interestin studying econometrics, which is supported by the study of (Weber, 2003).

The association between Usefulness and Confidence was confirmed to be positively significant in this study. It portrays that Usefulness and Confidence positively connect and affect the students'confidence to study econometrics and is consistent with their research(Biagi & Loi, 2013). The correlation between Usefulness and Motivation was realized to be significant. Results show that Usefulness and Motivation have a negative relationship and that usefulness affects students' motivation to study econometrics.(Biagi & Loi, 2013; Zafra-Gómez *et al.*, 2015)they have also confirmed these results in their research. The study's findings reveal that based on the investigation conducted concerning the rate and impact of the delivery medium of instructions ascribed as Online, Offline, and Hybrid. The rate of the medium of instructions indicated that online learning accounted for 22%, offline 10%, and hybrid accounted for 68%. Also, the rate usage noted that online learning had 25%, offline 17%, and hybrid had 58%. This suggests that gradually most education is shifting to online and most students might be impacted negatively.

CONCLUSION

The primary contribution of this research is founded on attribution theory, where individuals'decisions and activities influence their motivation, expectations, self-esteem, risk-taking behaviour, and even the actual outcome of their actions.This study analyzedfrom theory to practice of promoting student interest in Econometrics; application of structural equation model.In this study, student Interest (IN) in Econometrics as a course was hypothesized to be influenced by variables such as Confidence (CO), Motivation (MO), Anxiety (AN), and Usefulness (US). The study administered questionnaires to gather primary data from students within the Jiangsu Province of China. The report results revealed from the survey show that most of the students who respondents (51%) intermediate level of their knowledge in Mathematics and Economics as a course. Few of the respondents

(23%) have advance knowledge in Mathematics and Economics, and 26% have basic knowledge in Mathematics and Economics. This paper used the Partial Least Squares and Structural Equation Modelling (PLS-SEM) for analysis. We premised this study on seven hypotheses (7) to give more credence to the results obtained. The empirical evidence from the survey supported six (6) hypotheses with positive and significant effects, and only one of the hypotheses estimated was not supported. The internal quality evaluation, which included the Construct reliability, Cronbach's alpha, and Composite Reliability, was also acceptable. The measurement model converged and has strong internal reliability, according to this analysis. The researchers can conclude from this study that anxiety is not positively associated with confidence in studying Econometrics as a course. Also, anxiety has a positive relationship with motivation in studying Econometrics. Our research revealed that students' confidence significantly affects their desire to learn an Econometrics course. Furthermore, there is a link between confidence and motivation in the study of Econometrics. Other key findings from the study revealed that student confidences are positively related to their motivation in studying Econometrics. Students' knowledge of the usefulness of Econometrics is affected directly by their confidence in learning this course. In the same vein, the usefulness of learning Econometrics is positively associated with their motivation in this subject. This study also found that although there is an increase in online lessons, the hybrid form of delivery outweighs the other two forms that would help students maintain their interest.

Policy Implementation: The goal of teaching Econometrics should be to help students comprehend and recognize the value of taking such a course. Econometrics lecturers should therefore introduce students to Econometrics' real-life applications to increase their motivation and self-confidence in learning the subject as a school course. The researchers suggest that much effort should be put in place by school authorities and curriculum planners to help learners have much more interest in studying Econometrics. Students are also expected to put in much effort to learn very hard to succeed in the study of Econometrics.

Declarations

Funding: This study received no external funding.

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.

Data Availability: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Compliance with ethical standards

Ethical compliance and standards: The study and its protocols were approved by the university's Human Research and Ethics Committee.
Code Availability: Not Applicable.

Author's contribution: Conceptualization, Acquisition of Data: Agyemang Kwasi Sampene; Methodology, Software, Writing-review: Fredrick Oteng Agyeman.

Consent Participate: The consent of the participants was sort before the survey was conducted.

Consent for Publication: All the author's consent to the publication of this manuscript

REFERENCES

Abrahim, S., Mir, B. A., Suhara, H., Mohamed, F. A., & Sato, M. 2019. Structural equation modeling and confirmatory factor analysis of social media use and education. *International Journal of Educational Technology in Higher Education*, *16*(1). https://doi.org/10.1186/s41239-019-0157-y

Ani, A. 2019. Positive Feedback improves students psychologiscal and physical learning Outcome. *Indonesian Journal of Educational Studies (Ijes)*, *22*(2), 144–152.

Assor, A., Kaplan, H., Kanat-Maymon, Y., & Roth, G. 2005. Directly controlling teacher behaviors as predictors of poor motivation and engagement in girls and boys: The role of anger and anxiety. *Learning and Instruction*, *15*(5), 397–413.

Biagi, F., & Loi, M. 2013. Measuring ICT use and learning outcomes: Evidence from recent econometric studies. *European Journal of Education*, *48*(1), 28–42.

Brady, P., & Bowd, A. 2005. Mathematics anxiety, prior experience and confidence to teach mathematics among pre-service education students. *Teachers and Teaching*, *11*(1), 37–46.

Chang, C., & Cheng, W. 2008. Science Achievement and Students' Self-confidence and Interest in Science: A Taiwanese representative sample study. *International Journal of Science Education*, *30*(9), 1183–1200.

Cheng, L., Nsiah, T. K., Charles, O., & Ayisi, A. L. 2020. Credit risk, operational risk, liquidity risk on profitability. A study on South Africa commercial Banks. A PLS-SEM Analysis. *Revista Argentina de Clínica Psicológica*, *XXIX*, 5–18. https://doi.org/10.24205/03276716.2020.1002

Dwivedi, Y. K., Hughes, D. L., Coombs, C., Constantiou, I., Duan, Y., Edwards, J. S., Gupta, B., Lal, B., Misra, S., Prashant, P., Raman, R., Rana, N. P., Sharma, S. K., & Upadhyay, N. 2020. Impact of COVID-19 pandemic on information management research and practice: Transforming education, work and life. *International Journal of Information Management*, *55*(July), 102211. https://doi.org/10.1016/j.ijinfomgt.2020.102211

Fornell, C., & Larcker, D. F. 1981. Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*, *18*(3), 382. https://doi.org/10.2307/3150980

Gottfried, A. E. 1985. Academic intrinsic motivation in elementary and junior high school students. *Journal of Educational Psychology*, *77*(6), 631.

Graham, S. 2020. An attributional theory of motivation. *Contemporary Educational Psychology*, *61*, 101861.

Greimel-Fuhrmann, B., Silgoner, M., Weber, R., & Taborsky, M. (2016). Financial literacy in Austria. In *International Handbook of Financial Literacy* (pp. 251–262). Springer.

Hair, Joe F, Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, *40*(3), 414–433. https://doi.org/10.1007/s11747-011-0261-6

Hair, Joseph F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hussain, S., Fangwei, Z., Siddiqi, A. F., Ali, Z., & Shabbir, M. S. 2018. Structural Equation Model for evaluating factors affecting quality of social infrastructure projects. *Sustainability (Switzerland)*, *10*(5), 1–25. https://doi.org/10.3390/su10051415

Joerg-Henseler, Christian M. Ringle, M. S. 2009. *Using Partial Least Squares Path Modeling in International Advertising Research: Basic Concepts and Recent Issues*.

Jüttler, M., & Schumann, S. 2019. Is economics a man's business? Exploring the long-term effects of the gender gap in economic competencies at the upper secondary level on students' choice to study economics at university. *Citizenship, Social and Economics Education*, *18*(3), 177–197.

Kelley, H. H. 1973. The processes of causal attribution. *American Psychologist*, *28*(2), 107.

Kennette, L., & Chapman, M. 2021. Providing positive student feedback in an online environment. *Academia Letters*, *January*, 1–3. https://doi.org/10.20935/al203

Kifle, T., & Alauddin, M. 2016. What determines students' perceptions in course evaluation rating in higher education? An

econometric exploration. *Economic Analysis and Policy*, *52*, 123–130. https://doi.org/10.1016/j.eap.2016.09.004

Kotte, D., Lietz, P., & Lopez, M. M. 2005. Factors Influencing Reading Achievement in Germany and Spain: Evidence from PISA 2000. *International Education Journal*, *6*(1), 113–124.

LaForce, M., Noble, E., & Blackwell, C. 2017. Problem-based learning (PBL) and student interest in STEM careers: The roles of motivation and ability beliefs. *Education Sciences*, *7*(4), 92.

Lavy, V. 2015. Do differences in schools' instruction time explain international achievement gaps? Evidence from developed and developing countries. *The Economic Journal*, *125*(588), F397–F424.

Lefcourt, H. M. 1966. Internal versus external control of reinforcement: a review. *Psychological Bulletin*, *65*(4), 206.

Legault, L., Green-Demers, I., & Pelletier, L. 2006. Why do high school students lack motivation in the classroom? Toward an understanding of academic amotivation and the role of social support. *Journal of Educational Psychology*, *98*(3), 567.

Malle, B. F. 2011. Attribution theories: How people make sense of behavior. *Theories in Social Psychology*, *23*, 72–95.

Mare, C., Popa, I., Dinu, V., & Dragos, C. 2013. Econometric modelling of the perceptions students have regarding the probability of finding a job in the field of the master's programme. *New Educational Review*, *32*(2), 35–48.

Mata, M. de L., Monteiro, V., & Peixoto, F. 2012. Attitudes towards mathematics: Effects of individual, motivational, and social support factors. *Child Development Research*, *2012*.

Memon, M. A., Ting, H., Ramayah, T., Chuah, F., & Cheah, J.-H. (2017). a Review of the Methodological Misconceptions and Guidelines Related To the Application of Structural Equation Modeling: a Malaysian Scenario. *Journal of Applied Structural Equation Modeling*, *1*(August), i–xiii. https://doi.org/10.47263/jasem.1(1)01

Musso, M., Kyndt, E., Cascallar, E., & Dochy, F. 2012. Predicting mathematical performance: The effect of cognitive processes and self-regulation factors. *Education Research International*, *2012*.

Núñez-Peña, M. I., Suárez-Pellicioni, M., & Bono, R. 2013. Effects of math anxiety on student success in higher education. *International Journal of Educational Research*, *58*, 36–43.

Otoo, D., Iddrisu, W. A., Kessie, J. A., & Larbi, E. 2018. Structural model of students' interest and self-motivation to learning mathematics. *Education Research International*, *2018*.

Peters, M. A., Rizvi, F., McCulloch, G., Gibbs, P., Gorur, R., Hong, M., Hwang, Y., Zipin, L., Brennan, M., Robertson, S., Quay, J., Malbon, J., Taglietti, D., Barnett, R., Chengbing, W., McLaren, P., Apple, R., Papastephanou, M., Burbules, N., … Misiaszek, L. (2020). Reimagining the new pedagogical possibilities for universities post-Covid-19. *Educational Philosophy and Theory*, 1–44. https://doi.org/10.1080/00131857.2020.1777655

Rotter, J. B. 1966. Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, *80*(1), 1.

Sauer, K. 2012. *The impact of student interest and instructor effectiveness on student performance.*

Scagnoli, N. I., Choo, J., & Tian, J. 2019. Students' insights on the use of video lectures in online classes. *British Journal of Educational Technology*, *50*(1), 399–414.

Schmitt, M. T., & Branscombe, N. R. 2002. The internal and external causal loci of attributions to prejudice. *Personality and Social Psychology Bulletin*, *28*(5), 620–628.

Seeber, G., & Remmele, B. 2008. *Does Economic Competence Indicate the Individual Level of Agreement with Market Economy?* WHL.

Semin, G. R. 1980 A gloss on attribution theory. *British Journal of Social and Clinical Psychology*, *19*(4), 291–300.

Sowey, E. R. 2007. University teaching of econometrics a personal view. *Econometric Reviews*, *2*(2), 255–289. https://doi.org/10.1080/07311768308800046

Stephan, M., Register, J., Reinke, L., Robinson, C., Pugalenthi, P., & Pugalee, D. 2021. People use math as a weapon : critical mathematics consciousness in the time of COVID-19. *Springer Nature*. https://doi.org/https://doi.org/10.1007/s10649-021-10062-z

Su, C.-H. 2016. The effects of students' motivation, cognitive load and learning anxiety in gamification software engineering education: a structural equation modeling study. *Multimedia Tools and Applications*, *75*(16), 10013–10036.

Swamy, P. A. V. B., Conway, R. K., & Von Zur Muehlen, P. 2007. The foundations of econometrics –are there any. *Econometric Reviews*, *4*(1), 75–80. https://doi.org/10.1080/07474938508800074

Teo, T., Tsai, L. T., & Yang, C.-C. 2013. Applying Structural Equation Modeling (SEM) in Educational Research. *Application of Structural Equation Modeling in Educational Research and Practice*, 3–21. https://doi.org/10.1007/978-94-6209-332-4_1

Ugwuanyi, C. S., & Okeke, C. I. O. 2020. Determinants of university students' interest in science, technology, engineering and mathematics education in nigeria: a case of a structural equation modeling. *International Journal of Mechanical and Production Engineering Research and Development, 10 (3): 6209–6218. Http://Dx. Doi. Org/10.24247/Ijmperdjun2020590.*

Ugwuanyi, C. S., Okeke, C. I. O., & Asomugha, C. G. 2020. Prediction of Learners' Mathematics Performance by Their Emotional Intelligence, Self-Esteem and Self-Efficacy. *Cypriot Journal of Educational Sciences*, *15*(3), 492–501.

Weber, K. 2003. The relationship of interest to internal and external motivation. *Communication Research Reports*, *20*(4), 376–383.

Zafra-Gómez, J. L., Román-Martínez, I., & Gómez-Miranda, M. E. 2015. Measuring the impact of inquiry-based learning on outcomes and student satisfaction. *Assessment & Evaluation in Higher Education*, *40*(8), 1050–1069.

****