

Students' attitudes toward Mathematics: The case of Greek students

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Abstract

The aim of present research paper is to evaluate Greek Students' attitudes towards mathematics through multidimensional statistical analysis. A sample of 168 Greek students participated in the study. The study used an instrument named ATMI (Students' attitudes towards learning Big Data, analytics and AI algorithms) that is a five-point Likert scale. The scale consisted of four conceptual constructs named Self-Confidence, Value, Enjoyment, Motivation. Greek Students' attitudes toward Mathematics were evaluated by another item that rate from 1 to 100 scaling the total score. The results demonstrated that students' perceptions Self-Confidence, Value, and Enjoyment motivate their willing for learning and appreciating mathematics.

Keywords: Attitudes, Mathematics, Self-Confidence, Value, Enjoyment, Motivation

1.Introduction

Students often deal with many difficulties and obstacle regarding learning mathematics (Jeong, & González-Gómez, 2021). These difficulties may have their basis on cognitive obstacles as well as negative attitudes toward the subject. Attitudes toward mathematics play an important role in understanding and learning mathematics (Atan, & Kasmin, 2018; Anastasiadou, Elia, Gagatsis, 2007; Petridis et al., 2017; Nicolaou, et al., 2017). Self-confidence and Value and Importance of Mathematics, Math anxiety as well as well gender influence achievement in mathematics (Awaludin et al., 2015; Manalaysay, 2019; Wahid et al., 2014).

Brezavšek, et al. (2020) indicated a strong negative effect of mathematics confidence on seeming degree of math anxiety. Furthermore, the perceived level of math anxiety has a strong negative influence on mathematics achievement.

According to Hagan et al., (2020) many students indicated a negative perception towards Mathematics. In their research they showed a negative perception by indicating a low interest in the study of Mathematics.

Mathematics play an important role in science. Together science, technology, engineering and mathematics define STEM, that has been widely studied (Fernández-César et al. 2020). In addition, the teaching of mathematics generally applies in many areas such as Big Data applications, Cloud structures (Souravlas & Katsavounis, 2019; Souravlas, 2019), algorithms for stream processing (Souravlas, Anastasiadou & Katsavounis 2021; Souravlas & Anastasiadou, 2020; Tantaraki et al., 2020a, Tantalaki, et al., 2020b, Souravlas, Katsavounis, Anastasiadou. 2020; Tantalaki, et al., 2019) and many other applications (Tantalaki, Souravlas, & Roumeliotis, 2019; Souravlas & Roumeliotis, 2015a; Souravlas & Roumeliotis, 2015b; Souravlas & Roumeliotis, 2014a; Souravlas & Roumeliotis, 2014b; Margaritis et al., 2007).

Vice versa several big data applications refers to understanding the numerous mathematical algorithmic applications that affect all aspects of our everyday life, education (Florou et al., 2021; Valsamidis et al., 2021) and so on.

This the present study tries to capture Greek students' attitudes towards mathematics related to Self-Confidence, Value, Enjoyment, Motivation conceptual constructs of ATMI Scale.

2. Purpose of the study-Research Hypotheses

The objective of current study is to evaluate Greek Students' attitudes towards mathematics through multidimensional statistical analysis. In addition, the present paper examines the following research hypotheses.

Ho1: Self-Confidence has a strong effect on General attitude towards mathematics

Ho2: Value has a strong effect on General attitude towards mathematics

Ho3: Enjoyment has a strong effect on General attitude towards mathematics

Ho4: Motivation has a strong effect on General attitude towards mathematics

Ho5: Gender influences General attitude towards mathematics

3. The instrument

The study used a 5-point response scale, higher scores then correspond to more positive attitudes, whereas 1 corresponding to strongly disagree to 5 strongly agree. The scale named ATMI (Students' attitudes toward Mathematics) consists of 40 items grouped into four conceptual constructs (Tapia, 1996; Tapia, & Marsh, 2002;2004) (Table 1).

The four components/ conceptual structures were named 1. Self-Confidence (e.g. Sel_Con1: Mathematics is one of my most dreaded subjects). According to Anastasiadou (2002) Self-Confidence viewed as attitudes toward the degree that Mathematics scare individuals, make them feel uncomfortable and nervous, with or without self-confidence when it comes to mathematics related to many areas such as algebra, statistics, analytics, algorithms, probabilities, geometry etc. (Anastasiadou, 2004a, 2004b, 2004c, 2004d; Anastasiadou, Chadjipadelis & Kofou 2013; Chadjipantelis & Anastasiadou, 2010; Dauphinee et al., 1997; Petridis et al., 2017; Nicolaou, et al., 2017; Schau, et al., 1995). Many of those mathematics areas are related to AI algorithms complexity, scheduling of Big Data Stream, Modeling and Simulation related to Cloud Computing, efficiency of AI algorithms, advance knowledge in analytics, in mathematics as was as in AI, advance programming skills requirements and determined students' accomplishment (Souravlas & Anastasiadou, 2020a, Souravlas, et al., 2020a) (Table 1). Students' achievement regarding learning AI algorithms, scheduling of Big Data Stream and Cloud Computing simulation is strongly related to students Self-Confidence in mathematics (Anastasiadou, 2009a, 2009b; Souravlas, et al., 2020a).

2. Value (e.g. Mathematics is a very worthwhile and necessary subject). Value is the conceptual construct that examines students' perceptions about the usefulness and importance of mathematics systems both in professional life and everyday life (Anastasiadou & Papadimitriou, 2001, 2003; Anastasiadou, 2007a, Anastasiadou, 2007b). In addition, mathematics is one of the most important subjects to study due to the fact that Mathematics helps improve the mind and influence people' way of thinking (Anastasiadou, 2008a, 2008b, 2008c; Anastasiadou, 2012a) (Table 1).

3. Enjoyment (e.g. I have usually enjoyed studying mathematics in school). The Enjoyment conceptual construct measures students' satisfaction out of solving a mathematics problem as well as happiness in a mathematics class than in any other class (Anastasiadou, 2005a, 2005b, 2005c; Anastasiadou & Gagatsis, 2005a, 2005b; Anastasiadou & Chadjipantelis, 2008; Anastasiadou, Elia, Gagatsis, 2007; Anastasiadou & Gagatsis, 2007; Anastasiadou, Gagatsis, Elia, 2005, Draganis et al., 2013) (Table 1).

4. Motivation (e.g. The challenge of mathematics appeals to me). Motivation is the conceptual construct that examines students' perceptions about motives regarding learnings mathematics generally, representations of mathematics as well as advanced mathematics (Table 1).

Table 1: ATMI Scale

ATMI Scale	
Conceptual Construct	Item
Self-Confidence	<p>Sel_Con1: Mathematics is one of my most dreaded subjects</p> <p>Sel_Con2: My mind goes blank, and I am unable to think clearly when working with mathematics</p> <p>Sel_Con3: Studying mathematics makes me feel nervous</p> <p>Sel_Con4: Mathematics makes me feel uncomfortable</p> <p>Sel_Con5: When I hear the word mathematics, I have a feeling of dislike</p> <p>Sel_Con6: Mathematics does not scare me at all</p> <p>Sel_Con7: I have a lot of self-confidence when it comes to mathematics</p> <p>Sel_Con8: I am able to solve mathematics problems without too much difficulty</p> <p>Sel_Con9: I expect to do fairly well in any mathematics class I take</p> <p>Sel_Con10: I am always confused in my mathematics class</p> <p>Sel_Con11: I learn mathematics easily</p> <p>Sel_Con12: I believe I am good at solving mathematics problems</p> <p>Sel_Con13: I am always under a terrible strain in a math class.</p> <p>Sel_Con14: It makes me nervous to even think about having to do a mathematics problem.</p> <p>Sel_Con15: I feel a sense of insecurity when attempting of mathematics</p>
Value	<p>Val1: Mathematics is a very worthwhile and necessary subject</p> <p>Val2: I want to develop my mathematical skills</p> <p>Val3: Mathematics helps develop the mind and teaches a person to think</p> <p>Val4: Mathematics is important in everyday life</p> <p>Val5: Mathematics is one of the most important subjects to study</p> <p>Val6: High school mathematics courses would be very helpful no matter what I decide to study</p> <p>Val7: I can think of many ways that I use mathematics outside of school</p> <p>Val8: I think studying advanced mathematics is useful.</p> <p>Val9: A strong math background could help me in my professional life.</p> <p>Val10: I believe studying math helps me with problem solving in other areas.</p>
Enjoyment	<p>Enjoy1: I have usually enjoyed studying mathematics in school</p> <p>Enjoy2: Mathematics is dull and boring</p> <p>Enjoy3: I like to solve new problems in mathematics</p> <p>Enjoy4: I would prefer to do an assignment in mathematics than to write an essay</p> <p>Enjoy5: I really like mathematics</p> <p>Enjoy6: I am happier in a mathematics class than in any other class</p> <p>Enjoy7: Mathematics is a very interesting subject</p> <p>Enjoy8: I am comfortable expressing my own ideas on how to look for solutions to a difficult problem in mathematics</p> <p>Enjoy9: I am comfortable answering questions in mathematics class</p> <p>Enjoy10: I get a great deal of satisfaction out of solving a mathematics problem.</p>
Motivation	<p>Motiv1: I am confident that I could learn advanced mathematics</p> <p>Motiv2: I would not like to avoid using mathematics in tertiary education level</p> <p>Motiv3: I am willing to take more than the required amount of mathematics</p> <p>Motiv4: I plan to take as much mathematics as I can during my education</p> <p>Motiv5: The challenge of mathematics appeals to me</p>

4. Profiles of the respondents

The demographic profiles include the following characteristics of the respondents' gender, age and year of education. The demographic profiles shown in Table 3 is based on frequency and relative frequency distributions. The sample comprised of 168 interviewees of whom 112 (66.7%) were men and 56 (33.3%) were women. With respect to the ages of participants, 12 (7.1%) of them were 18 years old, 41 (24.64%) of them were 19 years old, 80 (47.6%) of them were 21 years old, 21 (12.5%) of them were 21 years old and, finally, 14 (8.3%) were 22 years or more. With respect to their year of studies, 22 (13.1%) of them were during their first year of their studies, 32 (19%) of them were during the second year, 82 (48.8%) of them were during the third year, 30 (17.9%) of them were during the fourth year and 2 (1.2%) of them were during the fifth year and above (Table 2).

Table 2: Demographic data of the sample (N = 168)

Variables	Classes	N=168	%
Gender	Male	112	66.7
	Female	56	31.6
Age	18 years	12	7.1
	19 years	41	24.4
	20 years	80	47.6
	21 years	21	12.5
	22 years or more	14	8.3
Year of Studies	First year	22	13.1
	Second year	32	19
	Third year	82	48.8
	Fourth year	30	17.9
	Fifth year	2	1.2

5. Results

Below (Table 3) the results related the internal consistency or reliability of the instrument, and its conceptual constructs are described. The reliability of the ATMI Scale was related to items 1 to 40 was estimated by Cronbach alpha coefficient (α) (Cronbach, 1984).

The Cronbach' alpha coefficient is calculated to measure the reliability of the six conceptual constructs, i.e. Self-Confidence, Value, Enjoyment and Motivation issues (Table 2). Cronbach' alpha coefficient equals to 0.900 verified the reliability of the Scale of Students' attitudes towards Self-Confidence, Value, Enjoyment and Motivation. In additions Cronbach' alpha coefficient was above the cutoff point of 0.70 for all the dimensions of ATMI Scale (Students' attitudes towards learning Big Data, analytics and AI algorithms) (Anastasiadou, et al., 2014b; Anastasiadou et al., 2016a; Anastasiadou et al., 2016b; Anastasiadou & Giossi, 2014; 2018a, 2018b; Anastasiadou & Karakos, 2011; Anastasiadou, 2014; Anastasiadou, 2016; Anastasiadou, 2018a, 2018b, 2018c, 2018d) (Table 3).

The value of Cronbach's α coefficient for this instrument was equal to 0.900 and it is a very high value in terms of internal consistency (Anastasiadis, 2020; Anastasiadis & Christoforidis, 2019; Anastasiadou, 2006; Anastasiadou, 2007c; Anastasiadou, 2008d; Anastasiadou, 2009c; Anastasiadou et al., 2010b; Anastasiadou, 2011; Anastasiadou, 2012a, 2012b, 2012c, 2012d, 2012e, 2012f) (Table 3).

The value of Cronbach's α coefficient for Self-Confidence, conceptual construct was equal to 0.804 and it is a very high value in terms of internal consistency (Anastasiadou & Anastasiadis, 2011; Anastasiadou & Anastasiadis, 2019; Anastasiadou, et al., 2010a; Anastasiadou, et al., 2010b; Anastasiadou, et al., 2013) (Table 3).

The value of Cronbach's α coefficient for Value, conceptual construct was equal to 0.788 and it is a very high value in terms of internal consistency (Anastasiadou & Pappa, 2009; Anastasiadou & Pappa, 2019; Anastasiadou & Taraza, 2020a; Anastasiadou & Taraza, 2020b; Anastasiadou & Tiliakou, 2014, 2015, 2016a, 2016b) (Table 3). The value of Cronbach's α coefficient for Enjoyment conceptual construct was equal to 0.836 and it is a very high value in terms of internal consistency (Panistides & Anastasiadou, 2015; Patralli et al., 2012; Souravlas & Anastasiadou, 2020; Souravlas, et al., 2020; Thapa et al., 2016; Theodoridou, et al., 2014) (Table 3).

The value of Cronbach's α coefficient for Value conceptual construct was equal to 0.874 and it is a very high value in terms of internal consistency (Anastasiadou et al., 2013; Cohen, et al., 1988; Florou, et al., 2015; Fotiadis & Anastasiadou, 2018a,2018b; Florou & Anastasiadou 2013; Kapetanopoulou et al., 2021; Kofou, & Anastasiadou, 2013; Ntotsi, & Anastasiadou, 2019a, 2019b) (Table 3).

The value of Cronbach's α coefficient for Motivation conceptual construct was equal to 0.744 and it is a very high value in terms of internal consistency (Anastasiadou et al., 2007, Anastasiadou et al., 2014; Anastasiadou & Draganis, 2014; Anastasiadou, et al., 2014a; Anastasiadou & Kofou, 2013a, 2013b; Anastasiadou & Loukas, 2009; Anastasiadou & Panitsides, 2014; Anastasiadou et al., 2015; Gkolia et al., 2007; Papademetriou et al., 2022) (Table 3).

Finally, the value of Cronbach's α coefficient for Total score related to Students' attitudes towards Mathematics was equal to 0.927 and it is a very high value in terms of internal consistency (Anastasiadou, 2013a,2013b,2013c, 2013d; Anastasiadou, Florou, 2013; Batiou & Anastasiadou, 2015) (Table 4).

Table 3: Cronbach's Alpha

Dimensions	Cronbach's Alpha
Self-Confidence	0.866
Value	0.859
Enjoyment	0.741
Motivation	0.819

The following table presents the mean value (M) and the standard Deviation (SD) of each item and each conceptual construct of ATMI scale (Table 4). Among the dimensions, the highest mean level of perceptions was 3.6952 (SD=0.59479) for Self-Confidence conceptual construct following by Motivation conceptual construct 3.5381 (SD=0.83600) following by the Value conceptual construct 3.4458 (SD=0.68218) the lowest mean level was 3.2030 (0.46551) or Motivation conceptual construct (Table 4).

Table 4: ATMI Scale

SATBDAAIA Scale		Cronbach's Alpha	M	SD
Conceptual Construct	Item	.927		
Self-Confidence		.866	3.6952	.59479
	Sel_Con1: Mathematics is one of my most dreaded subjects		4.40	.776
	Sel_Con2: My mind goes blank, and I am unable to think clearly when working with mathematics		4.44	.756
	Sel_Con3: Studying mathematics makes me feel nervous		4.48	.766
	Sel_Con4: Mathematics makes me feel uncomfortable		4.18	.799
	Sel_Con5: When I hear the word mathematics, I have a feeling of dislike		3.92	.973
	Sel_Con6: Mathematics does not scare me at all		4.31	.868
	Sel_Con7: I have a lot of self-confidence when it comes to mathematics		4.28	.915
	Sel_Con8: I am able to solve mathematics problems without too much difficulty		3.15	1.151
	Sel_Con9: I expect to do fairly well in any mathematics class I take		2.67	1.382
	Sel_Con10: I am always confused in my mathematics class		2.85	1.184
	Sel_Con11: I learn mathematics easily		3.54	1.049
	Sel_Con12: I believe I am good at solving mathematics problems		3.19	1.044
	Sel_Con13: I am always under a terrible strain in a math class.		3.26	1.128
	Sel_Con14: It makes me nervous to even think about having to do a mathematics problem.		3.57	1.103
	Sel_Con15: I feel a sense of insecurity when attempting of mathematics		3.19	1.003
Value		.859	3.4458	.68218
	Val1: Mathematics is a very worthwhile and necessary subject		3.99	1.116
	Val2: I want to develop my mathematical skills		4.05	.927
	Val3: Mathematics helps develop the mind and teaches a person to think		3.49	1.078
	Val4: Mathematics is important in everyday life		3.66	.965
	Val5: Mathematics is one of the most important subjects to study		3.49	1.044
	Val6: High school mathematics courses would be very helpful no matter what I decide to study		3.54	1.083
	Val7: I can think of many ways that I use mathematics outside of school		3.83	1.083
	Val8: I think studying advanced mathematics is useful.		3.28	1.038
	Val9: A strong math background could help me in my professional life.		3.64	1.029
	Val10: I believe studying math helps me with problem solving in other areas.		1.51	.896

Enjoyment	.741	3.2030	.46551
Enjoy1: I have usually enjoyed studying mathematics in school		2.74	.979
Enjoy2: Mathematics is dull and boring		1.48	.889
Enjoy3: I like to solve new problems in mathematics		3.46	.915
Enjoy4: I would prefer to do an assignment in mathematics than to write an essay		4.14	.937
Enjoy5: I really like mathematics		3.95	.911
Enjoy6: I am happier in a mathematics class than in any other class		3.96	.975
Enjoy7: Mathematics is a very interesting subject		3.91	.934
Enjoy8: I am comfortable expressing my own ideas on how to look for solutions to a difficult problem in mathematics		1.74	1.027
Enjoy9: I am comfortable answering questions in mathematics class		3.82	.871
Enjoy10: I get a great deal of satisfaction out of solving a mathematics problem.		3.82	1.112
motivation	.819	3.5381	.83600
Motiv1: I am confident that I could learn advanced mathematics		4.02	.976
Motiv2: I would not like to avoid using mathematics in tertiary education level		3.12	1.173
Motiv3: I am willing to take more than the required amount of mathematics		3.27	1.150
Motiv4: I plan to take as much mathematics as I can during my education		3.77	.952
Motiv5: The challenge of mathematics appeals to me		3.52	1.21
Model Fit	x ² /df=1.89 CFI=0.95, GFI=0.94, RMSEA=0.04, AGFI=0.90, IFI=0.95		

The following table, Table 5, presents the intercorrelations across the six conceptual constructs used in this study plus an item measures the attitude toward Mathematics. An assessment of the bivariate correlations indicates that all the correlations are significant and are in the expected direction. The strongest correlation was between the conceptual constructs Self-Confidence and Value ($r=0.660$, $p<0.001$). The second strongest correlation was between the conceptual constructs Value and Motivation ($r=0.613$, $p<0.01$) whereas the third strongest correlation was between the conceptual constructs Self-Confidence and Enjoyment ($r=0.601$, $p<0.01$) following by the correlation between the conceptual constructs Self-Confidence and Motivation, ($r=0.582$, $p<0.01$) following by the correlation between the conceptual constructs Value and Enjoyment ($r=0.530$, $p<0.01$) and by the correlation between the conceptual constructs Enjoyment and Motivation ($r=0.474$, $p<0.01$).

As far as the correlations between Self-Confidence, Value, Enjoyment and Motivation and the Total score related to Students' attitudes towards Mathematics concerns that correlation analysis revealed significant correlations at a significant level of 99%.

More specifically, the strongest correlation was between the conceptual construct Self-Confidence and Total score related to Students' attitudes towards Mathematics ($r=0.650$, $p<0.01$), the second strongest correlation was between the conceptual construct Value and Total score related to Students' attitudes toward Mathematics ($r=0.428$, $p<0.01$), whereas the third strongest correlation was between the conceptual construct Enjoyment and Total score related to Students' attitudes towards Mathematics ($r=0.426$, $p<0.01$) (Table 5).

Equally statistically significant were the correlations between the Motivation conceptual construct and Total score related to Students' attitudes Mathematics ($r=0.347$, $p<0.01$), (Table 5). Finally, gender has statistically insignificant correlations with Self-Confidence, Value, Enjoyment and Motivation conceptual constructs (Table 5).

Table 5: Correlation Estimates
Correlations

		Self_Con	Value	Enjoyment	Motivation	Attitudes_Math	Gender
Self_Con	Pearson Correlation	1					
Value	Pearson Correlation	,660**	1				
Enjoyment	Pearson Correlation	,601**	,530**	1			
Motivation	Pearson Correlation	,582**	,613**	,474**	1		
Attitudes_Math	Pearson Correlation	,650**	,428**	,426**	,347**	1	
Gender		,138	,117	,174	,109	,128	1

** . Correlation is significant at the 0.01 level (2-tailed).

Furthermore, the four hypothesized effects were supported (Table 6). Thus, it is evident that the conceptual constructs Self-Confidence, Value, Enjoyment and Motivation, have a positive effect on Total score related to Greek Students' attitudes towards Mathematics.

Table 6: Hypotheses Testing

Hypotheses	Standardized estimates	p-value	Results
Ho1: Self-Confidence has a strong effect on General attitude towards mathematics	.59	<0.001	Supported
Ho2: Value has a strong effect on General attitude towards mathematics	.56	<0.001	Supported
Ho3: Enjoyment has a strong effect on General attitude towards mathematics	.47	<0.001	Supported
Ho4: Motivation has a strong effect on General attitude towards mathematics	.51	<0.001	Supported
Ho5: Gender influences General attitude towards learning Big Data, analytics and AI algorithms	.32	>0.05	Not Supported

6. Conclusions

The objective of current study is to evaluate Greek Students' attitudes towards Learning Big Data, Analytics and AI algorithms. The structural equation model verified the measurement model fit regarding the observed data (Model Fit $\chi^2/df=1.89$, CFI=0.95, GFI=0.94, RMSEA=0.04, AGFI=0.90, IFI=0.95) ((Churchill, 1979; Cohen, et al., 1988; Fornell & Larcker, 1981; Chin, 1998; Kim, et al., 2008). Spector, 1992; Wixon, & Watson, 2001). Therefore, the conceptualized model that describes of Greek students' attitudes toward Mathematics. The model revealed students' attitudes toward consist of conceptual constructs named Self-Confidence, Value, Enjoyment and Motivation.

The strongest correlation was between the conceptual construct named Self-Confidence and Total attitude Mathematics, the second one was between the conceptual construct named Value and Total attitude Mathematics and the third one was between the conceptual construct named Enjoyment and Total attitude toward Mathematics and the fourth one was between the conceptual construct named and Total attitude toward Mathematics.

In addition, the study made it evidence that the strongest correlation between the conceptual constructs was between Self-Confidence and Value, the second strongest one was between Self-Confidence and Motivation, the third strongest one was between Value and Enjoyment, whereas the fourth strongest one was Enjoyment and Motivation.

These results demonstrated that students' perceptions Self-Confidence, Value, and Enjoyment motivate their willing for learning and appreciating mathematics. The results also made evidence that there was no statistically significant relation between the gender and students' attitudes toward Mathematics.

However there is great need for empirical research connected with students' attitudes toward Mathematics, Statistics, Big Data and Artificial Intelligence mathematical algorithms.

References

- Alevriadou, A. Anastasiadou S. & Damianidou, D. (2014). Reliability and validity of the "Reading-free Vocational Interest Inventory (R-FVII)" in adolescents and adults with intellectual disabilities. *Procedia - Social and Behavioral Sciences*. 114, 388 – 393.
- Anastasiadis, L. (2020). Emotional Intelligence Influences on Consumers Consumer Behavior. *International Journal of Entrepreneurship and Innovative Competitiveness-IJEIC*, Vol2, Iss1, <https://hephaestus.nup.ac.cy/bitstream/handle/11728/11527/article1.pdf?sequence=1&isAllowed=y>.
- Anastasiadis, L., Anastasiadou, S. & Iakovidis, G. (2016). *Malcolm Baldrige National Quality Award (MBNQA) dimensions in Greek Tertiary Education System*. 8th International Conference 'The Economies of Balkan and Eastern Europe Countries in the changed world', EBEEC 2016, Split, Croatia. KnowledgeE Publishing-the Economies of Balkan and Eastern Europe Countries in the Changed World (EBEEC) | pages 436-455.
- Anastasiadis, L. & Christoforidis, C. (2019). *Evaluating citizens' actual perceptions and expectations and assessing e-Service Quality Gap in Public Sector related to e- Government Services*, International Journal of Entrepreneurship and Innovative Competitiveness –IJEIC, Vol. 1 – Iss. 1. <http://hephaestus.nup.ac.cy/bitstream/handle/11728/11395/Paper5.pdf?sequence=1&isAllowed=y>.
- Anastasiadou, S. (2002). *Enhancing prospective teachers' knowledge of students' attitudes and representations towards statistics-the case of Greek students*. In the Journal 'Scientia Paedagogica Experimentals' XXXIX 1, pp. 103-127.
- Anastasiadou, S. (2004a). *Teacher's opinions about statistics and probability*. In the journal 'Quaderni di Ricerca in Didattica', no 14. pp. 134-143. <http://math.unipa.it/~grim/quaderno14.htm>.
- Anastasiadou, S. (2004b). *The influence of social factors on Greek mathematics teachers about statistics education*, in Gr Maridis, A. Gagatsis, K. Nikolaou eds in Castme International and Castme Europe Conference, (CASTME) Cyprus, 2004, pp. 47-58.
- Anastasiadou, S. (2004c). *Perceptions-Attitudes-Conducts of the Greek Mathematicians for Statistics in Secondary Education*, D. De Bock, M. Isoda, J. A. C. Cruz, A. Gagatsis, E Simmt (eds) 10th International Congress on Mathematical Education (ICME 10) Copenhagen, Demark, pp. 61-68.
- Anastasiadou, S. (2004d). *The influence of social factors on Greek mathematics teachers about statistics education*, in Gr Maridis, A. Gagatsis, K. Nikolaou eds in Castme International and Castme Europe Conference, (CASTME) Cyprus, 2004, pp. 47-58.
- Anastasiadou, S. (2005a). *Survey of attitudes and beliefs toward Statistics in Greek Secondary Education*. International Conference on Mathematics Education, Svishtov, Bulgaria, pp. 125-133.
- Anastasiadou, S. (2005b). *Affective reactions and attitudes of the last class of Greek high school students towards statistics*, In M Boosch (Eds) Proceedings of the Fourth Conference of the European Society for Research in Mathematics Education (CERME 4), Sant Feliu de Guíxols, Spain, 2005 in the <http://cerme4.crm.es/Papers%20definitius/5/Anastasiadou%20Sofia.pdf>.
- Anastasiadou, S. (2005c). *How Greek Primary and Secondary school teachers perceive and evaluate statistics? A comparative study*. In A. Gagatsis, F. Spagnolo, Gr. Makridis, V. Farmaki eds, 4th Mediterranean Conference in Mathematics Education, Palermo, Italy, pp. 117-126.
- Anastasiadou, S. (2005d). *Analysis of compound variables concerning students' attitudes towards statistics after the first contact with the lesson of statistics*. In the journal 'Meditereean Journal for research in Mathematics Education', Vol 4 No 1, pp. 71-102.

- Anastasiadou, S. (2006). *Factorial validity evaluation of a measurement through principal components analysis and implicative statistical analysis*. In D.X. Xatzidimou, K. Mpikos, P.A. Stravakou, & K.D. Xatzidimou (eds), 5th Hellenic Conference of Pedagogy Company, Thessaloniki, pp. 341-348.
- Anastasiadou, S. (2007a). *Affective Responses and Attitudes of ninth grade Greek Students*. Proceedings of the 5th Mediterranean Conference in Mathematics Education, Rhodes, Greece pp. 169-178.
- Anastasiadou, S. (2007b). *Compartmentalization in learning process: The case study of Greek primary school pupils in statistical concepts*. In J. Novotha and H. Moraova (Eds), International Symposium Elementary Mathematics Teaching (SEMT 07), Prague, Czech Republic, pp. 61-68.
- Anastasiadou, S. (2007c). It's the men's world: Greek males' students believe that the women's position must be home with the kids. *The International Journal of Interdisciplinary Social Sciences*, Volume 2, Issue 5, pp.123-132.
- Anastasiadou, S. (2008a). *Representations and learning in statistics: a comparative study between Greek primary school students and immigrants*. Eleventh International Congress on Mathematical Education, in its eleventh edition is to be held in Monterrey, Mexico, 2008 in the <http://tsg.icme11.org/document/get/195>.
- Anastasiadou, S. (2008b). *Greek students' ability in statistical problem solving: A multilevel statistical analysis. A conference of five cities: Nicosia, Rhodes, Bologna, Palermo, Locarno*. Research in mathematics education. Nicosia, Cyprus, pp.73-84.
- Anastasiadou, S. (2008c). *The Effects of representational systems on the learning of statistics between Greek primary school students and immigrants*. Proceeding of the 5th International Mathematics Education and Society Conference (MES 5) Albufeira, Portugal, pp.167-176.
- Anastasiadou, S. (2008d). Exploring Intrinsic and Extrinsic Motivation during a PhD completion with the aid of Principal Components Analysis. *The International Journal of Interdisciplinary Social Sciences*, Volume 3, Issue 2, pp. 171-178.
- Anastasiadou, S. (2009a). *A structural equation model representing the hierarchical structure of translations among representations in Frequency concept*. In J. Novotha and H. Moraova (Eds), International Symposium Elementary Mathematics Teaching (SEMT 09), Prague, Czech Republic, pp. 57-64. <http://storage.cet.ac.il/cetnews/SEMT09.PDF>.
- Anastasiadou, S. (2009b). *Greek students' ability in probability problem solving*. In the Sixth Conference of the European Society for Research in Mathematics Education. Proceedings of CERME 6, Lyon France © INRP 2010 <www.inrp.fr/editions/cerme6> pp. 404-412. <http://ife.ens-lyon.fr/editions/editions-electroniques/cerme6/working-group-3>.
- Anastasiadou, S. (2009c). The effects different modes of representations in statistical problems solving: A study with third grade primary school pupils. *The International Journal of Learning*, Volume 16, Issue 4, pp.27-36.
- Anastasiadou, S. (2011). Reliability and validity testing of a new scale for monitoring attitudes toward learning statistics with technology. *Acta Didactica Napocencia*, vol. 4 number 1, pp. 1-10. <http://adn.teaching.ro/>.
- Anastasiadou, S. (2012a). Diversifications between expected and perceived attitudes toward learning statistics with technology. *The International Journal of Learning*, vol 18, Issue 3, pp.161-176
- Anastasiadou, S. (2012b). Evaluating a structural equation model measuring lifelong learning and continuing education factors. *The International Journal of Knowledge, Culture and Change Management*, Volume 12, Issue 3, pp.21-34.
- Anastasiadou, S. (2012c). Diversifications between expected and perceived attitudes toward learning statistics with technology. *The International Journal of Learning*, vol 18, Issue 3, pp.161-176.
- Anastasiadou, S. (2012d). *A structural model describes Chinese tradesmen attitudes towards Greek students' consumption behaviour*. 4th International Conference The Economies of Balkan and Eastern Europe Countries in the changed world EBEEC 2012, Sofia, Bulgaria. pp. 489-501.
- Anastasiadou, S. (2012e). *Reliability and validity testing of a new scale for measuring attitudes toward Chinese products*. 4th International Conference. The Economies of Balkan and Eastern Europe Countries in the changed world EBEEC 2012, Sofia, Bulgaria. pp 536-548.
- Anastasiadou, S. (2012f). *A structural model describes Chinese tradesmen attitudes towards Greek students' consumption behavior*. Economic Sciences. Vol 11, Issue 2, pp. 102-111.

- Anastasiadou, S. (2012g). Structural Equation Modelling in the Construction of a Structural Model of the Repercussions and Consequences in the Greek society and economy of Balkan and Eastern Europe Countries immigrants' entrance. *International Review of Applied Economic Research*, Vol.6. No.1-2, pp1-9.
- Anastasiadou, S. (2013a). Evaluating a Structural Equation Model Measuring Attitudes toward Reading Books and E-books. *The International Journal of the Book*, vol 10, pp.1-10.
- Anastasiadou, S. (2013b). Evaluating a structural equation model measuring lifelong learning and continuing education factors. *The International Journal of Knowledge, Culture and Change Management*. Volume 12, Issue 3, pp.21-34.
- Anastasiadou, S. (2013c). Developing and Evaluating a Structural Equation Model Measuring Leadership Changes in a Lifelong Learning World. *The International Journal of Educational Organization and Leadership*, Volume 19, Issue 2, pp.1-17.
- Anastasiadou, S. (2013d). *Consumer ethnocentrism: the case of Greek students*. Proceedings of the EBEEC 2013-5th International Conference 'The Economies of Balkan and Eastern Europe Countries in the changed world' EBEEC 2013. Kostadinopolis. Turkey, pp.92-97.
- Anastasiadou, S. (2014). A structural equation model describes factors affecting Greek students' consumer behavior. *Procedia Economics and Finance*. Volume 9, pp. 402– 406.
- Anastasiadou, S. (2015). The Roadmaps of the Total Quality Management in the Greek Education System according to Deming, Juran and Crosby in light of EFQM Model. *Procedia Economics and Finance*, vol. 33 pp. 562 – 572.
- Anastasiadou, S. (2016). *Greek Tertiary Education System evaluation in respect of quality assurance dimensions according to Malcolm Baldrige Performance Excellence Model*. 8th International Conference 'The Economies of Balkan and Eastern Europe Countries in the changed world', EBEEC 2016, Split, Croatia n: Karasavoglou A., Goić S., Polychronidou P., Delias P. (eds) Economy, Finance and Business in Southeastern and Central Europe. Springer Proceedings in Business and Economics. Springer, Cham, pp. 811-825.
- Anastasiadou, S. (2018a). *Gap analysis between perceived and expected of service quality in Greek Tertiary Education*. Proceedings of EDULEARN18: 10th annual International Conference on Education and New Learning Technologies Palma de Mallorca, Spain, pp. 8373-8382. doi:10.21125/edulearn.2018.1951.
- Anastasiadou, S. (2018b). Evaluating Perception, Expectation of Students/Pre-service Teachers and Service Quality Gap in Greek Tertiary Education. *KnE Social Sciences | The Economies of the Balkan and the Eastern European Countries in the changing World (EBEEC 2018) | pages: 294–308*.
- Anastasiadou, S. (2018c). *Leadership according to EFQM Model in Tertiary education: The case of Greek Universities*. Proceedings of 10th International Conference The Economies of the Balkan and the Eastern European Countries in the changing world, EBEEC 2018, Warsaw, Poland, pp. 20-24.
- Anastasiadou, S. (2018d). *Total quality management in Greek Tertiary Educational System: The case of Greek Universities*. Proceedings of 10th International Conference EBEEC 2018 - The Economies of the Balkan and the Eastern European Countries in the changing world, Warsaw, Poland, pp. 59-64.
- Anastasiadou, S. (2019). *Comparison of contemporary advanced statistical methods regarding construct validity evaluation of TEIque-SF instrument: Statistical Implicative Analysis vs. Principal Components*. Analysis. 9ème Colloque International sur Analyse Statistique Implicative (ASI 10). Belfort – France. pp. 148-163.
- Anastasiadou, S. & Anastasiadis, L. (2011). Reliability and validity testing of a new scale for monitoring attitudes toward electronics and electrical constructions subject. *International Journal of Applied Science and Technology (IJAST)*, Vol 1, No 1, pp. 1- 10.
- Anastasiadou S., Anastasiadis, L. Kalabouka, K. & Florou, G. (2014). Ethnocentrism, patriotism and animosity impact on freedom of competition and business activity. *WSEAS TRANSACTIONS on BUSINESS and ECONOMICS*, Vol 11, pp. 692-699.
- Anastasiadou, S. & Anastasiadis, L. (2019). *Quality Assurance in Education in the Light of the Effectiveness of Transformational School Leadership*. In: Sykianakis N., Polychronidou P., Karasavoglou A. (eds) Economic and Financial Challenges for Eastern Europe. Springer Proceedings in Business and Economics. Springer, Cham, pp. 323-344. https://doi.org/10.1007/978-3-030-12169-3_21.
- Anastasiadou, S., Anastasiadis, L, Vandikas, J. & Angeletos, T. (2010a). Implicative statistical analysis and Principal Components Analysis in recording students' attitudes toward electronics and electrical constructions subject. *The International Journal of Technology, Knowledge and Society*, Volume 16, Issue 5, pp. 341-356.

- Anastasiadou, S. Anastasiadis, L. Angeletos, T. & Vandikas J. (2010b). A Multidimensional Statistical Analysis of Students' Attitudes toward Physics *International Journal of Diversity in Organisations, Communities and Nations*, Volume 16, Issue 5, pp. 341-356.
- Anastasiadou, S., Anastasiadis, L. Kalabouka K. & Florou G. (2014a). Ethnocentrism, patriotism and animosity impact on freedom of competition and business activity. *Wseas Transactions on Business and Economics*, Vol 11, pp. 692-699.
- Anastasiadou S.D., Batiou, V. & Balkanos, E. (2014b). Occupation mobility in Greece: A completely new area. *Global Journal of Business, Economics and Management* 4(2), 73-80.
- Anastasiadou S., Batiou V., Balkanos E., 2015. Occupation mobility in Greece. *Procedia Economics and Finance, Elsevier*, 19, pp. 325 – 331.
- Anastasiadou, S. & Chadjipantelis, T. (2008). *The role of representations in the understanding of probabilities in tertiary education*. Eleventh International Congress on Mathematical Education, Monterrey, Mexico, 2008 in the <http://tsg.icme11.org/tsg/show/14>.
- Anastasiadou, S., Chadjipantelis, T., Kofou, I. 2013. *Pre-school Education department to understand probability distributions*. International Symposium Elementary Mathematics Teaching (SEMT '13), Prague, Czech Republic, In Jarmila Novotná and Hana Moraová ed., pp 67-75.
- Anastasiadou, S., Dimitriadou A. & Toda, E., (2013). What Makes Students Perform in PISA? Science Teachers' Beliefs. *International Journal of Humanities and Social Science*. Vol 3, Issue 1, pp.80-99.
- Anastasiadou S., Elia I. & Gagatsis A. (2007). *Le rôle des représentations dans l'apprentissage des concepts de statistique des étudiants de l'école primaire de Grèce*. In Regis Gras, Pilar Orus, Bruno Pinaud, Pablo Gregori Eds, 4th International Conference Implicative Statistic Analysis, Castellon, Spain, pp. 135-144.
- Anastasiadou, S.D, Fotiadou, X.G. & Anastasiadis, L. (2016a). Estimation of Vocational Training School (IEK) students' contentment in relation to quality of their studies. *New Trends and Issues Proceedings on Humanities & Social Sciences*, [On line].10, pp 09-18. Available from: www.prosoc.
- Anastasiadou S., Florou G., 2013. *Consumer Ethnocentrism: The case of Greek students*. 3rd International Conference on Quantitative and Qualitative Methodologies, Athens, pp. 52-57.
- Anastasiadou, S.D, Florou, G.S, Fotiadou, X.G. & Anastasiadis, L. (2016b). *Evaluation of the satisfaction of preservice educators of Primary Education from their work and faithfulness to their work*. *New Trends and Issues Proceedings on Humanities and Social Sciences*. [On line].10, pp35-41. Available from: www.prosoc.eu.
- Anastasiadou, S. & Gagatsis, A. (2005a). *Attitudes vers la statistique des étudiants –futurs enseignants de l'école primaire grecque*. In Regis Gras, Filippo Spagnolo, Jerome David Eds, 3rd International Conference Implicative Statistic Analysis, Palermo, Italy, pp. 109-118.
- Anastasiadou, S. & Gagatsis, A. (2005b). *Believes and academic behaviors in statistics education*. In J. Novotha Eds, International Symposium Elementary Mathematics Teaching SEMT 05 Prague, pp. 59-65.
- Anastasiadou, S., Gagatsis, A. (2007). *Exploring the effects of representation on the learning of statistics in Greek primary school*. In the Fifth Conference of the European Society for Research in Mathematics Education (CERME 5), Nikosia, Cyprus pp. 90-100. <http://ermeweb.free.fr/CERME5b/> και http://ermeweb.free.fr/CERME%205/WG1/1_Anastasiadou.pdf.
- Anastasiadou, S., Gagatsis A. & Elia, I. (2005). The relation between the perceived math ability and the feelings about mathematics and statistics. In the journal '*Scientia Paedagogica Experimentals*', vol. 42, no 2, pp. 351-364.
- Anastasiadou, S. & Giossi, S. (2018a). *Implicative Statistical Analysis vs. Confirmatory Factor Analysis in evaluation of Lifelong Learning Impact on Human Resources Development*. *Proceedings of CER12018: 12th annual International Conference on Education and New Learning Technologies*, Seville (Spain) pp. 6413-6413.
- Anastasiadou, S. & Giossi, S. (2018b). *A structural equation model describing the influence of lifelong learning on human resource development*. *Proceedings of CER12018: 12th annual International Conference on Education and New Learning Technologies*, Seville (Spain), pp. 6368-6374.
- Anastasiadou S., Draganis, A. (2014). Research on feelings of elementary school students in learning foreign languages: the case of Greek, the first and the second foreign language. *American International Journal of Contemporary Research*, Vol 4, no 4, pp. 105-111.
- Anastasiadou, S. & Karakos, A. (2011). The beliefs of electrical and computer engineering students' regarding computer programming. *The International Journal of Technology, Knowledge and Society*, Vol 7. Issue 1, pp.37-52.

- Anastasiadou, S. & Kofou, I. (2013a). The Development of a Structure Equation Model, for Goal Achievement and Preparation for a Future Education Leader. *The International Journal of Educational Organization and Leadership* 19 (2): 41-55.
- Anastasiadou, S. & Kofou, I. (2013b). Incorporating Web 2.0 Tools into Greek Schools. *International Journal of Technologies in Learning*, Volume 20, Issue 1, pp.11-23.
- Anastasiadou S., Kyridis A., Gkolia P., Karatasos G., 2007. *Students, Politics and Politicians in Greece: trends of political apathy and devaluation of political institutions*. Proceedings of the 2007 South-European and Mediterranean Conference on Citizenship Education, pp 145-168.
- Anastasiadou, S. & Loukas, D. (2009). Greek pre-service teachers' cognitive abilities in understanding the concept of frequency: A multilevel statistical analysis. *The International Journal of Learning*, Volume 16, Issue 5, pp.189-202.
- Anastasiadou, S. & Panitsides, E. (2014). *And now whither...? European Union lifelong learning policy: a two-level analysis*. Proceedings of EBEEC 2014. The 6th International Conference Economies of Balkan and Eastern Europe Countries in the changed world EBEEC 2014, Nis, Serbia, pp. 42-51.
- Anastasiadou, S. & Pappa, A. (2009). Structural Equation Modelling in the Construction of Structural Model of Educational Research. *The International Journal of Interdisciplinary Social Sciences*, Vol 4, Issue 5, pp.151-158.
- Anastasiadou, S. & Pappa, A. (2019). *Greek pre-service teachers' perceptions, emotions and attitudes toward representations of physic concepts*. ICERI2019, the 12th annual International Conference of Education, Research and Innovation, Seville (Spain), ICERI2019, pp. 8987-8992.
- Anastasiadou, S. & Papadaki, Z. (2019). Consumers' perceptions toward E-Service Quality, Perceived Value, Purchase and Loyalty Intentions. *International Journal of Entrepreneurship and Innovative Competitiveness – IJEIC*, Vol 1, Issue 1, <https://hephaestus.nup.ac.cy/bitstream/handle/11728/11391/paper1.pdf?sequence=1&isAllowed=y>.
- Anastasiadou, S. & Papadimitriou, I. (2001). Another way to estimate the validity of a questionnaire for measurement of attitudes towards statistics. The case of Greek students. *Learning in Mathematics and Science and Educational Technology*, Volume II, Intercollege Press, pp. 345-368.
- Anastasiadou, S. & Papadimitriou, I. (2003). *Secondary mathematics teachers' attitudes towards statistics in Greece*. 30 Mediterranean Conference in Mathematics Education, Athens, pp. 441-448.
- Anastasiadou, S. & Taraza, E. (2019a). *Total Quality Management: Implementation of the Six Sigma Methodology for Improving Quality in Higher Education*. ICERI2019, the 12th annual International Conference of Education, Research and Innovation, Seville (Spain), ICERI2019, pp. 9533-9537.
- Anastasiadou, S. & Taraza, E. (2019b). *Pre-service teachers' perceptions toward leadership regarding the MBVQA Model*. 11th annual International Conference on Education and New Learning Technologies, Palma de Mallorca, Spain, EDULEARN 19, pp. 533-543.
- Anastasiadou, S. & Taraza, E. (2019c). The structure and paths of Malcolm Baldrige National Quality Award (MBNQA) dimensions applied in Greek Tertiary educational systems dimensions in Greek Tertiary Education System. *11th annual International Conference on Education and New Learning Technologies*, Palma de Mallorca, Spain, EDULEARN 19, pp. 455-463.
- Anastasiadou, S. & Taraza, E. (2020a). Resistance to Change as an Obstacle Regarding Quality in Higher Education Institutions (HEIS). *Proceedings of of 14th annual International Technology, Education and Development Conference (INTED2020)*, Valencia, Spain, pp. 396-401.
- Anastasiadou, S. & Taraza, E. (2020b). *Six Sigma in Tertiary Education: A Win of Change regarding Quality Improvement in Education*, Proceedings of of 14th annual International Technology, Education and Development Conference (INTED2020), Valencia, Spain, pp. 9595-9601.
- Anastasiadou, S. & Tiliakou, C. (2014). Classical Item Analysis of the Greek State of English Language Proficiency "A" Level Exam. *The International Journal of Literacies*, Volume 20, Issue 3, pp.39-53.
- Anastasiadou, S. & Tiliakou, C. (2015). The Greek State Certificate in English Language Proficiency (KPG) Level A: Item difficulty, learning ability and cultural background through regression analysis. *Procedia-Social and Behavioral Sciences*, 197, 1501-1506. doi: 10.1016/j.sbspro.2015.07.101
- Anastasiadou, S. & Tiliakou, C. (2016a). Investigation of the discriminating ability of the Greek State certificate of language proficiency by means of Vacor method: The case of Greek-speaking and Turkish-speaking bilingual students from the Muslim minority of Thrace. *International Journal of Learning and Teaching*, 8 (2),109-118. DOI <https://doi.org/10.18844/ijlt.v8i2.517>

- Anastasiadou, S. & Tiliakou, C. (2016b). Evaluation of the discriminating ability of the Greek state foreign language exam (KPG) for English by means of the factorial analysis of correspondences, *International Journal of Learning and Teaching*. 8 (2), 129-140.
- Anastasiadou, S. & Zirinolou, P. (2014). Reliability testing of EFQM scale: The case of Greek secondary teachers. *Procedia - Social and Behavioral Sciences*, Volume 143, pp. 990–994.
- Anastasiadou, S. & Zirinoglou, P. (2015a). Teachers' attitudes toward Quality Assurance Dimensions regarding EFQM Model in Primary Education in Greece, *Procedia Economics and Finance*, vol. 33, pp. 411-431.
- Anastasiadou, S. & Zirinoglou, P. (2015b). EFQM dimensions in Greek Primary Education System. *Procedia Economics and Finance*, vol 33, pp. 411 – 431.
- Anastasiadou, S. & Zirinoglou, P. (2020a). Quality assessment in Greek Tertiary Education using Gap Analysis. *International Journal of Entrepreneurship and Innovative Competitiveness – IJEIC*. Vol 2, Issue 1, <http://hephaestus.nup.ac.cy/handle/11728/11531>.
- Anastasiadou, S. & Zirinoglou, P. (2020b). Reliability and Validity Analysis of validity testing of a new scale for monitoring Students Attitudes toward Entrepreneurship Courses (SATEC). *International Journal of Entrepreneurship and Innovative Competitiveness – IJEIC* Vol 2, Issue 1, <http://hephaestus.nup.ac.cy/handle/11728/11530>.
- Anastasiadou, S., Zirinoglou, P., Karasavoglou, A. & Florou, G. (2016c). Total Quality Management in Education: The case of Primary and Secondary Education for the implementation of the best educational policy. *Data Analysis, Bulletin* 17, 110-130.
- Atan, M. & Kasmin, F. (2018). Assessing Mathematics' Attitude among Technical University Students. *Int. J. Acad. Res. Bus. Soc. Sci.* 7, 103–115.
- Awaludin, I.S.; Ab Razak, R.; Azliana Aridi, N.; Selamat, Z. Causes of Low Mathematics Achievements in a Private University. *J. Comput. Sci. Comput. Math.* 2015, 21–26.
- Batiou V., Anastasiadou S. (2015). *Greek people's attitudes toward boundary less mindset careers*. Proceedings of the EBEEC 2015-7th International Conference 'The Economies, of Balkan and Eastern Europe Countries in the changed World' EBEEC 2015 Kavala, Greece, pp 75-80.
- Brezavšček, A., Janja, J., Rus, G. & Žnidaršič, A. (2020). Factors Influencing Mathematics Achievement of University Students of Social Sciences. *Mathematics*, 8, 2134, MDPI; doi:10.3390/math8122134.
- Car J, Sheikh A, Wicks P, Williams MS. (2019). Beyond the hype of big data and artificial intelligence: building foundations for knowledge and wisdom. *BMC Med.* 2019 Jul 17;17(1):143. doi: 10.1186/s12916-019-1382-x. PMID: 31311603; PMCID: PMC6636050.
- Chin. W. W. (1998). Issues and opinion on structural equation modeling, *Mis Quarterly*, 22(1), pp 7-16.
- Christodoulou, T., Gagatsis, A., Anastasiadou, S. (2017). *Enquête internationale comparative: croyances et attitudes des élèves du secondaire inférieur relatives aux erreurs en mathématiques*. Proceedings of 9ème Colloque International sur Analyse Statistique Implicative, Belfort – France, pp. 404-418.
- Churchill, G.A. (1979). A paradigm for developing better measures for marketing constructs. *Journal of Marketing Research*, 16, pp 64-73.
- Cohen, R.T., Monlaque, P., Nathason. L.S., & Swerdlik, M.E. (1988). *Psychological testing: An introduction to tests of measurement*. Mountain Viw, CA: Mayfield Publishing Company.
- Chadjipantelis T., Anastasiadou S. 2010. *Pre-service teachers' understanding of probability Distributions: A Multilevel Statistical Analysis*. International Conference on the Teaching of Statistics. ICOTS 8, Ljubljana, Slovenia 2010. <http://www.stat.auckland.ac.nz/~iase/publications.php?show=icots8>.
- Draganis, A., Dragani, M. Anastasiadou S. (2013). *Economic crisis in Greece: Students worst nightmare*. Proceedings of the EBEEC 2013-5th International Conference. The Economies of Balkan and Eastern Europe Countries in the changed world EBEEC 2013. Kostadinopolis. Turkey, pp.1-6.
- Croanbach, L.J. (1984). *Essentials of psychological testing* (4th ed.). New York: Harper & Row.
- Dauphinee, T.L., Schau, C. & Stevens, J.J. (1997). Survey of attitude Toward Statistics: Factor structure and factorial invariance for female and males. *Structural Equation Modeling*. 4 (1997), pp. 129–141.
- Fernández-César, R., Garrido, D. & Solano-Pinto, N. Do Science, Technology, Engineering and Mathematics (STEM) Experimentation Outreach Programs Affect Attitudes towards Mathematics and Science? A Quasi-Experiment in Primary Education. *Mathematics* 2020, 8, 1490; doi:10.3390/math8091490.

- Florou, G., Anastasiadou, S., Karasavoglou, A., Valsamidis, S., & Mandilas, A. (2015). *Greek Public Tertiary Education Departments in Agriculture*. Proceedings of the 7th International Conference on Information and Communication Technologies in Agriculture, Food and Environment (HAICTA), Kavala, Greece, pp. 471-479.
- Florou G., Anastasiadou S. 2013. *Academic staff of Greek technological educational institutes*. 3rd International Conference on Quantitative and Qualitative Methodologies, Athens, pp. 52-156.
- Florou, G., Anastasiadou, S., Valsamidis, S. 2021. *E-Learning and tertiary education students*. Proceedings of EDULEARN21 Conference, pp. 9796-9805.
- Fornell, C. & Larcker, D. (1981). Evaluating Structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18, pp 39-50.
- Fotiadis, Th., Anastasiadou S. (2018a). *Contemporary advanced statistical methods for the science of marketing: Implicative Statistical Analysis vs Principal Components Analysis*. Proceeding of the ICME 2018- 1st International Conference on Marketing and Entrepreneurship. Cyprus.
<http://hephaestus.nup.ac.cy/handle/11728/11393>.
- Fotiadis, Th., Anastasiadou S. (2018b). *Contemporary advanced statistical methods for the science of marketing: Principal Components Analysis vs Analyse Factorielle des Correspondances*. Proceeding of the ICME 2018- 1st International Conference on Marketing and Entrepreneurship. Cyprus.
<http://hephaestus.nup.ac.cy/handle/11728/11392>.
- Gkolia, P., Kyridis, A., Anastasiadou S., Vamvakidou, I. & Zagkos, C. 2007. The concepts and connotations of “homeland” as a core elements Greek national identity. Proceedings of the 2007 South-European and Mediterranean Conference on Citizenship Education, pp 225-258.
- Giossi, S., Anastasiadou, S. 2014. *Human resources dimensions: an approach of Greek managers*. Proceedings of EBEEC 2014. The 6th International Conference Economies of Balkan and Eastern Europe Countries in the changed. EBEEC 2014, Nis, Serbia, pp 59-62.
- Giossi, S., Anastasiadou, S., Gamanis, A. & Gamanis G. G. (2019). Tracing the concept of entrepreneurship and the role of an entrepreneur: A critical review. *International Journal of Entrepreneurship and Innovative Competitiveness* – IJEIC, Vol 1, Issue 1, <https://hephaestus.nup.ac.cy/bitstream/handle/11728/11394/Paper4.pdf?sequence=1&isAllowed=y>.
- Hagan, I.E, Amoaddai, S. Terkwor Lawer, V & Atteh, E. (2020). Students’ Perception towards Mathematics and Its Effects on Academic Performance. *Asian Journal of Education and Social Studies*, 8(1): 8-14, 2020; Article no.AJESS.57132, ISSN: 2581-6268
- Hair, J., Anderson, R., Tatham, R. & Black, W. (1995). *Multivariate Data Analysis With Raedings*, p.373. USA: Prentice-Hall International, Inc.
- Hair, F.J., Black C.W., Badin, N.J., Anderson, E.R. & Tatham, R.L. (2005). *Multivariate Data Analysis*. New Journey, Pearson Education Inc.
- Howe III EG & Elenberg, F. (2020). Ethical Challenges Posed by Big Data, *Innov Clin Neurosci*. 2020 Oct-Dec; 17(10-12): 24–30. Published online 2020 Oct 1. PMID: PMC7819582.
- Jeong, J.S.; González-Gómez, D. (2021). Flipped-OCN Method in Mathematics Learning to Analyze the Attitudes of Pre-Service Teachers. *Mathematics*, 2021, 9, 607. <https://doi.org/10.3390/math9060607>
- Kapetanopoulou, P., Kouroutzi, A. & Anastasiadou, S. (2021). The Impact of Information Systems Implementation in the Greek Manufacturing Enterprises. *Appl. Sci.* 2021, 11(24), 11781; <https://doi.org/10.3390/app112411781>
- Kim, D.J., Ferrin, D.L. & Rao, H.R. (2008). A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents. *Decision support systems*, 44(2), pp.544-564.
- Kofou, I. & Anastasiadou S. (2013). Language and Communication Needs Analysis in Intercultural Education. *The International Journal of Diversity in Education*. Vol 12, pp.15-64.
- Lee, CH, Yoon HJ. (2017). Medical big data: promise and challenges. *Kidney Res Clin Pract*. 2017, 36(1), pp.3–11.
- Manalaysay, E.G. (2019). Gender Differences, Mathematics Anxiety, And First-Year College Students’ Mathematical Achievement. *Int. J. Sci. Technol. Res.*, 8, 25–29.
- Margaris, A., Souravlas, S., Kotsialos, E. & Roumeliotis, M. (2007). Design and Implementation of Parallel Counterpropagation Networks using MDPI, *INFORMATICA, Volume 18, NO 1, 2007, p. 79-102*.

- Nicolaou, S. Gagatsis, A., Deliyianni, E., Panaoura, A., Elia, I., Anastasiadou, S. (2017). *Tracing the beliefs and self-efficacy beliefs of undergraduate economic sciences students: the case of the representations of functions*. Proceedings of 9ème Colloque International sur Analyse Statistique Implicative. Belfort – France, pp. 461-478.
- Ntotsi, P. & Anastasiadou, S. D. 2019a. Contemporary advanced statistical methods for the science of educational research: Principal components analysis versus L' analysee factorielle des correspondances. *New Trends and Issues Proceedings on Humanities and Social Sciences*. [Online]. 6(1), pp. 246–255. Available from from: www.prosoc.eu.
- Ntotsi, P. & Anastasiadou, S. D. 2019b. Comparison of multivariate patterning methods in group/cluster identification regarding the science of educational research: Implicative Statistical Analysis vs. L' Analysee Factorielle des Correspondances. *New Trends and Issues Proceedings on Humanities and Social Sciences*. [Online]. 6(1), pp 238–245. Available from from: www.prosoc.eu.
- Nunnally, C.J. (1978). *Psychometric Theory*. New York: McGraw Hill Book Co.
- Panitsides, E. & Anastasiadou S. (2015). Lifelong Learning Policy Agenda in the European Union: A bi-level analysis. *Open Review of Educational Research*, 2015 Vol. 2, No. 1, 128–142, <http://dx.doi.org/10.1080/23265507.2015.1043936>, Routledge.
- Papadaki, Z.E. & Anastasiadou, S.D. (2019). *Evaluating Perception, Expectation of Consumers, and Service Quality Gap in Greek Banking in a Period of Financial Crisis and Capital Controls*. In: Sykianakis N., Polychronidou P., Karasavoglou A. (eds) *Economic and Financial Challenges for Eastern Europe*. Springer Proceedings in Business and Economics. Springer, Cham, pp. 67-80. https://doi.org/10.1007/978-3-030-12169-3_5.
- Patrali, K., Alevriadou, A., Petrou, M., Anastasiadou, S. & Kyridis, A. (2012). How social factors influence the understanding of the computers by kindergarten pupils. *The International Journal of Learning and Development*, vol 2, No3, pp. 229-246.
- Papadimitriou, C, Anastasiadou, S., Kondeos, 2022. Papalexandris, S. (2022). COVID-19 Pandemic: The Impact of the Social Media Technology on Higher Education, *Educ. Sci.* 2022, 12(4), 261; <https://doi.org/10.3390/educsci12040261>.
- Petridou, A., Elia, I, Gagatsis, A., Anastasiadou, S. (2017). *L' appréhension perceptive des figures géométrique*. Proceedings of 9ème Colloque International sur Analyse Statistique Implicative. Belfort – France, pp. 231-247.
- Schau, C., Stevens, J., Dauphinee, T. L. & Del Vecchio, A. (1995). The development and validation of the Survey of Attitudes Toward Statistics. *Educational and Psychological Measurement*. 55. 868-875.
- Souravlas, S., Anastasiadou, S. (2020a). Pipelined Dynamic Scheduling of Big Data Streams. *Applied Sciences*. 10, 4796.
- Souravlas, S., Katsavounis, S. & Anastasiadou, S. (2020b). On Modeling and Simulation of Resource Allocation Policies in Cloud Computing Using Colored Petri Nets. *Applied Sciences*. 020, 10(16), 5644; <https://doi.org/10.3390/app10165644>.
- Souravlas, S. (2019). ProMo: A Probabilistic Model for Dynamic Load-Balanced Scheduling of Data Flows in Cloud Systems, *Electronics, Open Access Journal*, MDPI, vol.8, issue 9, September 2019.
- Souravlas, S. & Anastasiadou, S. (2020). Pipelined Dynamic Scheduling of Big Data Streams, *Applied Sciences, Open Access Journal*, MDPI, 2020; 10(14):4796.
- Souravlas, S, Anastasiadou, S. & Katsavounis, S. (2021). More on Pipelined Dynamic Scheduling of Big Data Streams. *Applied Sciences*, 2021; 11(1):61. <https://doi.org/10.3390/app11010061>
- Souravlas, S. & Katsavounis, S. (2019). Scheduling Fair Resource Allocation Policies for Cloud Computing Through Flow Control, *Electronics, Open Access Journal*, MDPI, Vol.8, Issue 11, Nov. 2019.
- Souravlas, S., Katsavounis, S. & Anastasiadou, S. (2020). On Modeling and Simulation of Resource Allocation Policies in Cloud Computing Using Colored Petri Nets", *Appl. Sci.* 2020, 10, 5644.
- Souravlas, S. & Roumeliotis, M. (2014a). *Dynamic Load Balancing on Allto-All Personalized Communications Using the NNLB Principle.*, 6th International Conference on Computational Intelligence, Communication Systems, And Networks, CICSYN2014, Tetovo, FYROM, pp. 107-112, May, 2014. (IEEE Xplore, DOI: 10.1109/CICSyN.2014.34).

- Souravlas, S. & Roumeliotis, (2014b). Verification & Performance Evaluation of Parallel Pipelined Communications Using Petri Nets", UKSim-AMSS 16th International Conference on Computer Modelling and Simulation, Cambridge, UK, March 2014, pp. 399-404. (IEEE Xplore, DOI: 10.1109/CICSyN.2014.34)
- Souravlas, S. & Roumeliotis, M. (2015a). Scheduling Array Redistribution With Virtual Channel Support, *Journal of Supercomputing*, Springer, Volume 71, Issue 11, pp. 4215-4234, November 2015.
- Souravlas, S. & Roumeliotis, M. (2015b). Petri Net Modeling and Simulation of Pipelined Deadlock-Free Redistributions, *Congent Engineering, Systems & Control Taylor and Francis Group*, Volume 2, Issue 1, 2015.
- Spector P.E. (1992). Summated Rating Scale Construction: An Introduction. Sage University Paper Series on Quantitative Application in the Social Sciences. Newbury Park, CA.
- Tantalaki, S. Souravlas, S., Roumeliotis, M. & Katsavounis, S. (2019a). *Linear Scheduling of Big Data Streams on Multiprocessor Sets in the Cloud*, 19th IEEE/WIC/ACM. International Conference on Web Intelligence, pp. 107-115, Thessaloniki, Oct. 2019.
- Tantalaki, N., Souravlas, S. & Roumeliotis, M. (2019b). Data-Driven Decision Making in Precision Agriculture: The Rise of Big Data in Agricultural Systems, *Journal of Agricultural & Food Information*, Taylor and Francis, Vol.20, Issue 4, pp 344-380, Nov. 2019.
- Tantalaki, N. Souravlas, S. Roumeliotis, M. & Katsavounis, S. (2020a). Pipeline-Based Linear Scheduling of Big Data Streams in the Cloud, *IEEE Access*, vol. 8, pp. 117182-117202, 2020, doi: 10.1109/ACCESS.2020.3004612
- Tantalaki, N., Souravlas, S. & Roumeliotis, M. (2020b). A review on big data real-time stream processing and its scheduling techniques, *International Journal of Parallel, Emergent and Distributed Systems*, Taylor & Francis, Vol.35, Issue 5, July 2020, pp 571-601.
- Tapia, M. (1996). The Attitudes Toward Mathematics Instrument. Paper presented at the annual meeting of the Mid-south Educational Research Association, Tuscaloosa, AL (ERIC Reproduction Service No. ED 404165).
- Tapia, M., & Marsh, G. E., II. (2002). Confirmatory factor analysis of the Attitudes Toward Mathematics Inventory. Paper presented at the Annual Meeting of the Mid-South Educational Research Association, Chattanooga, TN. (ERIC Document Reproduction Service No. ED 471 301).
- Tapia, M., & Marsh, G. E., II. (2004). An instrument to measure mathematic attitudes. *Academic Exchange Quarterly*, 8(2), 16-21.
- Taraza, E. & Anastasiadou, S. (2019a). *Evaluation of Total Quality Management (TQM) in Greek Higher education Using advanced statistical methodologies*. ICERI2019, the 12th annual International Conference of Education, Research and Innovation will be held in Seville (Spain), ICERI2019, pp. 9450-9460.
- Taraza, E. & Anastasiadou, S. (2019b). *EFQM Excellence Model in Vocational Lyceum: Reliability and Validity of EFQM Instrument*. Proceedings of 13th annual International Technology, Education and Development Conference (INTED2019), Valencia, Spain, pp. 2273-2285.
- Taraza, E.I. & Anastasiadou, S.D. (2019c). Personality traits in the light of the effectiveness of transformational vocational school leadership and leaders. *New Trends and Issues Proceedings on Humanities and Social Sciences*. [Online]. 6(1), pp 184–Available from: www.prosoc.eu.
- Thapa, K.B. Okalidou, A. & Anastasiadou, S. (2016). Teachers' screening estimations of speech–language impairments screening estimations of speech–language. *International Journal of Language & Communication Disorders*. Vol. 51, No. 3, 310–327.
- Theodoridou, E., Alevriadou, A., Semoglou, A. & Anastasiadou, S. (2014). Investigating Memory Strategies and Motor Memory in Dyslexic and Non-dyslexic Children, *International Journal of Learner Diversity and Identities*, Volume 20, Issue 3, pp.25- 44.
- Wixon, B.H & Watson, H.J. (2001). An empirical investigation of the factors affecting data warehousing. *MIS Quarterly* 25(1), pp 17-41.
- Valsamidis, S., Giannoula Florou, G., Anastasiadou, S., Mandilas, A. (2021). *Educational robotics as a teaching tool of information technology in the primary education*. Proceedings of EDULEARN21 Conference, pp. 9806-9816.
- Wahid, S.N.S.; Yusof, Y.; Razak, M.R. (2014). Math anxiety among students in higher education level. *Procedia Soc. Behav. Sci.* 2014, 123, 232–237.