International Journal of Education and Social Science; Vol. 9 No. 3; June 2022
ISSN 2410-5171 (Online), 2415-1246 (Print)
Published by Research Institute for Progression of Knowledge

Students' attitudes towards Learning Big Data, Analytics and AI algorithms: The case of Greek students

Lazaros Anastasiadis
University of Crete
Greece

Poulcheria Zirinoglou
Hellenic Open University
Greece

Abstract

Nowadays, Universities all over the world are studying students' capability of learning analytics, Big Data applications and algorithms. Many researchers are studying students' attitudes toward these subjects in order to foresee students' preservation, capture students' behaviors and enhance students learning by providing feedback and support. A sample of 165 Greek students participated in the study. The study used an instrument named SATBDAAIA (Students' attitudes towards learning Big Data, analytics and AI algorithms), that is a five-point Likert scale. The scale consisted of six conceptual constructs named Difficulty, Cognitive Competence, Affective, Value and Motivation, Ethical issues. Greek Students' attitudes towards Learning Big Data, Analytics and AI algorithms were evaluated by another item that rate from 1 to 100 scaling the total score. The results indicated that they have a positive direct effect on Total score related to Greek Students' attitudes towards Learning Big Data, Analytics and AI algorithms. In addition, gender has not any significant role on shaping Greek students' attitudes towards Learning Big Data, Analytics and AI algorithms.

Keywords: Learning Big Data, Analytics, AI algorithms, Ethical issues

1.Introduction

The teaching of big data should concentrate on 3 areas: 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 applications (Tantalaki, Souravlas, & Roumeliotis, 2019). The cloud structure refers to the hardware and software needed to implement the cloud. Some knowledge of computer organization and architecture as well as computer networks is needed here. The algorithms refer to the way the receiving data streams are efficiently assigned to the various working elements for processing. Some knowledge of parellel processing and data distribution methods is necessary (Souravlas & Roumeliotis, 2015a; Souravlas & Roumeliotis, 2015b; Souravlas & Roumeliotis, 2014a; Souravlas & Roumeliotis, 2014b; Margaris et al., 2007). Finally, the number of big data applications refers to understanding the numerous big data applications that affect all aspects of our everyday life, education (Florou et al., 2021; Valsamidis et al., 2021), marketing, agriculture and food and so on.

Many researchers argued that although Big Data advance innovative research at the same time raise ethical questions and challenges related to individuals' privacy violation, informed consent (Howe III & Elenberg, 2020) equity, fairness, ethics, information governance and security etc (Car et al., 2019), methodological issues like legal and ethical issues (Lee &Yoon, 2017) and bias Bellazzi (2014)

Big Data together with advanced analytical approaches usage related to Artificial Intelligence (AI) have significant impact on many sciences, especially on medicine (Car et al., 2019). Big data analytics regularly take advantage of analytic methods created in data mining, involving classification and regression. (Lee &Yoon, 2017). Bellazzi (2014) argued that Big Data necessitate new architecture techniques, algorithms and analytics to handle it and extract value and obscure knowledge for it.

Artificial Intelligence (AI) is the ability of a computer to act and conduct operations that usually supposed to require human intelligence. Machine learning is considered as the core concept in Artificial Intelligence (AI). In addition, Artificial Intelligence (AI) is a modern comprehensive technical discipline that seeks theories, processes, tools and applications tools for simulating the increase and enlargement of human intelligence. Artificial Intelligence (AI) aiming to make machines capable of dealing with more sophisticated and complicates tasks that demand humans' intelligence to carry out (https://pub.towardsai.net/basic-concepts-of-artificial-intelligence-and-its-applications-294fb84bfc5e). Artificial Intelligence (AI) can analyze Big Data in order to make patterns that in a different situation they possibly continue to stay undetected by human supervision. Image recognition, voice recognition, autonomous driving are some of major applications of AI. Many other applications are well done as those related to telecommunications industry, to health informatics, to medicine, to consumer finance etc.

we are also realistic that these application concern remain about privacy, equity, security, and benefit to all. This the present study tries to capture Greek students' attitudes towards Learning Big Data, Analytics and AI algorithms, in the frame of Difficulty Cognitive Competence Affective Value Motivation Ethical issues conceptual constructs.

2. Purpose of the study-Research Hypotheses

The objective of current study is to evaluate Greek Students' attitudes towards learning Big Data, analytics and AI algorithms through multidimensional statistical analysis. In addition, the present paper examines the following research hypotheses.

Ho1: Difficulty has a strong effect on General attitude towards learning Big Data, analytics and AI algorithms
Ho2: Cognitive Competence has a strong effect General attitude towards on learning Big Data, analytics and AI algorithms
Ho3: Affective has a strong effect General attitude towards on learning Big Data, analytics and AI algorithms
Ho4: Value has a strong effect on General attitude towards learning Big Data, analytics and AI algorithms
Ho5: Motivation has strong effect on General attitude towards learning Big Data, analytics and AI algorithms
Ho6: Ethical issues has a strong effect on General attitude towards learning Big Data, analytics and AI algorithms
Ho7: Creative has a strong effect on General attitude towards learning Big Data, analytics and AI algorithms
Ho8: Gender influences General attitude towards learning Big Data, analytics and AI algorithms

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 SATBDAAIA (Students' attitudes towards learning Big Data, analytics and AI algorithms) consists of 46 items grouped into six conceptual constructs (Table 1).

The six components/ conceptual structures were named 1. Difficulty (e.g. Dif1: There is a great deal of complexity in many AI algorithms). According to Anastasiadou (2002) Difficulty viewed as attitudes toward the problems, the obstacles, the difficulties in compressing a subject as Big Data Systems, Analytics and AI algorithms (Anastasiadou, 2004a, 2004b, 2004c, 2004d, 2009a, 2009b; Dauphinee et al., 1997, Schau, et al., 1995). Other indicators of this conceptual construct are 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 (Souravlas & Anastasiadou, 2020a, Souravlas, et al., 2020a) (Table 1).

2. Cognitive Competence (e.g. I can learn Analytics easily). The Cognitive Competence conceptual construct measures students' ability and skills to understand and efficiently learn Analytics, AI algorithms and Big Data systems (Anastasiadou, 2005a, 2005b, 2005c; Anastasiadou & Gagatsis, 2005a, 2005b) (Table 1).

3. Affective (e.g. I enjoy taking AI lessons). (Anastasiadou & Chadjipantelis, 2008; Anastasiadou, Elia, Gagatsis, 2007; Anastasiadou & Gagatsis, 2007; Anastasiadou, Gagatsis, Elia, 2005) (Table 1).

4. Value (e.g. Big data systems are important for decision making). Value is the conceptual construct that examines students' perceptions about the usefulness of Analytics tools, AI algorithms and Big Data systems both in professional life and everyday life (Anastasiadou & Papadimitriou, 2001, 2003; Anastasiadou, 2007a, Anastasiadou, 2007b; Anastasiadou, 2008a, 2008b, 2008c; Anastasiadou, 2012a) (Table 1).

5. Motivation (e.g. Knowledge related to Bid Data systems is beneficent in future carriers). Motivation is the conceptual construct that examines students' perceptions about motives regarding learnings Analytics tools, AI algorithms and Big Data systems. These motives are both intrinsic and extrinsic (Table 1).

6. Ethical issues (e.g. Analytics raise concerns regarding privacy issues). Ethical issues is the conceptual construct that examines students' perceptions about issues related to privacy violation, transparency, etc. (Howe III & Elenberg, 2020) (Table 1).

Table 1: Scale of SATBDAAIA

	Scale of SATBDAAIA
Conceptual Construct	Item
Difficulty	
	There is a great deal of complexity in many AI algorithms
	There are many algorithms that can solve the same problem and the difficulty is which one is more efficient
	There is different implement for different programming languages
	Big data systems are difficult to use
	Big data systems require advance knowledge in analytics
	Big data systems require advance programming skills
	Big data systems require advance knowledge in AI
	There is strong need for deep knowledge in mathematics for algorithms analysis
Cognitive Competence	
	I can learn Analytics easily
	I find it easy to program in AI
	I do not make errors in programming regarding AI applications
	I understand AI algorithms
	I can appreciate the way Analytics tools are used
Affective	
	I enjoy taking AI lessons
	I am interested in working in the AI field
	I like programming relate to AI
	I have fun working with Big data systems
	Due to gamification, learning can also be modified to be fun
	I am not afraid the AI revolution
	I am not feeling insecure that AI applications replace human intelligence
Value	
	Big data systems are important for decision making
	Big data systems reduce cost for business processes
	Big data systems are important in customers service
	Big data applications are important in data analysis
	Big data systems have benefits in medicine

	AI is valuable
	AI is worth studying
	The evidence of the practical benefits of Big Data is not rarely.
	AI is related to everyday life
	Contemporary jobs require deep knowledge in AI algorithms
	Big data is widely used in environmental protection including pollution monitoring, disaster warning
	Many sensors have been installed in the forest to supply environmental data for observing and disaster forecasting
	Autonomous driving or self-driving car is also very common in the field of artificial intelligence.
Motivation	
	Knowledge related to Bid Data systems is beneficent in future carriers
	Knowledge in AI makes me more employable
	Big data is used to analyze related public safety data
	Programming efficient AI algorithms allow to be part of a global business and to belong to international networks
	I appreciated the role of learning analytics
	Learning of big data is beneficent in future carriers
	I study Analytics hard because I enjoy being good at it
	I want to study Analytics because I enjoy learning about the topic
Ethical issues	
	Analytics raise concerns regarding privacy issues
	There are issues of transparency
	Individuals' autonomy is easily be disregarded regarding Big Data research
	There are significant ethical concerns related to racism and human right issues
	Big Data research requires access to large scale amounts of individual information
	Big Data research requires an inform consent decision regarding participation

4.Profiles of the respondents

The demographic profiles include the following characteristics of the despondences' 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 177 interviewees of whom 121 (68.4%) were men and 56 (31.6%) were women. With respect to the ages of participants, 12 (6.8%) of them were 18 years old, 40 (22.6%) of them were 19 years old, 82 (46.3%) of them were 20 years old, 21 (11.9%) of them were 21 years old and, finally, 22 (12.4%) were 22 years or more. With respect to their year of studies, 22 (12.4%) of them were during their first year of their studies, 32 (18.1%) of them were during the second year, 80 (45.2%) of them were during the third year, 37 (20.9%) of them were during the fourth year and 6 (3.4%) of them were during the fifth year and above (Table 2).

Table 2: Demographic data of the sample (N = 177)

Variables	Classes	N=177	%
Gender	Male	121	68.4
	Female	56	31.6
Age	18 years	12	6.8
	19 years	40	22.6
	20 years	82	46.3
	21 years	21	11.9
	22 years or more	22	12.4
Year of Studies	First year	22	12.4
	Second year	32	18.1
	Third year	80	45.2
	Fourth year	37	20.9
	Fifth year	6	3.4

5. Results

Below (Table 3) the results related reliability of the instruments and its conceptual constructs are presented. The reliability of the instrument was related to items 1 to 46 was estimated by Cronbach alpha coefficient (a) (Croanbach, 1984).

The Cronbach' alpha coefficient is calculated to measure the reliability of the six conceptual constructs, i.e. Difficulty, Cognitive Competence, Affective, Value, Motivation and Ethical issues (Table 2). Cronbach' alpha coefficient equals to 0.900 verified the reliability of the Scale of Students' attitudes towards learning Big Data, analytics and AI algorithms. In SATBDAAIA additions Cronbach' alpha coefficient was above the cutoff point of 0.70 for all the dimensions of SATBDAAIA 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, 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 Difficult 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 Cognitive Competence 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 Affective conceptual construct was equal to 0.836 and it is a very high value in terms of internal consistency (Panistides & Anastasiadou, 2015; Patrali 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., 2014; Anastasiadou & Draganis, 2014) (Anastasiadou, 2013a,2013b,2013c, 2013d; Anastasiadou, Florou, 2013; Batiou & Anastasiadou, 2015) (Table 3).

The value of Cronbach's α coefficient for Motivation conceptual construct was equal to 0.772 and it is a very high value in terms of internal consistency (Anastasiadou, et al., 2014a; Anastasiadou & Kofou, 2013a, 2013b; Anastasiadou & Loukas, 2009; Anastasiadou & Panitsides, 2014; Anastasiadou et al., 2015; Papademetriou et al., 2022) (Table 3).

Table 3: **Cronbach's Alpha**

Dimensions	**Cronbach's Alpha**
Difficulty	0.804
Cognitive Competence	0.788
Affective	0.836
Value	0.874
Motivation	0.744
Ethical issues	0.772

The following table presents the mean value (M) and the standard Deviation (SD) of each item and each conceptual construct of SATBDAAIA scale (Table 4). Among the dimensions, the highest mean level of perceptions was 4.1798 (SD=0.56548) for Difficulty conceptual construct and 4.1782 (SD=0.53546) for Ethical issues conceptual construct and the lowest mean level was 3.1222 (0.87022) for Cognitive Competence conceptual construct (Table 4).

Table 4: SATBDAAIA Scale

	SATBDAAIA Scale	**Cronbach's Alpha**	**M**	**SD**
Conceptual Construct	**Item**	**0.804**	**4.1798**	**56548**
Difficulty	There is a great deal of complexity in many AI algorithms		4.39	.759
	There are many algorithms that can solve the same problem and the difficulty is which one is more efficient		4.45	.732
	There is different implement for different programming languages		4.47	.773
	Big data systems are difficult to use		4.23	.782
	Big data systems require advance knowledge in analytics		3.98	.967
	Big data systems require advance programming skills		4.38	.833
	Big data systems require advance knowledge in AI		4.35	.868
	There is strong need for deep knowledge in mathematics for algorithms analysis		3.18	1.165
Cognitive Competence		**0.788**	**3.1222**	**.87022**
	I can learn Analytics easily		2.68	1.357
	I find it easy to program in AI		2.84	1.222
	I do not make errors in programming regarding AI applications		3.55	1.049
	I understand AI algorithms		3.25	1.044
	I can appreciate the way Analytics tools are used		3.29	1.218

Affective		**0.836**	**3.5897**	**.75263**
	I enjoy taking AI lessons		3.30	1.131
	I am interested in working in the AI field		3.47	1.144
	I like programming relate to AI		3.16	1.019
	I have fun working with Big data systems		3.99	1.101
	Due to gamification, learning can also be modified to be fun		4.04	.924
	I am not afraid the AI revolution		3.50	1.078
	I am not feeling insecure that AI applications replace human intelligence		3.67	1.001
Value			**3,8693**	**,62663**
	Big data systems are important for decision making		4.11	.943
	Big data systems reduce cost for business processes		3.55	1,095
	Big data systems are important in customers service		3.82	1,109
	Big data applications are important in data analysis		3.97	.938
	Big data systems have benefits in medicine		4.46	.913
	AI is valuable		4.51	.898
	AI is worth studying		4.22	1.003
	The evidence of the practical benefits of Big Data is not rarely.		3.65	1.040
	AI is related to everyday life		3.27	1.057
	Contemporary jobs require deep knowledge in AI algorithms		3.94	.912
	Big data is widely used in environmental protection including pollution monitoring, disaster warning.		3.44	.990
	Many sensors have been installed in the forest to supply environmental data for observing and disaster forecasting.		3.46	1.064
	Autonomous driving or self-driving car is also very common in the field of artificial intelligence.		3.91	.910
Motivation		**0.744**	**3.7635**	**.60113**
	Knowledge related to Bid Data systems is beneficent in future carriers		3.84	.864
	Knowledge in AI makes me more employable		4.09	1.133
	Big data is used to analyze related public safety data		3.73	1.130
	Programming efficient AI algorithms allow to be part of a global business and to belong to international networks		3.91	1.095
	I appreciated the role of learning analytics		3.81	.963
	Learning of big data is beneficent in future carriers		4.29	.807
	I study Analytics hard because I enjoy being good at it		3.28	1.136
	I want to study Analytics because I enjoy learning about the topic		3.16	1.150

Ethical issues		**0.772**	**4.1782**	**.53546**
	Analytics raise concerns regarding privacy issues		4.28	.817
	There are issues of transparency		4.29	.860
	Individuals' autonomy is easily be disregarded regarding Big Data research		4.10	.802
	There are significant ethical concerns related to racism and human right issues		3.94	.947
	Big Data research requires access to large scale amounts of individual information		4.27	.866
	Big Data research requires an inform consent decision regarding participation		4.20	.839
Model Fit	x2/df=1.88 CFI=0.95, GFI=0.93, 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 Learning Big Data, Analytics and AI algorithms. 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 Difficulty and Ethical Issues ($r=0.855$, $p<0.001$). The second strongest correlation was between the conceptual constructs Affective and Value ($r=0.760$, $p<0.01$) whereas the third strongest correlation was between the conceptual constructs Value and Motivation ($r=0.699$, $p<0.01$) following by the correlation between the conceptual constructs Difficulty and Cognitive Competence, ($r=0.595$, $p<0.01$) following by the correlation between the conceptual constructs Difficulty and Value ($r=0.593$, $p<0.01$) and by the correlation between the conceptual constructs Affective, and Motivation ($r=0.590$, $p<0.01$). Equally statistically significant were the correlations between the conceptual constructs Cognitive Competence and Affective, ($r=0.563$, $p<0.01$), between the conceptual constructs Motivation and Difficulty ($r=0.551$, $p<0.01$), between the conceptual constructs Value and Cognitive Competence ($r=0.543$, $p<0.01$), between the conceptual constructs Value and Ethical Issues ($r=0.493$, $p<0.01$), between the conceptual constructs Difficulty and Affective ($r=0.491$, $p<0.01$),between the conceptual constructs Cognitive Competence andMotivation ($r=0.478$, $p<0.01$), between the conceptual constructs Motivation andEthical Issues ($r=0.466$, $p<0.01$), between the conceptual constructs Cognitive Competence and Ethical Issues ($r=0.424$, $p<0.01$) and between the conceptual constructs Affective and Ethical Issues ($r=0.371$, $p<0.01$) (Table 5).

As far as the correlations between Difficulty, Cognitive Competence, Affective, Value and Motivation, Ethical Issues conceptual constructs and the Total score related to Students' attitudes towards Learning Big Data, Analytics and AI algorithms concerns that correlation analysis revealed significant correlations at a significant level of 99%. More specifically, the strongest correlation was between the conceptual construct Value and Total score related to Students' attitudes towards Learning Big Data, Analytics and AI algorithms ($r=0.933$, $p<0.01$), the second strongest correlation was between the conceptual construct Affective and Total score related to Students' attitudes towards Learning Big Data, Analytics and AI algorithms ($r=0.857$, $p<0.01$), whereas the third strongest correlation was between the conceptual construct Motivation and Total score related to Students' attitudes towards Learning Big Data, Analytics and AI algorithms ($r=0.815$, $p<0.01$) (Table 5).

Equally statistically significant were the correlations between the conceptual construct Difficulty and Total score related to Students' attitudes towards Learning Big Data, Analytics and AI algorithms ($r=0.734$, $p<0.01$), between the conceptual construct Cognitive Competence and Total score related to Students' attitudes towards Learning Big Data, Analytics and AI algorithms ($r=0.696$, $p<0.01$) and between the conceptual construct Ethical Issues and Total score related to Students' attitudes towards Learning Big Data, Analytics and AI algorithms ($r=0.599$, $p<0.01$) (Table 5).

Table 5: Correlation Estimates

Correlations

		DIFF	COGNIT	AFFECTIVE	VALUE	MOTIV	ETHICAL_T	Total_Attitude	Gender
DIFF	Pearson Correlation	1							
COGNIT	Pearson Correlation	,595**	1						
AFFECTIVE	Pearson Correlation	,491**	,563**	1					
VALUE	Pearson Correlation	,593**	,543**	,760**	1				
MOTIV	Pearson Correlation	,551**	,478**	,590**	,699**	1			
ETHICAL_T	Pearson Correlation	,855**	,424**	,371**	,493**	,466**	1		
Total Attitude	Pearson Correlation	,734**	,696**	,857**	,933**	,815**	,599**	1	
Gender	Pearson Correlation	,088	,023	,053	,043	,001	,096	,011	1

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

In addition, the eight hypothesized effects were supported (Table 6). Thus, it is evident that the conceptual constructs Difficulty, Cognitive Competence, Affective, Value and Motivation, Ethical issues have a positive effect on Total score related to Greek Students' attitudes towards Learning Big Data, Analytics and AI algorithms.

Table 6: Hypotheses Testing

Hypotheses	Standardized estimates	p-value	Results
Ho1: Difficulty has a strong effect on General attitude towards learning Big Data, analytics and AI algorithms	.40	<0.001	Supported
Ho2: Cognitive Competence has a strong effect General attitude towards on learning Big Data, analytics and AI algorithms	.51	<0.001	Supported
Ho3: Affective has a strong effect General attitude towards on learning Big Data, analytics and AI algorithms	.53	<0.001	Supported
Ho4: Value has a strong effect on General attitude towards learning Big Data, analytics and AI algorithms	.48	<0.001	Supported
Ho5: Motivation has strong effect on General attitude towards learning Big Data, analytics and AI algorithms	.39	<0.001	Supported
Ho6: Ethical issues has a strong effect on General attitude towards learning Big Data, analytics and AI algorithms	.36	<0.001	Supported
Ho7: Creative has a strong effect on General attitude towards learning Big Data, analytics and AI algorithms	.29	<0.001	Supported
Ho8: Gender influences General attitude towards learning Big Data, analytics and AI algorithms	.68	>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 x2/df=1.88 CFI=0.95, GFI=0.93, 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 towards Learning Big Data, Analytics and AI algorithms. The model revealed students' attitudes towards Learning Big Data, Analytics and AI algorithms consist of conceptual constructs named Difficulty Cognitive Competence Affective Value Motivation Ethical Issues.

The strongest correlation was between the conceptual construct named Value and Total attitude towards Learning Big Data, Analytics and AI algorithms, the second one was between the conceptual construct named Affection and Total attitude towards Learning Big Data, Analytics and AI algorithms and the third one was between the conceptual construct named Motivation and Total attitude towards Learning Big Data, Analytics and AI algorithms. In addition, the study made it evidence that the strongest correlation was between the conceptual constructs was between Difficulty and Ethical Issues, the second strongest one was between Affective and Value whereas the third strongest one was between Motivation and Value. These results proved that students' perceptions about the usefulness of Analytics tools, AI algorithms and Big Data systems both in professional life and everyday life influence people, motivate their willing for learning and appreciating analytics. The results also madeevidence that there was no statistically significant relation between the gender and students' attitudes towards Learning Big Data, Analytics and AI algorithms.
Still a lot of empirical research need to be done regarding students' attitudes towards Learning Big Data, Analytics and AI algorithms. Academics should and must pay attention to crucial ethical issues.

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&i sAllowed=y.

Anastasiadou, S. (2002). *Enhancing prospective teachers' knowledge of students' attitudes and representations towards statistics-the case of Greek students.* In the Journal 'Scientia Paedacogika 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 'Meditereeanean 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, Rodes, 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 Repuplic, 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 Repuplic, 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: Karasavvoglou 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., Karasavvoglou 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., 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., Eliα 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, 4nd 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, 3nd 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 Paedacogika 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 CERI2018:* 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 CERI2018: 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. & 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&i sAllowed=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.

Anasatsiadou, S. & Papadimitriou, I. (2003). *Secondary mathematics teachers' attitudes towards statistics in Greece.* 3o 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.

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.

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.

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). *Psycholoical testing: An introduction to tests of measurement.* Mountain Viw, CA: Mayfield Publishing Company.

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.

Florou, G., Anastasiadou, S., Karasavvoglou, 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 Analysee Factorielle des Correspondances.* Proceeding of the ICME 2018- 1st International Conference on Marketing and Entrepreneurship. Cyprus. http://hephaestus.nup.ac.cy/handle/11728/11392.

Chin, W. W. (1998). Issues and opinion on structural equation modeling, *Mis Quarterly*, 22(1), pp 7-16.

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.

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 Joursey, 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. PMCID: PMC7819582.

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.

Margaris, A., Souravlas, S., Kotsialos, E. & Roumeliotis, M. (2007). Design and Implementation of Parallel Counterpropagation Networks using MDPI, *INFORMATICA, Volume 18, N0 1, 2007, p. 79-102.*

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 pattering 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. & Anastsasiadou, 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., Karasavvoglou 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.

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.

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.