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Teachers' Attitude Scale Towards Metaverse Use: A Scale Development Study

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Abstract
The metaverse, or virtual universe, is a hypothetical iteration of the internet that supports persistent online 3D virtual environments through traditional personal computers as well as virtual and augmented reality devices. The "metaverse", which has been on the agenda in recent days, had a great impact both in Turkey and in the world. In other words, a virtual world, represented by a metaverse avatar, where users can shop, socialize, participate in leisure activities and learn. The concept of metaverse, which came to the fore with billions of dollars of investment plans by companies such as Facebook, Microsoft, Roblox and Epic, is seen as the next stage in the development of the internet. It is possible to access this virtual reality universe using VR headsets, augmented reality (AR), smart watches and smart glasses. With the increasing popularity of online learning, educators, trainers, institutions are looking for ways to make distance learning more interesting and interactive. There are 4 important ways that the metadata store can help with this; creating an engaging and life-like online classroom, encourage communication, supporting immersive learning and enriching gamification. Due to the effect of the pandemic on digitalization, many different models have been developed in education methods and three-dimensional models have been focused on, where students' readiness levels and interaction with each other are higher. Metaverse is one of these methods. In this sense, it is important to get opinions from teachers and students, who are the most important stakeholders of education, in the use of metaverse technologies, which make a quick introduction to learning and teaching processes, in educational environments. It is important to determine the readiness levels of students and teachers, especially for the use of metaverse technologies in teaching environments. In the light of all these, this study was based on evaluating the teachers' attitudes towards metaverse technologies by considering the teacher dimension. It is aimed to present a valid and reliable scale that can be developed for the relevant subject. The validity and reliability studies of the scale were carried out on a total of 301 computers teachers working as permanent teachers in a city in Türkiye. The three-factor structure (perceived benefit, readiness and satisfaction) of the scale with an eigenvalue greater than 1 explains 78.42% of the total variance. A scale whose validity and reliability have been proven according to the results of EFA and CFA has been added to the literature. Moreover it is foreseen that the research will be important since it is the first scale developed in Türkiye on the metaverse.

Keywords: Metaverse Technologies, Teacher' Attitudes, Scale Development, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA)

1. Introduction

Lee et al., (2021), states that there is a paradigm change in information and communication technologies every ten years; He states that communication with computers in the 1990s, the web in the 2000s, and the mobile in the 2010s have changed, and the keyword of the paradigm of the 2020s is Metaverse. Even though the concept of metaverse is increasing its popularity day by day, the discussions about it in the academic field are limited (Duan et al., 2021).

Some researchers explain that the Metaverse has been on the agenda lately, with the impact of COVID-19 on digitalization (Kang, 2021& Kuş, 2021). When the literature is examined, it is stated that COVID-19 accelerates the transition to the digital world, which offers solutions regardless of the physical world and different variables. Lee (2021), on the other hand, justified the rise of the Metaverse with the continuity of non-face-to-face communication during the COVID-19 pandemic. On the other hand, it is emphasized that the popularity of Metaverse started to increase an average of one year after the start of the pandemic, recorded a sharp rise in April of 2021 for the first time and gained momentum after the name of Facebook Inc. was changed to Meta. It is stated that the technologies that form the basis of Metaverse have been in a natural development process for a long time and technology companies' investments in this sense have accelerated. In this context, Facebook uses realistic avatars of a person. It created a virtual reality project called Codec Avatar (Tech@Facebook, 2019) focused on designing. ByteDance, the creator of TikTok, took the step to create its own Metaverse and acquired the virtual reality startup Pico Interactive, which ranked third in sales of virtual reality-oriented headsets in the first quarter of 2021 (Borak, 2021).

Metaverse-supported training platforms available 2D-based by overcoming the limitations of online and remote classrooms it can increase students' active participation by bringing together lecture (theory) and practice (practice) (Kye et al., 2021; Mystakidis, 2022). At the point of moving education to the Metaverse, the information and guidance to be provided to students and teachers in the transition process is important (MacCallum & Parsons, 2019). Lee et al. (2022) experienced an effective and successful training process in 3D-based aircraft maintenance simulation compared to the video-based course with the same content. During the augmented reality supported education process, students were able to continue instant communication with their classmates by listening to the experts and practicing. Via Metaverse, high costs in education can be minimized. For example, instead of building a new planetary house for education and training in the near future, it may make more sense to build the same in the digital world for 1% of the cost (Damar, 2021). Moreover in the metaverse environment, holistic support of learning processes in a visual, auditory and kinesthetic way will enable effective learning (Lee & Hwang, 2022).

In the literature, the effect of metaverse technology applications and its positive results on learning from virtual primary school groups to higher education are emphasized (Suh & Ahn, 2022; Sahandar, 2019; Sahin, 2016). However, the main thing to consider is how to integrate students' holistic skills, senses and knowledge development into technology platforms in the educational setting of the future. It is important to determine the readiness levels of students and teachers, especially for the use of metaverse technologies in teaching environments. In the light of all these, this study was based on evaluating the teachers' attitudes towards metaverse technologies by considering the teacher dimension.

1.1. Purpose and Important of the Research:

Technology is advancing rapidly, and with Mark Zuckerberg, the founder of Facebook, announcing that the company will be renamed Meta, the tech world has started to speak a brand new term: “Metaverse”, which many tech experts call “the future of Web 3.0”. Meta means "after, beyond" in Greek. The Oculus VR headset has made a huge investment in VR, and with Facebook's acquisition of Oculus, these headsets have been made cheaper compared to their competitors. Aiming to transform the company from being a social media company into a metaverse company in the next 5 years, Zuckerberg introduced her virtual offices called "Horizontal Workrooms" and took an important step in moving the business world to Metaverse. The Oxford dictionary has declared the word of 2022, which we are preparing to leave behind. With the popular vote, the word of the year was metaverse (virtual universe).

Metaverse, which is derived from the combination of the word meta and the words "universe" in English, also means "beyond the universe". You can think of it as a world where the world on the internet is brought to life or rendered in 3D. The use of the concept of metaverse, which has entered human life so quickly, in teaching environments has also been under the spotlight. It is important to determine the readiness levels of students and teachers, especially for the use of metaverse technologies in teaching environments. It is aimed to present a valid and reliable scale that can be developed for the relevant subject. When the literature is examined, it has been determined that there is no relevant scale in Turkey within the scope of the subject. In this sense, it is foreseen that this study will be a first and fill the gap in the literature. Besides, it will be possible to evaluate teachers' perspectives and attitudes towards a new technology based on the scale data. In line with these results, teacher competencies in the use of related technology will be questioned and improvement measures can be taken.

2. Method

This study is a scale development study. Scale development is the process of developing items that will stimulate the characteristics of individuals to be measured and appropriate response categories to these stimuli. The development stages of the scale and the relevant sections are presented below:

2.1. Study Groups

The study group of the research consists of 301 computers teachers working as permanent teachers in a province in Türkiye. The demographic characteristics of the participants are presented in tables below:

Table 1: Gender

Gender	**f**	**%**
Female	71	76.4
Male	230	23.6
Total	**301**	**100**

Table 2: Branch

Branch	**f**	**%**
Numerical	139	46.2
Verbal	94	31.2
Vocation	68	22.6
Total	**301**	**100**

Table 3: Education Status

Education Status	**f**	**%**
Degree	139	46.2
Master	94	31.2
Phd	68	22.6
Total	**301**	**100**

Table 4: Teaching Time

Teaching Time	f	%
1-5 years	87	28.9
6-10 years	65	21.5
11-15 years	54	17.9
16-20 years	48	15.9
20 years and more	47	15.8
Total	**301**	**100**

Table 5: Have you had computer education?

Computer Education	f	%
Yes	186	61.8
No	115	38.2
Total	**301**	**100**

Table 6: Have you had design education?

Design Education	f	%
Yes	172	57.1
No	129	42.9
Total	**301**	**100**

Table 7: Do you use Digital Materials in your lessons?

Digital Materials	f	%
Yes	115	38.2
No	186	61.8
Total	**301**	**100**

Table 8: Is there any digital material that you have developed yourself?

Develop digital materials	f	%
Yes	136	45.2
No	165	54.8
Total	**301**	**100**

Table 9: Did you receive Instructional Design Training?

Instructional Design	f	%
Yes	137	45.5
No	164	54.5
Total	**301**	**100**

Table 10: Your Institution

Institution	f	%
Yes	94	31.2
No	207	68.8
Total	**301**	**100**

2.2. Data Collection Tool

As a first step, an item pool of 17 items based on theoretical foundations was created as a result of a comprehensive literature review. In addition to this, 9 items were added to the scale that reveal the demographic characteristics of the instructors. The data were analyzed with the SPSS 21 package program.

2.3. Introduction of Scale

The scale consists of 17 items and 3 dimensions, the naming of the dimensions was made by the researchers. These dimensions are perceived usefulness, readiness, satisfaction. The perceived usefulness consists of 6 items, readiness 6 and satisfaction 5 items.

2.3. Validity and Reliability Study of the Scale

The three-factor structure of the scale with an eigenvalue greater than 1 explains 78.42% of the total variance. The validity and reliability studies carried out prove its consistency within itself. In this study, the construct validity of the related scale was examined as a validity study. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) was performed for the construct validity of the scale. Kaiser Meyer Olkin, who tested the adequacy of the scale as a result of EFA (KMO) value was found to be .88. According to the results of the exploratory factor analysis, the 3-dimensional structure of the scale was confirmed. Accordingly, it was determined that the final conformity indices of perceived benefit, readiness and satisfaction dimensions were within the desired limits.

2.3.1. Validity of the scale

	Component		
	1	2	3
S11	,834		
S12	,785		
S13	,731		
S14	,665		
S15	,653		
S16	,599		
S23		864	
S24		752	
S25		,653	
S17			800
S18			762
S26		,647	
S19			667
S27		,556	
S20			689
S21			591
S22			,537

Opening factor analysis (AFA) was performed to demonstrate the distribution of scale items on the sample. The essence of the scale with a three -factor structure of 17 items greater than 1 explains 78.42 %of the total variance. The fact that the variance ratio explained is over 30 %is sufficient in the test development studies in behavioral sciences (Rennie 1997; Buyukozturk, 2018). The results obtained after validity and reliability studies prove that the scale has a consistent structure within itself.

2.4. Exploratory Factor Analysis (EFA)

Since the data obtained from the scale were normally distributed, the "Principal Component Analysis" method was used in the factor analysis process. The most widely used of these is the Principal Components method (Hutcheson & Sofroniou, 1999). In order to carry out exploratory factor analysis, first of all, the Kaiser-Meyer-Olkin (KMO) test, which tests the adequacy of the scale of "Teachers' attitude towards Metaverse use", was examined. The KMO

value was found to be .88. According to Field (2000), a KMO limit value greater than .80 indicates a "perfect conformity ". Rotation was performed to show the status of the items in the factors. The results obtained from EFA confirmed that the scale has a three-dimensional structure. These dimensions are “Perceived Benefit”, “Readiness” and “Satisfaction” and are seen in Figure 1. In addition, the load values in the factors with the items and the common factor variance are presented in Figure 1 and Table 10.

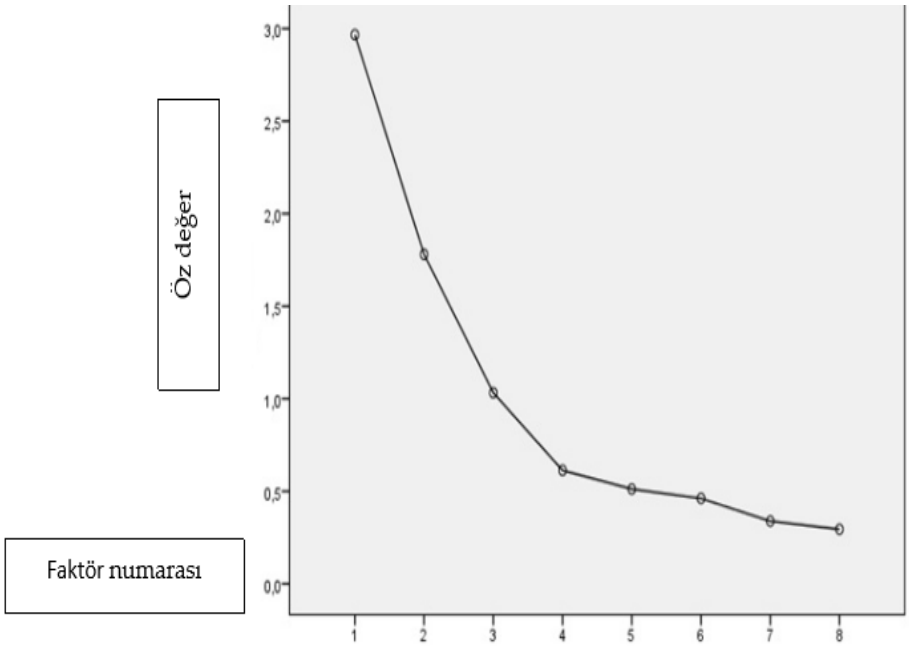

Figure 1: Eigenvalue-factor number graph of Teachers' Attitude Scale towards Metaverse Use Scale

Table 10: Results of Exploratory Factor Analysis

	Initial Eigenvalues			Sum of Subtraction of Square of Charges			Rotation Sum of Square of Charges		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1	12.165	53.272	57.282	12.365	53.272	53.262	5.643	22.782	22.882
2	2.335	9.625	62.183	2.531	9.725	62.183	4.346	16.745	41.733
3	1.203	5.410	66.798	1.503	5.410	66.798	4.893	15.872	58.412

2.5. Reliability of the Scale

In order to test the reliability of the study, the internal consistency coefficient of the 3-factor structure of the scale consisting of 17 items, which was determined by Cronbach Alpha, was determined as .88. At the end of the statistical analyzes for the sub-dimensions of the scale, the internal consistency coefficients calculated with Cronbach Alpha were .90 for the perceived benefit dimension; .84 for the readiness dimension and .85 for the satisfaction dimension were determined. According to the researchers, reliability increases when the reliability coefficient approaches 1 (Huang, Ryan, Zaber & Palmer, 2014; Sekaran, 2003). In this context, it can be interpreted that the reliability coefficients of each of the relevant dimensions of the scale are "excellent".

2.5.1. Perceived Benefit Confirmatory Factor Analysis

The confirmatory factor analysis results of the Benefit Factor of the scale, which was evaluated within the conceptual framework, are shown in Figure 2. In Figure 2, S11, S12, S13, S14, S15, S16 are the question codes representing the observed variables.

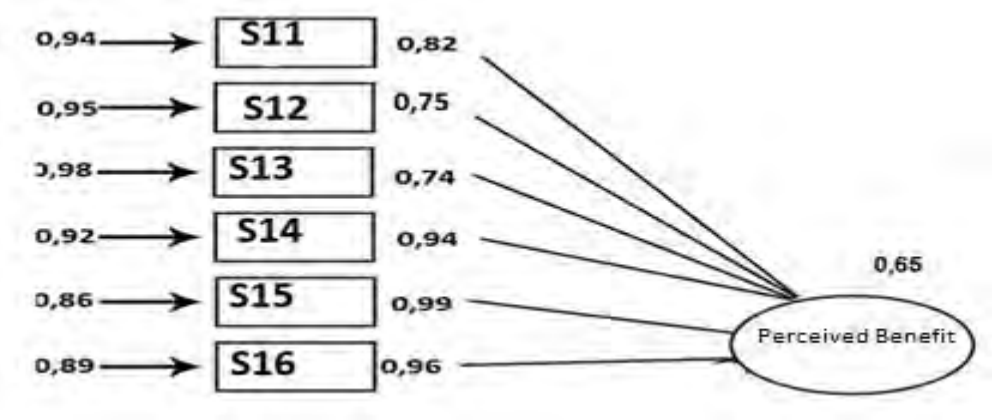

Figure 2: Perceived Benefit Confirmatory Factor Analysis

In the CFA in Figure 2, the values on the arrows directed from the Benefit to Learning factor to the observed variables show the standard regression coefficients (confirmative factor analysis loads) of each observed variable used to explain the factor. The error values (1-R^2 results) of the observed variables in Figure 2 are seen on the arrows directed from the error values to each observed variable. In the DFA in Figure 2, the values on the arrows directed from the Benefit to Learning factor to the observed variables. It shows the standard regression coefficients (confirmative factor analysis loads) of each observed variable used to explain the factor. The error values (1-R^2 results) of the observed variables in Figure 2 are seen on the arrows directed towards each observed variable from the error values. When Figure 2 is examined, it is observed that the strongest question in the perceived benefit Factor is question 15 and the weakest question is question 13.

2.6. Benefit Factor Conformity Indices

Table 11: Perceived Benefit Factor Conformity Indices

Properties	**Conformity Indices**					
	χ^2/df	**GFI**	**AGFI**	**TLI**	**CFI**	**RMSEA**
	41,6/ 17	,912	,976	,905	,922,	,049

The final conformity indices of the utility factor were observed to be within the desired limits as seen in Table 11, and the relationships between the variables are seen in Figure 2.

2.6.1. Readiness Confirmatory Factor Analysis

The confirmatory factor analysis results of the readiness factor of the scale, which was evaluated within the conceptual framework, are shown in Figure 3. In Figure 3, S17, S18, S19, S20, S21, S22 are the question codes representing the observed variables.

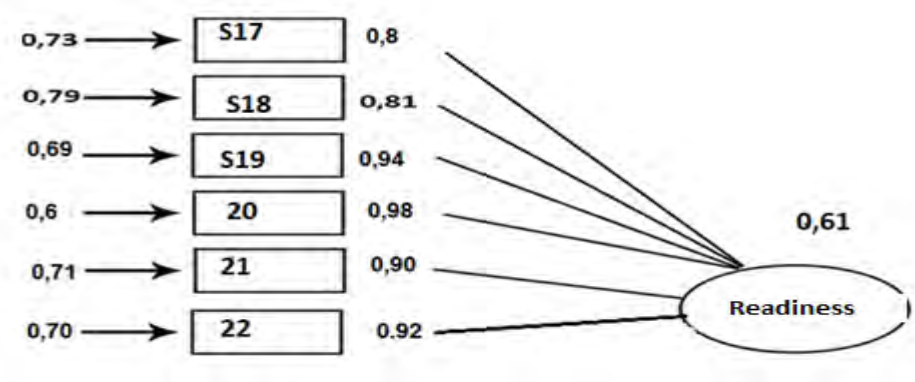

Figure 3: Readiness Confirmatory Factor Analysis

In the CFA in Figure 3, the values on the arrows directed from the Readiness factor to the observed variables show the standard regression coefficients (confirmative factor analysis loads) of each observed variable used to explain the factor. The error values (1-R^2 results) of the observed variables in Figure 3 are seen on the arrows directed towards each observed variable from the error values. When Figure 3 is examined, it is observed that the strongest question in the Readiness Factor is question 20, and the weakest question is question 17.

2.7. Readiness Factor Fit Indices

Table 12: Readiness Factor Confirmatory Indices

Properties	**Conformity Indices**					
	χ^2/df	**GFI**	**AGFI**	**TLI**	**CFI**	**RMSEA**
	78,2/ 17	,918	,923	,911	,942	,052

The final conformity indices of the readiness factor were observed to be within the desired limits as seen in Table 12, and the relations between the variables are seen in Figure 3.

2.7.1. Satisfaction Confirmatory Factor Analysis

The confirmatory factor analysis results of the Satisfaction Factor of the scale, which was evaluated within the conceptual framework, are shown in Figure 4. In Figure 4, S23, S24, S25, S26, S27 are the question codes representing the observed variables.

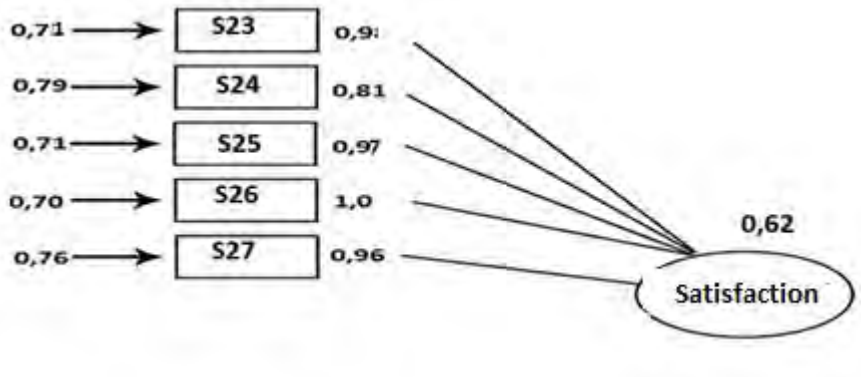

Figure 4: Readiness Confirmatory Factor Analysis

2.8. Satisfaction Factor Confirmatory Indices

Table 12: Satisfaction Factor Confirmatory Indices

Properties	Conformity Indices					
	χ^2/df	GFI	AGFI	TLI	CFI	RMSEA
	2,2/18	,915	,945	,928	,936	,047

The final conformity indices of the satisfaction factor were observed to be within the desired limits, as seen in Table 12, and the relationships between the variables are seen in Figure 4.

3. Result and Suggestions

Technology is advancing rapidly, and with Facebook founder Mark Zuckerberg announcing that the company will be renamed Meta, the tech world has started to speak a whole new term: The “Metaverse” called “the future of Web 3.0” by many technologists. Meta means "after, beyond" in Greek. Metaverse, which is derived from the combination of the word meta and the words "universe" in English, also means "beyond the universe". Zuckerberg describes the metaverse as a "virtual environment" that one can enter instead of looking at the screen. It's basically a world of endless, interconnected virtual communities where people can meet, work and play using augmented reality glasses, smartphone apps or other devices.

In the light of all these, this study was based on evaluating the teachers' attitudes towards metaverse technologies by considering the teacher dimension. It is aimed to present a valid and reliable scale that can be developed for the relevant subject. The validity and reliability studies of the scale were carried out on a total of 301 computers teachers working as permanent teachers in a city in Türkiye.

Exploratory Factor Analysis (EFA) was performed to show the distribution of scale items over the study group. At the end of EFA, 17 items and 3-dimensional structure of the scale were revealed. These dimensions are; They were named as Perceived Benefit (1), Readiness (2), and Satisfaction (3). Kaiser-Meyer-Olkin for the validity study of the scale.(KMO) value was checked; In this context, the KMO value is .88 detected.

Confirmatory in research to verify the resulting construct Factor Analysis (CFA) procedures were applied. As a result of these processes, it has been proven that the final fit indices of all dimensions of the scale are within the desired limits. In summary, “Teachers' attitude scale towards Metaverse use” has been presented to the literature as a data collection tool with proven validity and reliability. It is possible to use the related scale safely in the evaluation of teachers' attitudes towards metaverse technologies.

In the context of the recommendations; future work, further work groups and at different levels. In addition, cultural and geographical differences created by the relevant scale can be taken into account in order to guide future studies and researchers.

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ATTACHMENTS

TEACHERS' ATTITUDE SCALE TOWARDS METAVERSE USE

Gender Male ( ) Female ( )
Branch ……..
Education Status …….
Teaching Time ……
Have You Taken Computer Education? Yes ( ) No ( )
Have you received Design Education? Yes ( ) No ( )
Do you use Digital Materials in your lessons? Yes ( ) No ( )
Is there any digital material that you have developed yourself? Yes ( ) No ( )
Have you received Instructional Design Education? Yes ( ) No ( )
Your Institution Public ( ) Private ( )

	TEACHERS' ATTITUDE SCALE TOWARDS METAVERSE USE	5	4	3	2	1
	Perceived Benefit (Dimension I)	**Strongly agree**	**Agree**	**Undecided**	**Not Agree**	**Strongly disagree**
1	Useful of Metaverse Applications in Teaching.					
2	Metevarse applications in teaching increase efficiency.					
3	Using Metaverse in education makes teaching easier.					
4	Using Metaverse in education increases productivity.					
5	The use of Metaverse applications in teaching increases academic success.					
6	Using Metaverse in teaching increases persistent learning.					
	Readiness (Dimension II)					
7	I can design my own avatar in metaverse.					
8	I can design my own course materials in Metaverse.					
9	Metaverse technologies affect our health positively.					
10	Metaverse environments make a positive contribution to people's happiness.					
11	Metaverse educational environments make a positive contribution to the improvement of the quality of education.					
12	Metaverse educational environments increase students' motivation to learn.					
	Satisfaction (Dimension III)					
13	Metaverse teaching environments enrich educational materials					
14	I am proficient in Metaverse Design programs.					

15	I am proficient in Metaverse Software programs.					
16	I am proficient in Metaverse Game engines.					
17	I am proficient in the use of Metaverse Hardware tools.					