

# A TECHNOLOGY ACCEPTANCE MODEL ANALYSIS OF METAVERSE TECHNOLOGY IN EDUCATION AND BEHAVIOURAL INTENTION TO USE IT AMONG UNIVERSITY STUDENTS. A COMPARATIVE ANALYSIS OF STUDENTS' BEHAVIOUR IN THE NETHERLANDS AND GREECE

Nikolaos Misirlis<sup>1</sup> and Yannis Nikolaidis<sup>2</sup>

<sup>1</sup>HAN University of Applied Sciences, International School of Business, The Netherlands

<sup>2</sup>University of Macedonia, School of Applied Informatics, Greece

## ABSTRACT

The present study proposes a framework for university students' metaverse technologies in education acceptance and intention to use. The study is based on the Technology Acceptance Model (TAM). Data used are coming from two universities and are compared to each other. 311 university students from The Netherlands and 292 from Greece participated, gathering 513 valid answers to analyze (285 from The Netherlands and 228 from Greece).

The objectives of the study are to analyze the relationship between students' intention to use metaverse in education technologies (hereafter named **MetaEducation**) in correlation with selected constructs of TAM such as Attitude (ATT), Perceived Usefulness (PU), Perceived Ease of Use (PE), Self-efficacy (SE) of the metaverse technologies in education, and Subjective Norm (SN). Furthermore, we want to research any cultural differences between the two populations based on their answers. Therefore, we propose two different structural models from the SEM analysis, once for each country. For both proposed models, different and individual analysis is conducted. We decided not to combine the datasets, since the samples present several cultural differences.

The proposed models will be useful to universities' managers, policymakers, and professors to better incorporate the upcoming metaverse technology. The present study tests the correlations among the aforementioned constructs. Preliminary results show a hesitance to use MetaEducation technologies from university students from both countries. Self-efficacy and Subjective Norms affect Attitude and Perceived Usefulness positively, but on the other side, there is no strong correlation between Perceived Ease of Use and Attitude or Perceived Usefulness and Attitude. Authors believe that the weak ties among the study constructs have to do with the lack of knowledge of what really MetaEducation really is, and which are its advantages of use.

## KEYWORDS

Metaverse, Technology Acceptance Model, University Students, E-Learning, MetaEducation, Greece, The Netherlands

## 1. INTRODUCTION

Metaverse is the last trend in technology representing a combination of virtual and augmented technology. With this technology, users will be able to immerse into a fully digital environment by obtaining a virtual identity through a digital avatar and acting as if this was the real world. They can meet other users, shop, buy real estate, visit bars and restaurants, and even flirt. Metaverse can be applied in several aspects of life such as (among others): Economy (with Metaverse entering into the cryptocurrency field), finance, social life, working environment, healthcare, real estate, and education. In the last two and a half years, during the COVID-19 pandemic, universities made immediate use of e-learning technologies, providing students with access to online learning content and platforms. Previous considerations on how to better integrate technology into university courses or how the institutions can be better prepared in terms of infrastructure vanished almost immediately due to the necessity of immediate actions towards the need for social distance and global health. Metaverse

technology is constantly penetrating more and more fields of daily life. Starting 25 years ago, already, cinema industry was the first pioneer to introduce the term to a broader audience. Metaverse represents a combination of virtual and augmented reality, with augmented reality representing the biggest percentage (70%). The digital environment contains everything a 'real' world could have, including cities, real estate, schools, clubs, or restaurants. The fields that Metaverse can be applied is very broad as well. From economy to finance (Ko et al., 2021), to social life and work, eHealth (Misirlis et al., 2021) or even real estate (Terdiman, 2007), and lastly education (Collins, 2008) the possibilities keep on rising.

Regarding education, today more schools of all grades incorporate digital tools for their purposes. These facilities are not only a trend, but the post-covid-19 era made it necessary for the figurative function of schools (Park, 2009).

On the other hand, the process of integrating digital tools into education is not an easy process. Problems related to the technological knowledge and infrastructure of the institutions, the cost of new equipment, and the readiness of the personnel and students, may affect the usage of MetaEducation. Moreover, such technology is sometimes subject to acceptance from the involved entities. Faculty members and/ or students may not be aware of the benefits that this state-of-the-art technology may bring to their academic life.

On the other side, the acceptance of such technology is still under research, due to its innovative nature. Cultural differences between students from different countries, institutions' budgets, and different perspectives on the future of education can affect the levels of acceptance of MetaEducation.

## 2. RESEARCH OBJECTIVES

We present a comparison of the two populations regarding their demographics and their intended behavior towards new technologies and digital tools in daily activities related to wellbeing, leisure, education, and social life (Misirlis and Vlachopoulou, 2019, Misirlis et al., 2020). The results of this comparison may reveal differences in culture, perspective and acceptance of such new technologies and tools. The present study proposes a new framework based on the Technology Acceptance Model (TAM) on higher education students on whether the metaverse technology is accepted in the education field or not. Students from The Netherlands and Greece were chosen to answer a survey, in order to compare the results in two populations, that apparently, show cultural differences. Technology acceptance models were used before in the education field (Granić and Marangunić, 2019, Masrom, 2007, Scherer et al., 2019, Briz-Ponce and García-Peñalvo, 2015, Zaineldeen et al., 2020) but to the best of our knowledge, this is the first time that a study is focusing on MetaEducation, comparing two different populations with cultural differences.

The objective of this study is to calculate the correlation factors among students' intention to use MetaEducation and the rest of TAM components: *Attitude (ATT)*, *Perceived Usefulness (PU)*, *Perceived Ease of Use (PE)*, *Self-efficacy (SE) of the metaverse technologies in education*, and *Subjective Norm (SN)*. Furthermore, the students will answer general questions related to their relationship with the new technologies, not only for their education, but for their daily life, as well. That part of the survey, together with the TAM-related questions will provide an overall, more complete image on how students behave/ will behave toward MetaEducation.

Finally, the study presents two theoretical frameworks, one for each country to compare. The produced structural models provide insights to academic teachers, academic ethic committees, policymakers and managers, for further improving the infrastructures and formulating/ adapting the future of teaching.

## 3. LITERATURE REVIEW

The present research will use the well-known TAM, first introduced by Davis (1985) as an extension of Ajzen and Fishbein's Theory of reasoned action - TRA (Al-Suqri and Al-Kharusi, 2015). As aforementioned, TAM is using Subjective Norms, Perceived Usefulness, Perceived Ease of Use, Self-efficacy, and attitude as control variables, dependent and independent to predict the behavioural intention of users toward the use of technology and its acceptance. Several studies focusing on education have been already conducted (Scherer et al., 2019, Al-Emran et al., 2018, Weerasinghe and Hindagolla, 2017) , but to the best of our knowledge, this is the first

one searching the acceptance behavior of technologies applied in education, related to the Metaverse. TAM is a model that explains individuals' intention to accept a certain technology.

The basic concept of TAM is the fact that every individual has the intention of particular behaviors. These behaviors are determined perceived ease of use (PE), perceived usefulness (PU), attitude (ATT), and Self-efficacy (SE). The outcome of the model presents the actual behavior of the individuals.

Metaverse represents a rather new field of research in science. Even if the term, and what this represents, is known for decades, the studies on that matter remain still limited. Despite this limitation, though, researchers understand already that the importance of use of metaverse technologies in education is crucial and important. The study of Collins (2008) examines the use of metaverse in education from a future and theoretical perspective. On the other side, the study of Hwang and Chien (2022) examines the subject from an artificial intelligence perspective. Tlili et al. (2022) start their research with an ethical dilemma, whether MetaEducation is a blessing or not. Together with those, several other studies examine the topic from a theoretical perspective, mostly (Singh et al., 2022, Contreras et al., 2022, Suh and Ahn, 2022). The results in the next paragraphs show several common behaviors but some differences, as well, mostly because of the different cultural backgrounds of our sample. The aforementioned review is based on the most current theories and definitions related to TAM, and in specific to the education field. Metaverse is a new technology to apply in education, therefore highly targeted articles are still difficult to find. Despite that, though, general articles related to education and technology acceptance were reviewed (Misirlis and Munawar, 2022).

## 4. RESEARCH HYPOTHESES

The study tests and supports the following hypotheses:

- University students' **Behavioural Intention** to use MetaEducation is affected by:

H1a: Attitude, H1b: Perceived Usefulness, H1c: Perceived Ease of Use, H1d: Self-efficacy, H1e: Subjective Norms.

- University students' **Attitude** toward the use of MetaEducation is affected by:

H2a: Perceived Usefulness, H2b: Perceived Ease of Use, H2c: Self-efficacy, H2d: Subjective Norms.

- University students' **Perceived Usefulness** to use MetaEducation is affected by:

H3a: Perceived Ease of Use, H3b: Self-efficacy, H3c: Subjective Norms.

- University students' **Perceived Ease of Use** towards the use of MetaEducation is affected by:

H4a: Self-efficacy, H4b: Subjective Norms.

## 5. METHODOLOGY

The proposed model with the hypotheses is tested with Structural Equation Modeling (SEM), using maximum likelihood estimation. SEM differs from other similar tools, and this is what makes SEM a more trustworthy model, since it includes an error on the measurements, assuming that the used variables cannot be measured with absolute precision. With SEM, a construction model is first used. This model represents the theoretical components to be observed, its components correlations with the estimated errors. In the first phase, the model is still theoretical. Once the structural equations are applied, a structural model is created, showing the weights among the components and whether these correlations can be accepted or rejected.

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Based on previous research, a theoretical model was developed. Figure 1 presents the model to be tested and analyzed.

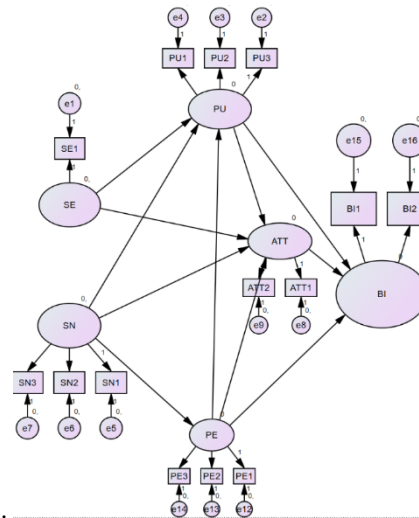


Figure 1. Theoretical model of our research

The directed arrows show the relationship between the latent variables and the observed ones. PE and PU can be considered cognitive constructs. Based on the above theoretical model, the dataset of our survey was applied to produce the measurement model (Figures 2 & 3).

### 5.1 Analysis of the Measurement Models

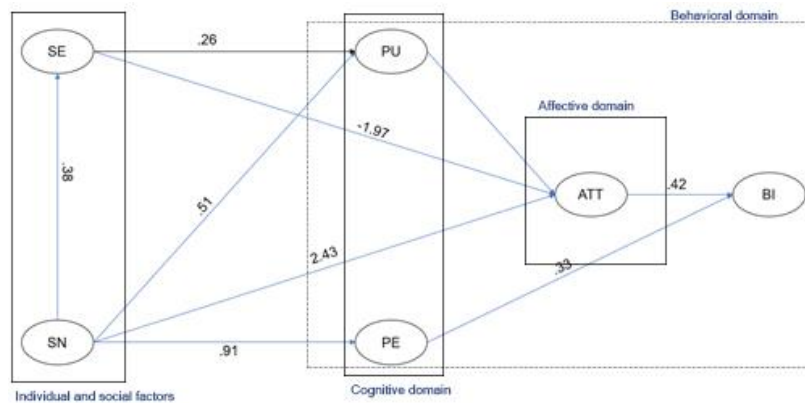


Figure 2. Structural model – Dutch dataset

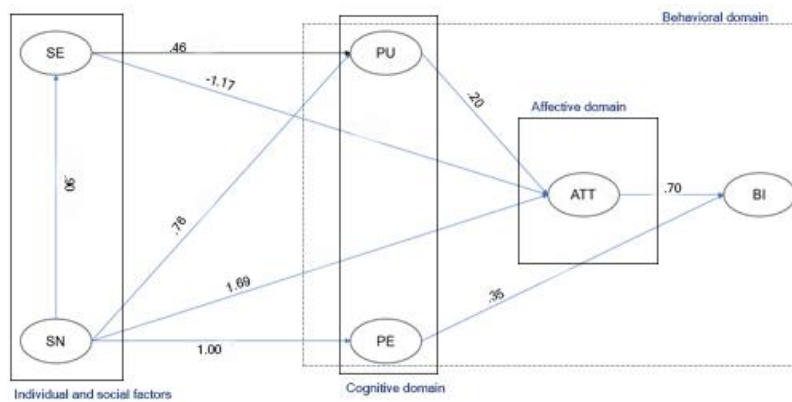


Figure 3. Structural model – Greek dataset

## 5.2 Dutch Structural Model

Self-efficacy is negatively correlated to attitude, but on the contrary, subjective norms are positively correlated. There is no strong correlation between Perceived Ease of Use and Attitude or Perceived Usefulness and Attitude. The overall model is still weak, even if it is statistically acceptable. We notice that the final behavior of students is slightly affected by the Perceived ease of use but not by the perceived usefulness.

## 5.3 Greek Structural Model

Self-efficacy is negatively correlated to attitude, but on the contrary, subjective norms are positively correlated. There is no strong correlation between Perceived Ease of Use and Attitude or Perceived Usefulness and Attitude. The overall model is still weak, even if it is statistically acceptable.

In correlation with the Dutch sample, we notice a less strong correlation between SN and ATT for the Greeks, as well as between SE and ATT. The positive correlations between SN and PU, SE and PU, ATT and BI, and PE and BI, are stronger in the Greek sample.

## 6. DEMOGRAPHICS AND DATASETS

The present study obtained 513 valid answers from university students in The Netherlands (n:285) and Greece (n:228). Students were asked some preliminary questions in order to understand better their relationship to the digital world and how familiar they are with Metaverse and new/ upcoming technologies. Table 1 represents the gender balance of our sample in The Netherlands and in Greece.

Table 1. Gender percentages in both countries

	<b>The Netherlands (n: 285)</b>	<b>Greece (m: 228)</b>
<b>Gender</b>	Male: 63.4%	Male: 60.5%
	Female: 32.4%	Female: 38.2%
	Other/ prefer not to say: 3.2%	Other/ prefer not to say: 1.3%

Greeks are more positive, respect to the Dutch population, towards the future of how education will be conducted (92.1% vs. 72.4%). Greeks believe that their social life and their creativity depend more on technology, respect to the Dutch population (67.9% vs. 55.6% and 69.3% vs. 42.9%, respectively). Greeks turn to technology to unwind more than the Dutch do (85.6% vs. 66.1%). When it comes to partying, the Greeks prefer physical parties at 94.7%, respect to the Dutch who would not mind assisting a digital party a 30%. Analytically for the rest of the questions, we obtain:

## 7. STUDENTS AND DIGITAL WORLD - DISCUSSION

The two populations, with some slight differences present a common behavior toward the MetaEducation and the use of technology in their daily activities. We would expect some differences on the way people party or train physically, for example. Using the Hofstede's calculator for the two countries' cultural dimensions we obtain the following figure (the blue column represents Greece and the purple one the Dutch population).

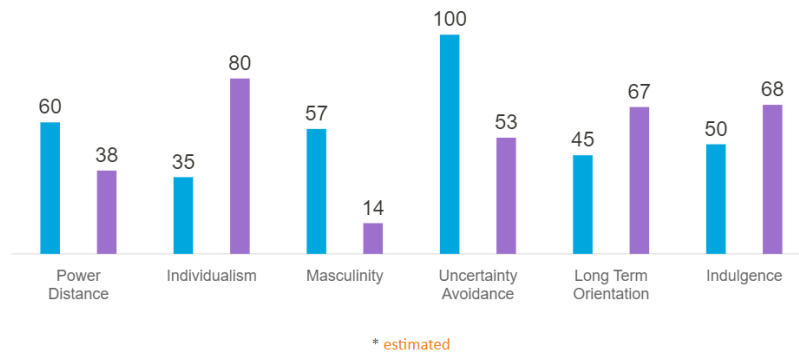


Figure 4. Cultural dimensions of Greece and The Netherlands (source: www.hofstede-insights.com)

Despite those differences, the majority of the findings as well as the correlations from the two structural models, is similar. An explanation for that, would be the lack of knowledge of what MetaEducation is and what can offer to the future of education, despite the fact that the vast majority of our respondents are Gen Zs, using technology for almost everything in their daily activities. The fact that the correlations of the structural models are weak, as well as the percentages to the generic questions, shows that students, trust the technology but probably ignore the usefulness, the easiness and the benefits of it. Metaverse represents the future. MetaEducation, inevitably, represents the future of education. Of course, it is still early to know how or when, as it is still early to know the cost and the infrastructure needed for that. On the other side, the education field which acted as a great pioneer during the Pandemic of COVID-19, being one of the first fields to incorporate the necessary technology and transform itself in hybrid or fully digital in a few days. We strongly believe that something similar will occur with the MetaEducation. When it will be the right, mature time, new technologies will be incorporated, adopted and accepted from Academia as it happened before.

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