

Developing the 3D Virtual Reality Environment to be used in the School Adaptation Process of Immigrant Students and Examining its Effectiveness*

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SUMMARY

The purpose of this study was to develop a 3D virtual reality environment and to examine its effectiveness in order to facilitate the adaptation and integration of immigrant students into school. In the study, which was carried out in two stages, the design-based research method and the mixed research method were used, respectively. In the study conducted with eight immigrants and eight Turkish students studying at the 5th-grade level, first of all, the 3D virtual reality environment was developed, and in the next part, the effectiveness of the 3D virtual reality environment was evaluated. During the eight-week design-based research process, various activities were designed regarding the subjects of basic Turkish concepts (introduction expressions, school objects, colours, numbers, etc.), the physical structure of the school, school staff, school and classroom rules that immigrant students needed in their adaptation to school, and a 3D virtual model of the school they attended was created. In the second stage of the study, the 3D virtual reality environment developed was applied to the immigrants and Turkish students for four weeks, and its effectiveness was tested. The results revealed that the attitudes of the immigrant students using the 3D virtual reality environment towards school changed positively and that the 3D virtual reality environment increased their love for the school and helped them know the school and learn Turkish. Although the 3D virtual reality environment used caused negative feelings such as nausea and dizziness in the immigrant students and Turkish students, it was seen that it had a positive effect on the development of positive emotions such as friendship bonds, love, confidence and happiness. It was found that the immigrant students performed all the performance criteria in the application process at a good level and that there was a significant positive difference in their academic achievement scores before and after the application.

Keywords: 3D Virtual Reality Environment, Immigrants and Education, Immigrant Students, Adaptation to School

INTRODUCTION

Migration, which is a phenomenon as old as the history of humanity, has become one of the important elements of social life and today's modern world throughout history. Even though the phenomenon of migration occurs due to compulsory reasons such as war, natural disasters and exile, it is defined as the movement of voluntary individuals and groups in order to reach better living conditions (Alan A. Brown, 1977). In the most general terms, it is referred to as changing the environment in which people live in order to adapt to new situations and conditions that arise due to natural, social and economic reasons, leaving one place and settling in another and changing places (Lucassen, 2022). This phenomenon not only affects the life of individuals and society but also seriously changes the history and social structure of countries. Today, it still continues to affect cultures and the lives of societies (Chiswick & Miller, 2014). The phenomenon of migration has more than doubled in the last two decades and has turned into a serious humanitarian problem. Today, more than 65 million people in the world have had to leave their places of residence due to war, oppressive policies, inequalities in the distribution of wealth, poverty and famine (Allen, 2019). It is seen that the number of international immigrants worldwide is 272 million, which is approximately 3.5% of the world's population (Manning, 2022a). These migration movements, which took place for various reasons, have transformed the modern world into a geography of migration. Globally, the number of international immigrants was 150 million in 2000, reaching 272 million in 2020. It is predicted that this number will exceed 400 million in 2050 (Veeramoothoo, 2022). This situation reveals the importance of the recently increased migration movements. Existing data provide clues that this prediction will come true and that migration

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movements will become an even more important issue at the international level (Manning, 2022b).

Migration movement of people is simply a movement of geographical displacement. However, the real problem is post-migration. Migration, which is a physical act, brings with it numerous psychological and sociological effects (Benček et al., 2022). When people leave a familiar environment, they settle into a new environment with fear and anxiety. Reasons such as alienation, unemployment, homelessness and language and religious differences make the adaptation difficult after migration. Immigrants cannot easily forget the culture and habits they belong to. Adapting to a new life and a new culture is difficult. Children and young people at school age are affected most by these difficulties. For children and young people of school age who are unfamiliar with the host society, adaptation is a difficult process in any case. Children and young people have to face many physical and psychological problems in the process of adaptation to the host society. Communication, understanding, expressing oneself, agreement, problem-solving, meeting needs, learning a new language and integrating into a new culture are some of the difficulties encountered in the adaptation process (McAuliffe & Triandafyllidou, 2022). The problems that immigrant students encounter in education can cause bigger problems by preventing both immigrants and the host society from living together. In this respect, education has a significant effect on ensuring that children and young people in the adaptation process become a part of society and become individuals compatible with society.

Every country in the world develops and implements different policies for the education of children and young people who are foreign to the host society. For example; While Austria and the Netherlands carry out studies on the readiness level of young immigrant students and their families, Bulgaria, Denmark, France, Germany, Sweden, Switzerland and England primarily carry out studies to teach the language of the host country to primary and secondary school students. While Denmark and Germany support students with extracurricular activities, Belgium, France, Greece, Ireland and England focus on teaching the mother tongue by trying to support multilingualism in the classroom (Freyer & Buran, 2022). In Türkiye, an inclusive education policy for immigrant students is preferred (Güldalı & Özmen, 2022). However, despite all these attempts, it has been revealed by various studies in the literature that there are some problems in practice.

In the studies carried out in the field of migration and education, it is seen that one of the most common problems in the education of immigrant students is adaptation to the school climate and to the education process (Canto & Wiese, 2018; Çelik & Ozlem, 2022; Julia et al., 2014; Simeon, 2022; Stockman, 2019). Overcoming adaptation problems in the education process is very important in terms of integrating immigrant students into the education system and social structure of the host country. As a matter of fact, the adaptation of immigrant children to the school climate and to the education process who have reached educational age constitutes the centre of adaptation policies (Tümtaş & Ergün, 2016). Another problem that immigrant students face in education is the language problem (Bianco et al., 2018; Ekici & Tuncel, 2015; Fatma, 2019; Gustafson & Cardozo, 2017; Hurst, 2017; Tanrikulu, 2017; Taşar, 2019; Uebelmesser et al., 2022). Due to the difference between their mother tongue and the official language used at school, immigrant students cannot communicate with teachers and other children or cannot participate adequately in classroom teaching-learning activities. It is seen that the dropout rate of immigrant students who are unsuccessful at school due to language problems is higher than that of others (Gökşen et al., 2008). Another problem that immigrant students face in the education process in the literature is the supply and training of teachers (Brown & Schulze, 2007; Erdem et al., 2017; Figueredo-Canosa et al., 2020; Rotter & Timpe, 2016). Although policies towards teachers on the education of immigrant students have started to develop in recent years, the readiness of teachers in public schools is at a very low level (Emin & Nur, 2018). In addition to these problems in the literature, strengthening the mutual relationships between parents and children, raising awareness of living together in tolerance and solidarity and empowering educators and school administrators for their social integration are seen as problem areas (Tekgöz, 2020).

The most important tool to be used in overcoming these problems in education is undoubtedly technology. Technology provides important contributions to educational activities in every field. The education process is supported at many points, from observing the individual needs of students through technology integration to developing environments for different ways and styles of learning; from increasing the effectiveness of existing teaching strategies and methods to the implementation of innovative and student-centred learning activities; and from enriching formal education processes to moving education beyond the boundaries of time and space (Trilling & Fadel, 2009). In this respect, the application of technological innovations in the integration process of immigrant students, who are included in the education environment, as in every field, provides important gains. The 2021 World Migration Report highlights the importance of using information and communication technologies (ICT) to facilitate immigrants' integration and social adaptation to the host country (Stockman, 2019). The report also mentions the benefits of technology-supported modules for immigrants and learning environments offered to students. Some countries use telecommunication technologies to support the integration of immigrants into the society. Some Dutch and Swiss immigrants use audio-visual learning tools to quickly improve their language proficiency and to support independent learning outside the classroom (Betts et al., 2013). Germany uses smart mobile applications supported in several languages for purposes such as language teaching, the asylum application

process, education and employment processes and acceleration of the integration process. In our country, it is seen that technology-supported attempts for immigrants generally occur in the language acquisition process (Öztürk & Ayça, 2019). Not only research results in the literature regarding what the technologies used for immigrants in the language teaching process are and at what level they are used but also the experiences of students and teachers in this field emphasise that ICT tools will contribute to the integration of immigrant students into the society (Kim, 2018).

3D virtual learning environments, the use of which is increasing day by day in education, are also among the new developing Technologies, and they offer various advantages in the environments where they are used. Advantages such as the effect of innovation, personalisation, ensuring continuity, reaching large masses, long-term use and equal opportunities have a significant potential to support the participation of students in educational activities (Kavacık et al., 2015; Kılıçer, 2008). Considering this potential of technology, it is thought that 3D virtual learning environments will contribute to the solution of the problems that immigrant students face in education. For example, Wang, Lan, Tseng, Lin & Gupta (2019) determined that the use of 3D virtual learning environments in language learning increases cooperative learning, attitudes towards language learning and self-efficacy. Similarly, Merchant et al. (2013) stated that the activities created in 3D virtual learning environments offer higher learning outcomes for K12 and higher education students. With 3D virtual learning environments, it can be easier for immigrant students to express their feelings and thoughts more easily, to feel closer to other individuals, and to create a sense of confidence, support and belonging. In addition, the use of these technologies in the adaptation process of immigrant students to education can be supported to get away from the difficulties experienced by these immigrant students, who come to the host country and who are included in the education environment, to ensure their healthy adaptation to school and to participate in educational activities at school. Moreover, the adaptation process to school is predicted to accelerate with the effect of innovation on immigrant students who are included in the education environment. It is stated that with the use of 3D virtual environments in the classroom, in-class communication will increase and students will be more motivated in the learning process (Charles et al., 2011). In this respect, the use of 3D virtual reality technology, which is one of today's innovative technologies, in the adaptation process of immigrant students to school, and the examination of the effectiveness of the 3D virtual reality environment designed to constitute the main problem in the study. For this purpose, answers to the following questions were sought in the study:

1. How does the 3D virtual reality environment development process take place?
2. What are the views of immigrant students and Turkish students about the use of the 3D virtual reality environment developed?
3. How does the 3D virtual reality environment developed affect the adaptation process of immigrant students to the school environment?

METHOD

Research Model

In this study, which was carried out in two stages, the design-based research method and mixed research method were used respectively. Design-based method is defined as one that aims to design educational practices in a real practice environment with the cooperation of researchers and practitioners (Wang & Hannafin, 2005). Mixed method is a research approach used in the health, social and behavioural sciences in which the researcher collects both quantitative and qualitative data to understand research problems, integrates two datasets with each other and then draws conclusions using the advantages of integrating these two datasets (Creswell, 2017). With the design-based research method, the design, development and evaluation of the 3D virtual reality environment, which was used in the second stage of the study and whose effectiveness was evaluated, was carried out. In the design and development process of the first stage of the study, a 3D virtual reality environment to be used in the adaptation process of immigrant students to the school environment was created. Next, the design dimensions of the 3D virtual reality environment created by piloting were tested. After the pilot application, the usability study of the 3D virtual reality environment was conducted. In the second stage of the study, the effectiveness of the 3D virtual reality environment, which was created by designing a study based on the convergent parallel design, one of the mixed research methods, on the adaptation process of immigrant students to the school environment was examined. The convergent parallel design is carried out by the researcher collecting quantitative and qualitative data simultaneously during the research process (Creswell, 2017). The 3D virtual reality environment developed was applied to immigrant students and Turkish students for four weeks. After the application, data on the immigrant students' adaptation to school, attitudes towards school, academic success, performance and their emotions were collected. In addition, through interviews with immigrant students and Turkish students and teachers, their opinions about the use of the 3D virtual reality environment developed were examined. After the analysis of the quantitative and qualitative data collected, the findings obtained were evaluated together, and general conclusions were drawn.

Study Group

In the pilot application and usability study in the development process of the 3D virtual reality environment in the first phase of the study and in the actual application study, in which the effectiveness of the developed 3D virtual reality environment developed in the second phase of the research was examined, there were three different study groups. The study group in the pilot application within the scope of the design phase of the 3D virtual reality environment consisted of 40 secondary school students studying in the 5th, 6th, 7th and 8th grades of a public school in the province of Tokat. Among the students participating in the pilot program, 50% of them were female; 50% were male; most of them were 7th and 8th-grade students; and the average age was 12.55. The study group of the usability study in the development phase of the 3D virtual reality environment, on the other hand, was made up of 10 secondary school students studying in the 6th, 7th and 8th grades in a state school where there were many immigrant students in the province of Tokat. Five of the students participating in the usability study were immigrants, and five were Turkish students. With each student, a 30-minute application was carried out. In the second stage of the study, the 3D virtual reality environment, the effectiveness of which was examined, was applied in a public school in the province of Tokat. The study group included eight immigrant students and eight Turkish students who had just started their education at the 5th-grade level in the school where the application was conducted and who was in the process of adaptation. The demographic information of the study group in the main application study carried out in the second stage of the research is presented in Table 1.

Table 1. Demographic Information about the Students Participating in the Main Application Study

Student Group	Variable	Sub-variable	Frequency (<i>f</i>)	Percentage (%)
Immigrant students	Gender	Female	6	75.0
		Male	2	25.0
	Age	11	7	87.5
		12	0	0.0
		13	1	12.5
	Year of accommodation in Türkiye (year)	1	2	25.0
		2	2	25.0
		3	1	12.5
	Experience in using VR glasses	Yes	0	0.0
		No	8	100.0
Turkish students	Gender	Female	4	50.0
		Male	4	50.0
	Age	11	5	62.5
		12	3	37.5
	Experience in using VR glasses	Yes	3	37.5
		No	5	62.5

When Table 1 is examined, it is seen that the majority of the participants in the main application study were women; that 11-year-old students were more common; and that 12- and 13-year-old students were immigrant students. The students who had an experience of using 3D virtual reality glasses before the study were Turkish students, and the immigrant students did not have any experience in using 3D glasses. Lastly, the immigrant students participating in the study had been in Türkiye for an average of 3.38 years.

Data Collection Tools

In the study, different data collection tools were used, including an attitude scale, achievement test, interview form, emotions form and performance evaluation form. All data collection tools were prepared in Turkish. Immigrant students with language problems were supported by upper-class Turkish-speaking immigrant students. Information about the data collection tools used within the scope of the study is presented under the headings below.

School Attitude Scale

The "School Attitude Scale" was developed to determine high school students' attitudes towards school (Adigüzel, 2012). The scale, which consisted of five-point Likert-type statements, included 21 items and four factors. The

sub-factors of the school attitude scale were confidence, love, value and harmony. Exploratory factor analysis was performed within the scope of the validity study of the original scale. As a result of the analysis, the total variance explained by the scale was found to be 53.73%. Within the scope of the reliability study, Cronbach's Alpha internal consistency coefficient was checked, and it was calculated as $\alpha=.86$.

As the original scale was developed to determine high school students' attitudes towards school, the validity of the scale was tested on secondary school students by performing confirmatory factor analysis (CFA). For this, the scale was applied to 112 secondary school students. According to the confirmatory factor analysis results, the goodness of fit indices indicated a good model fit ($\chi^2/df= 1.38$, RMSEA=0.049, SRMR=0.043, GFI=0.95, AGFI=0.90, CFI=0.95, NFI=0.94). Fit indices show the fit of the theoretical model (Kline, 2005; Tabachnick & Fidell, 2007; Anderson & Gerbing, 1984; Schermelleh, Moosbrugger & Müller, 2003). Accordingly, it was confirmed that the school attitude scale developed on high school students accurately measured the structure consisting of four factors in secondary school students as well.

School Cohesion Scale

Developed by Springer, McQueen et al. (2009) and adapted to Turkish culture by Durnalı et al. (2018), the "School Cohesion Scale" evaluates students' perceptions of school adaptation and supportive school relationships. The scale was prepared for high school students, and it consisted of eight items. Exploratory factor analysis was performed within the scope of the validity study of the scale. As a result of the analysis, the total variance explained by the scale was determined as 58.15%. Within the scope of the reliability study, Cronbach's Alpha internal consistency coefficient was checked, and it was found to be $\alpha=.80$.

As the original scale was developed to determine high school students' attitudes towards school, the validity of the scale was tested on secondary school students by performing confirmatory factor analysis (CFA). For this, the scale was applied to 119 secondary school students. According to the confirmatory factor analysis results, the goodness of fit indices indicated a good model fit ($\chi^2/df= 1.30$, RMSEA=0.049, SRMR=0.045, GFI=0.97, AGFI=0.90, CFI=0.98, NFI=0.94). Accordingly, it was confirmed that the school cohesion scale developed for high school students also measured school cohesion in secondary school students in a valid way.

Performance evaluation forms

The performance evaluation forms used to measure the student's achievement of the outcomes determined in the learning scenarios prepared in the 3D virtual reality environment were developed by the researchers. The performance evaluation forms were used in two stages: before and during the actual application study. The students' use of 3D virtual reality environment equipment before the actual application study and their performance of getting to know each other, getting to know the school, getting to know the school staff, and recognising the school and classroom rules during the actual application study were evaluated with the rubrics created. Evaluation criteria were determined by taking into account the learning scenarios in the creation of the rubrics. Then, behaviours describing each attitude of the students in the 3D virtual reality environment were created. First, the evaluation criteria were determined by taking into account the learning scenarios for the development of the rubrics. Next, behaviours describing each attitude of the students in the 3D virtual reality environment were formed. Performance criteria from weak to excellent for the behaviours formed were defined. These criteria were graded on a 4-point Likert-type scale as poor (1), moderate (2), good (3) and very good (4). Lastly, for the content validity of the performance criteria defined and their degrees, the opinions of experts from the fields of computer and instructional technologies education, measurement and evaluation, and Turkish language education were taken. During the experts' evaluation, the performance evaluation form was evaluated in terms of the difficulty level, the expression of the performances and appropriateness to the target audience. After the feedback from the experts, the performance evaluation forms were finalised.

Emotions identification form

An emotions identification form was developed by the researchers in order to determine the emotional states of the students while using the 3D virtual reality environment. The emotional states of the students were evaluated before and after the actual application of the emotions identification form. In order to develop the emotions identification form, first of all, the opinions of the teachers working at the school where the immigrant students were located were taken, and a list of emotions was created. Later, the emotions that the immigrant students mostly encountered in the education environment were evaluated by the school counsellor and the school administrator. As a result of this evaluation, the decision to measure the emotions of anger, sadness, fear, discomfort, happiness, fun, curiosity, friendship bond, confidence, surprise and love was made in the study. The emotional states to be measured with an expert in the field of teaching Turkish to foreigners were evaluated in terms of content validity. As a result of this evaluation, the decision to measure the emotional states of the students in the 3D virtual reality environment with a 10-point rubric was made. According to this rating score key, before and after the use of 3D virtual reality environment by the students, the decision made was to use the expressions of "1: It does not represent me at all" and "10: It represents me fully" The face validity of the form developed was examined by an expert in

the field of measurement and evaluation. After the feedback from the expert, the emotions identification form was given its final form.

Achievement test

An achievement test was developed by the researchers in order to evaluate the effectiveness of the 3D virtual reality environment developed within the scope of the study. In line with the learning scenarios in the 3D virtual reality environment, the achievement test was developed considering 14 outcomes related to the subjects, such as basic Turkish concepts to be acquired by the immigrant students, the physical structure of the school, school staff, classroom rules and so on. In the process of developing the achievement test, first of all, an item pool of 30 questions was created for the outcomes determined. Following this, the questions in the item pool were presented to experts in the field of computer and instructional technologies education, measurement and evaluation and teaching Turkish to foreigners, and the items were evaluated in terms of meaning, scope, spelling and face. After the feedback from the experts, the pre-trial form of the achievement test was created. Item difficulty and item discrimination indexes were calculated by applying the pre-test form to 32 students studying at a public school in the city of Tokat. As a result of the analysis, two items with an item discrimination index below 0.20 were removed from the test, and 16 items with an item discrimination index between 0.20 and 0.30 were rearranged. At the end of these arrangements, it was seen that the 28-item final version of the achievement test consisted of four difficult, fifteen average and nine easy questions and that the total difficulty of the test was moderate (0.45). Kuder Richardson-20 (KR-20) reliability coefficient was calculated to examine the reliability of the achievement test. Accordingly, it was seen that the KR-20 reliability coefficient for the final version of the achievement test was 0.78 and that its reliability was good (Büyüköztürk, 2016; Yaşar, 2014). In addition, an item analysis based on the difference between the lower and upper 27% group means was conducted in order to determine how adequate it was in distinguishing between those who knew and those who did not know in terms of the feature measured by the achievement test. The results of the analysis revealed that there was a significant difference between the lower 27% and upper 27% groups according to the achievement test total scores ($t(16)=6.36, p<.05$).

3D virtual school environment interview form

Within the scope of the study, a semi-structured interview form was created by the researchers in order to determine the adaptation of the immigrant students to school, the opinions of Turkish students about these students and the teachers' views about the adaptation of the immigrant students to school and to support the quantitative findings. In the process of developing the interview form, first of all, draft questions in line with the purpose were formed. Afterwards, the draft questions prepared were presented to the opinions of experts in the fields of measurement and evaluation, computer and instructional technologies education and Turkish language education. After the feedback from the experts, the draft questions were finalised, and semi-structured 6-item teacher and student interview forms were created. Lastly, the forms were checked for intelligibility with a Turkish student and an immigrant who expressed himself/herself easily.

Data Analysis and Interpretation

In line with the research purpose, the data were collected between April 2020 and December 2020 based on the permissions obtained. During the data collection process, the immigrant students with language problems were supported by upper-class immigrant students. Before the data analysis, the data obtained were examined, and the data collection tools which were not completed were not included in the analysis process. Content analysis was used in the analysis of the qualitative data, while SPSS (Statistical Package for the Social Sciences) and AMOS program were used in the analysis of the quantitative data (Özdamar, 2004; Field, 2005). The quantitative data collected to answer the research questions were analysed with such descriptive statistics as a percentage, frequency, means, standard deviation and Wilcoxon signed-rank test, which is one of the non-parametric tests.

FINDINGS

Findings Regarding the 3D Virtual Reality Environment Development Process

In the development of the 3D virtual reality environment, the effectiveness of which was evaluated in the second stage of the study, the stages of defining the problem, examining the problem theoretically, arranging the design, pilot application and usability study, which are found in the Type-1 model of the design-based research method, were followed.

Before the design and development process of the 3D virtual school environment, the target group was analysed, and the source of the problem was identified. In order to determine the points that the immigrant students needed in the school adaptation process, a needs analysis was conducted with 23 immigrant students and five teachers in a school where there were many immigrant students. As a result of the needs analysis, it was seen that as the main problem, the immigrant students faced the problem of adaptation to the school and society. The results of the analysis also revealed that 67.8% of the students were unable to adapt to the school. In addition, it was found that the course the students needed most was Turkish (52.1%) and that 62.8% of the students failed to understand what was in the courses. As a result of the needs analysis, the decision to include such subjects as basic Turkish concepts

(expressions used to get introduced, school objects, colours, numbers, and so on), the physical structure of the school, school staff and school and classroom rules in the 3D virtual reality environment was made. As a result of this definition, a school that would facilitate the immigrant students' adaptation to school was designed, and a 3D virtual reality environment that would allow them to learn about the school environment in which they studied was developed. Moreover, the purpose was to design a 3D virtual reality environment which was remarkable, which reflected reality and which was suitable for the targets and physical rules and for the level of the immigrant students studying in secondary school, which had effective orientation, and which supported the development of cognitive, affective and psychomotor skills. Later, the technologies required for the design and development of the 3D virtual reality environment were determined. In the process of developing the 3D virtual reality environment, Oculus Rift S PC-powered virtual reality (VR) glasses, Touch controller, Unity software and Unity Assets Store school environment design were used. In the first six months of the 3D virtual reality environment development process, which lasted 12 months, the problem was defined and theoretically developed, while the design and development processes were completed in the second six months.

In the design study of the 3D virtual school environment, the virtual modelling of the school where the main application study would be carried out in the second stage of the study was done. In the design of the 3D virtual reality environment, first of all, the programming algorithm was implemented; the code was written according to the prepared algorithm; and the interface was designed (Ersoy et al., 2011; Çoban, Kalkan & Hanıslıoğlu, 2017). In order to eliminate the deficiencies in the design process and to make the necessary arrangements, a pilot application was conducted, and as a result of the pilot application, the programming algorithm of the 3D virtual reality environment and the interface design that allowed 20 participants to be connected at the same time was formed. In addition, a total of four characters (avatars) were created in the 3D virtual reality environment (two female and two male characters), and the students were connected to the virtual environment with these avatars. As a result of the pilot study, the graphical interfaces of the 3D virtual reality environment were designed in a way to be close to reality and made ready for the usability study. In Figure 1, the real image of the entrance of the school and the 3D virtual image designed are given together.



Figure 1. Images of the 3D Virtual Reality Environment Design Process

As a result of the usability study carried out in the next stage, some changes were made in the interface area. First of all, it was ensured that the students were randomly connected to the previously opened virtual school environment and that a warning was given in case the username was blank. In addition, a user list was created so that the students could see the participants who had previously connected to the virtual school environment. In the list created, it was possible to see which participant was in which room. Furthermore, the first user who created the virtual room was defined as the administrator, and other users were included in the virtual environment under the coordination of the administrator. In this way, the students were prevented from getting lost in the 3D virtual reality environment. Within the scope of the usability study, it was seen that the immigrant students had problems in their first use of the 3D virtual reality glasses and equipment. The students got confused about some actions and key combinations in relation to head movements and touch control. In order to solve this situation, the training area that was displayed when the students first connected to the 3D virtual reality environment was created, and instructions for use in Turkish, Persian and Arabic were added to this area. In addition, due to the students' confusion regarding the class names and the difficulties in finding the educational tools in the classroom environment, directions to the entrances of the school and classroom and numbers to the educational tools in the classroom environment were added. Lastly, a discussion board was created to increase student-student interaction with people who were simultaneously involved in the 3D virtual reality environment. After making the necessary changes regarding the problems identified as a result of the usability study, the 3D virtual reality environment was given its final form. The visuals regarding the final form are shown in Figure 2.



Figure 2. Images of the PC-Supported 3D Virtual Reality Environment

Findings Regarding the Use of the 3D Virtual Reality Environment

First of all, the views of the immigrant students and Turkish students and, the teachers regarding the use of the 3D virtual reality environment developed were analysed using the content analysis method. As a result of the content analysis, two main themes and a total of fifteen sub-themes belonging to these themes were created in line with the views of immigrant students and Turkish students. Information about the themes created is presented in Table 2.

Table 2. Themes and Sub-Themes Obtained via the Views of the Immigrant Students and Turkish Students about the Use of the 3D Virtual Reality Environment

Student Group	Theme	Sub-theme	Number of Views	
Immigrant students	Positive views	Increasing love of school	13	
		Helping to get to know the school	12	
		Helping learn Turkish vocabulary	10	
		Being fun	10	
		Adapting to school	7	
		Teaching school staff	5	
		Increasing the love of friends	4	
		Contributing to cooperative learning	4	
		Increasing the love of teacher	3	
		Teaching the school and classroom rules	3	
		Being useful	3	
		Negative views	Experiencing nausea	5
			Experiencing dizziness	3
			Confusion in 3D environment	2
			Feeling uncomfortable	2
Turkish students	Positive views	Being fun	16	
		Helping to get to know the school	13	
		Being close to reality	7	
		Being useful	6	
		Contributing to cooperative learning	5	
		Helping to get introduced	4	
	Negative views	Experiencing nausea	4	
		Experiencing dizziness	4	
		Having trouble in adaptation	2	

As seen in Table 2, when the use of the 3D virtual reality environment by the immigrant students and Turkish students was evaluated, the sub-themes of "helping to get to know the school" and "being fun" were similarly high in both groups. The immigrant students stated that the 3D virtual reality environment they used mostly contributed to the titles of "Increasing the love of school", "Helping to get to know the school", "helping learn Turkish vocabulary" and "being fun". The Turkish students, on the other hand, reported that the 3D virtual reality environment they used mostly contributed to the titles of "being fun" and "helping to get to know the school". The most negative opinions expressed by the immigrant students and Turkish students about the use of the 3D virtual reality environment were similar nausea and dizziness in both groups. Some of the views of the immigrant students and Turkish students about the 3D virtual reality environment were as follows (ISx=Immigrant student, TSx=Turkish student);

"...I walked around the 3D environment of the school in 3D. It was very helpful, teacher, I learned a lot about the school, I have never used such a technology before (IS3)."

"...After using this app, I saw the school closer. I saw the classes closer. It helped me get to know the principal's room, teachers' room and servants' room (IS6)."

"...teacher, I learned Turkish. I'm talking to you right now, and you have all the words. I learned them all. It was helpful (IS4)."

"...our school seemed really real, when we put on these virtual reality glasses, we acted as if we were walking around the school (TS5)."

"...I was dizzy because I turned my head too much and because I moved a lot (IS3)."

"... I was dizzy, teacher. There was such a thing as nausea. It was partly because of moving too fast (IS7)."

"...since my eyes were bad, I got a little nauseous, and when I put on the glasses, the glasses got foggy, so I had to take the glasses off. I had a little difficulty with the glasses, teacher (TS3)."

"...my friend was disturbed. While he was dealing with the application, he got dizzy. He didn't want to make the application, and it impressed me for a while. He said he felt dizzy, but I was fine, I did not feel nauseous, or I did not feel dizzy (TS5)."

The two themes and 15 sub-themes belonging to these themes regarding the use of the 3D virtual reality environment developed are shown in Table 3.

Table 3. Themes and Sub-Themes Obtained via the Views of the Teachers about the 3D Virtual Reality Environment

Theme	Sub-theme	Number of views
Positive views	Being beneficial for the education	13
	Increasing the interest in using Turkish	12
	Adapting to school	10
	Bringing positive emotions	10
	The 3D environment's being fun	7
	Helping to establish communication between the students	7
	Being designed for the purpose	7
	Encouragement and developing self-confidence	6
	Persistence in learning	6
	The application's being fun	5
	Getting to know the school staff	2
	Decrease in disciplinary problems	1
Negative views	Nausea	3
	Difficulty in using the joystick	2
	Experiencing problems with adaptation	2

As seen in Table 3, the teachers stated that the use of the 3D virtual reality environment developed contributed to the benefit of education, increasing the interest in using Turkish, adapting to the school and gaining positive emotions. On the other hand, the teachers stated that the use of the 3D virtual reality environment had negative effects on nausea and having problems using joysticks. Some of the teachers' views about the 3D virtual reality environment were as follows (Tx= Teacher):

"...A great work, in terms of introducing our school to our first-time students, they have an idea about where our school is, who and what it consists of and what its building structure is like. There is a very positive feedback on the visuals in terms of endearing the school, and the effects are very nice. That is a very good work in that respect. It was very useful (T2)."

"...it has made a great contribution to our students, especially in terms of adaptation of our immigrant students to school. First of all, the viewpoint about the school, that is, the application of this technique in our school was a great chance for me. It was very nice to meet the viewpoints about the school with this technology. In this virtual learning environment, it is not about the school garden or the classes, that is, all the classes of the school, the rooms, the administration offices, the counselling service, conference halls and playgrounds, I mean visiting all parts of the school was sufficient and memorable (T3)."

"...Some children had nausea, and the reason was that they moved too fast (T1)."

"...They had some problems while using the 3D equipment, but they got used to it until last week (T4)."

Findings Regarding the Effectiveness of the 3D Virtual Reality Environment

In order to evaluate the effectiveness of the 3D virtual reality environment developed in the adaptation process of the immigrant students to school, their realising the learning scenarios, their attitudes towards school, school cohesion, academic success and emotional states were examined.

Attitudes towards school

The pre-test and post-test scores of the "School Attitude Scale" were analysed with the Wilcoxon signed-rank test in order to determine to what extent there was a difference in the attitudes of the immigrant students using the 3D virtual reality environment. The analysis result is shown in Table 4.

Table 4. Wilcoxon Signed Rank Test Results of the School Attitude Scale Pretest and Posttest Scores

Posttest-Pretest	N	Mean Rank	Sum of Ranks	z	p
Negative Rank	0	0.00	0.00	2.52	.012*
Positive Rank	8	4.50	36.00		
Equal	0				

* $p < .05$.

As seen in Table 4, the results of the analysis showed that there was a significant difference between the immigrant students' attitude scores towards school before and after the application. It was found that there was a significant increase in the attitudes of the immigrant students towards school after using the 3D virtual reality environment ($z = 2.52, p < .05$). Considering the mean rank and totals of the difference scores, it was seen that this observed difference was in favor of the positive ranks, that is, the posttest scores. The mean of the immigrant students' attitude scores towards the school before the application was $\bar{X} = 3.29$, while the mean of the attitude scores towards school after the use of the 3D virtual reality environment increased to $\bar{X} = 3.84$. According to these results, it was revealed that the 3D virtual reality environment contributed positively to immigrant students' attitudes towards school.

Adaptation to school

The pre-test and post-test scores of the "School Cohesion Scale" were used to determine the difference in school cohesion of the immigrant students using the 3D virtual reality environment. Whether there was a difference between the school cohesion scores of the immigrant students before and after the application was analysed with the Wilcoxon signed-rank test. Analysis results are shown in Table 5.

Table 5. Wilcoxon Signed Rank Test Results of the School Cohesion Scale Pretest and Posttest Scores

Posttest-Pretest	N	Mean Rank	Sum of Ranks	Z	p
Negative Rank	0	0.00	0.00	2.37	.018
Positive Rank	7	4.00	28.00		
Equal	1				

* $p < .05$.

As seen in Table 5, according to the results of the analysis, it was seen that there was a significant difference between the school cohesion scores of the immigrant students before and after the use of a 3D virtual reality environment ($z = 2.37, p < .05$). The mean score of school cohesion of the immigrant students was $\bar{X} = 2.25$ before the application, while the mean of school cohesion scores increased to $\bar{X} = 3.02$ after using the 3D virtual reality environment. Considering the mean rank and totals of the difference scores, it was seen that this observed difference was in favor of the positive ranks, that is, the posttest score. According to these results, it was found that the 3D virtual reality environment contributed significantly to immigrant students' adaptation to school.

Academic achievement

In order to follow the development of the immigrant students in the 3D virtual reality environment and to determine to what extent they had achieved the relevant outcomes, the change between the pre-test and post-test achievement test scores were examined. For this, the difference between the scores of the immigrant students before and after

the application was analyzed with the Wilcoxon signed-rank test. The results of the analysis can be seen in Table 6.

Table 6. Wilcoxon Signed Ranks Test Results of the Achievement Test Pretest and Posttest Scores

Posttest-Pretest	<i>N</i>	Mean Rank	Sum of Ranks	<i>z</i>	<i>p</i>
Negative Rank	0	0.00	0.00	2.52	.012*
Positive Rank	8	4.50	36.00		
Equal	0				

* $p < .05$.

As seen in Table 6, there is a significant difference between the achievement scores of the immigrant students before and after the use of the 3D virtual reality environment ($z=2.52, p<.05$). The mean of the immigrant students' achievement scores before the application was $\bar{X}=57.75$, while the success scores increased to $\bar{X}=86.00$ after using the 3D virtual reality environment. The Immigrant students' achievement scores increased after the use of the 3D virtual reality environment in terms of introducing themselves with related expressions, getting to know the school and the units of the school, saying where they lived, getting to know the school staff, knowing where to find the school staff, knowing classroom rules and the rules to be followed at school. This finding shows that the use of a 3D virtual reality environment significantly contributed to the increase in the success scores of the immigrant students in getting to know each other, getting to know the school, getting to know the school staff and recognising the school and classroom rules.

Realising the learning scenarios

The immigrant students' realisation of the learning scenarios in a 3D virtual reality environment was evaluated using a four-way rating scale as poor (1), moderate (2), good (3) and very good (4). The mean, standard deviation and frequency values obtained via the analysis of the performance criteria in a 3D virtual reality environment are shown in Table 7.

Table 7. Results of the 3D Virtual Reality Environment Performance Criteria

Outcome	Performance criteria	<i>N</i>	\bar{X}	<i>SD</i>
Completing the 3D virtual glasses and equipment preparations before the application	Students use 3D virtual reality equipment in accordance with the instructions before the application.	8	3.29****	0.43
Getting to know oneself	Introduces himself/herself based on the expressions of introducing oneself	8	3.28****	0.86
	Uses the expressions of introducing oneself in their logical order.	8	3.05****	1.22
Getting to know the immediate environment of the school	Says the name of his/her school.	8	3.00****	0.86
	Recognizes the school and the school units.	8	3.26****	0.75
	Says where s/he lives.	8	3.34****	1.18
	Describes the structure of the school building and the buildings around the school in a 3D virtual reality environment.	8	3.07****	1.25
Getting to know the class and the objects in the class	Says the name of his/her class	8	3.25****	1.03
	Demonstrates course equipment in a 3D virtual reality environment.	8	3.29****	1.12
	Says and shows numbers.	8	3.25****	1.16
	Says and shows the names of colours.	8	3.13****	1.24
Getting to know the school staff	Gets to know the school staff.	8	3.39****	0.32
	Shows the departments where the school staff are located.	8	3.33****	0.43
Recognising the duties of the school staff	Says the duties of the school staff.	8	2.67****	0.86
Learning the school rules	Says the rules to be followed at school.	8	3.86****	0.20
Learning the classroom rules	Says what the class rules are.	8	3.93****	0.05

*Poor = $1.00 < \bar{X} \leq 1.75$; **Average = $1.75 < \bar{X} \leq 2.50$; ***Good = $2.50 < \bar{X} \leq 3.25$; **** Very good = $3.25 < \bar{X} \leq 4.00$

As seen in Table 7, the immigrant students' realising the learning scenarios were generally at a good level in terms of the performance criteria mean scores. There were no performance criteria that the immigrant students completed at weak ($0.00 < \bar{X} \leq 1.75$) and moderate ($1.75 < \bar{X} \leq 2.50$) levels. In total, it was revealed that of the 16 performance criteria, seven of them were completed well ($2.50 < \bar{X} \leq 3.25$), and the other nine were completed very well

($3.25 < \bar{X} \leq 4.00$). The immigrant students fulfilled the performance criteria of "Expresses the duties of the school staff" at least ($\bar{X}=2.66$) and "Tells what the class rules are" at most ($\bar{X}=3.81$). This finding shows that the 3D virtual reality environment developed made a positive contribution to the successful completion of the performance criteria determined in the learning scenarios by the immigrant students.

State of emotions

The emotional states of the immigrant students were measured separately before and after using the 3D virtual reality environment. The difference between the scores was analysed with the Wilcoxon signed-rank test. The analysis results are shown in Table 8.

Table 8. Wilcoxon Signed Ranks Test Results of the Mean Emotions Scores Before and After the Application

	WEEK 1				WEEK 2				WEEK 3				WEEK 4			
	\bar{x}_1	\bar{x}_2	Z	p	\bar{x}_1	\bar{x}_2	z	p	\bar{x}_1	\bar{x}_2	z	p	\bar{x}_1	\bar{x}_2	z	p
Anger	1.13	2.00	-1.34	0.18	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00
Sadness	1.13	2.75	-1.60	0.11	1.00	1.00	0.00	1.00	1.00	1.38	-1.00	0.32	1.38	1.13	-1.34	0.18
Fear	2.75	1.63	-1.77	0.08	1.25	1.00	-1.00	0.32	1.50	1.50	0.00	1.00	1.50	2.25	-0.45	0.65
Discomfort	3.50	1.75	-1.64	0.10	2.63	2.88	0.00	1.00	2.00	3.25	-1.41	0.16	3.25	3.50	-1.00	0.32
Happiness	9.00	9.25	-0.38	0.71	9.50	9.38	0.00	1.00	7.63	9.00	-1.34	0.18	9.00	9.12	-1.34	0.18
Fun	9.13	9.38	-1.00	0.32	9.88	9.75	-0.45	0.65	9.00	9.00	0.00	1.00	9.00	8.25	-1.41	0.16
Curiosity	9.12	9.12	0.00	1.00	8.63	10.0	-1.63	0.10	9.12	8.13	-0.45	0.65	8.50	7.75	-1.41	0.16
Friendship	5.63	9.00	-2.12	0.03*	8.88	9.88	-1.30	0.19	8.88	10.0	-1.00	0.32	10.0	10.0	0.00	1.00
Confidence	5.38	8.25	-1.89	0.06	8.00	9.13	-1.84	0.07	9.50	9.50	0.00	1.00	9.50	10.0	0.00	1.00
Surprise	2.88	3.25	-0.37	0.72	1.63	1.00	-1.00	0.32	2.13	1.00	-1.00	0.32	1.00	1.00	0.00	1.00
Love	2.75	5.00	-1.19	0.23	4.63	6.00	-0.74	0.46	5.50	7.25	-0.76	0.45	9.38	9.38	0.00	1.00

* $p < .05$; X_1 , mean value before the application, X_2 , mean value after the application

As seen in Table 8, when the change in the emotional state of the immigrant students regarding the use of the 3D virtual reality environment was examined, it was seen that the use of the 3D virtual reality environment only contributed significantly to the increase in the emotion of friendship bond ($z=-2.12$, $p<.05$). Although there was a positive difference in other emotions, it did not seem to make a significant contribution. During the four-week application period, the highest increase in the mean score occurred in the emotion of love ($\bar{X}_{week1}=2.75$; $\bar{X}_{week4}=9.38$); there was a positive increase in the emotions of friendship bond ($\bar{X}_{week1}=5.63$; $\bar{X}_{week4}=10.00$), confidence ($\bar{X}_{week1}=5.38$; $\bar{X}_{week4}=10.00$) and happiness ($\bar{X}_{week1}=9.00$; $\bar{X}_{week4}=9.12$); there was a decrease in the emotions of curiosity ($\bar{X}_{week1}=9.12$; $\bar{X}_{week4}=7.75$), fun ($\bar{X}_{week1}=9.13$; $\bar{X}_{week4}=8.25$), surprise ($\bar{X}_{week1}=2.88$; $\bar{X}_{week4}=1.00$) and anger ($\bar{X}_{week1}=1.13$; $\bar{X}_{week4}=1.00$); and there was no change in the emotions of sadness ($\bar{X}_{week1}=1.13$; $\bar{X}_{week4}=1.13$), fear ($\bar{X}_{week1}=2.75$; $\bar{X}_{week4}=2.25$) and discomfort ($\bar{X}_{week1}=3.50$; $\bar{X}_{week4}=3.50$). This finding showed that the use of the 3D virtual reality environment increased the immigrant students' emotions of friendship bond, love, confidence and happiness, as well as decreased their emotions of anger.

CONCLUSION AND DISCUSSION

In the study, the development of a 3D virtual reality environment and the effectiveness of this environment were examined in order to facilitate the adaptation and integration of immigrant students into school. Within the scope of the study, first of all, the development process of the 3D virtual reality environment was examined. The 3D virtual reality environment was developed in three stages, namely design, development and actual implementation, in a cyclical design where improvements were made by taking feedback in each stage. In the literature, it is reported that achieving high-level learning is directly related to well-designed environments as the 3D design organisation exhibits a relational structure (Baydaş, 2017; Sanchez et al., 2000). In addition, it is pointed out that it will be advantageous to use interactive materials which meet the needs of the target audience and which are suitable for the content (Göktaş, 2017; Nguyen & Dang, 2017; Richey & Klein, 2005; Wang, 2018). It is stated that student-student interaction, student-teacher interaction and student-content interaction should be evaluated in order to create realistic environments (Parks & Roberts, 1998; Tokel & Topu, 2017). It should also be noted that a pilot application before the actual implementation affects the development process positively (Topu & Goktas, 2019). Considering all these, it could be stated that the 3D virtual reality environment, designed to facilitate the adaptation of immigrant students to school, is suitable for the development stages specified in the literature and is an effective educational environment that includes the design suggestions in the literature.

The effectiveness of the 3D virtual reality environment developed was also examined in the study. First of all, immigrant students and Turkish students who used the 3D virtual reality environment expressed positive opinions about the 3D virtual reality environment developed. It was understood from the experiences of both immigrant students and Turkish students that the 3D virtual reality environment contributed to getting to know the school,

having fun and learning cooperatively. It was observed that the 3D virtual reality environment increased the love for school in the immigrant students and helped them know the school and learn Turkish. For the Turkish students, on the other hand, it was seen that the 3D virtual reality environment helped them get to know the school and made them feel close to reality. Studies in the literature reported that ICT tools supported and positively contributed to the integration processes of immigrants (Abujarour et al., 2019; Acharya, 2016; Aluja-Banet et al., 2019; Borkert et al., 2009; Dosono, 2014; OECD, 2015). Research findings support that, as stated in the literature, with the innovation effect of technology, students adapt to the educational environment in a fun way and contribute positively to expressing their thoughts, values and feelings about educational experiences easily. Accordingly, it could be stated that the 3D virtual reality environment can be used by immigrant students as well as by students who have just started school and that such an environment will contribute to students. It was seen that the immigrant students and Turkish students using the 3D virtual reality environment experienced negative situations such as nausea and dizziness. Despite these negative situations, the use of the 3D virtual reality environment caused a positive increase in the immigrant students' positive emotions of love, friendship bond, confidence and happiness; It was observed that it caused a decrease in the emotions of curiosity, fun, surprise and anger. It was revealed that the negative emotions such as sadness, fear and discomfort remained the same throughout the process. It was found that the biggest changes were experienced in the emotions of friendship bond, confidence and love during the process. Accordingly, it could be stated that the use of the 3D virtual reality environment by the immigrant students especially contributed to the increase in the emotions of friendship bond, confidence and love. It was seen that the emotions of happiness, fun and curiosity were high in the first week of the application process and that these emotions decreased in the following weeks. It was found that the negative emotions showed partial increases in the first week of the application process but decreased in the following weeks. The results obtained in the study were similar to those obtained in other studies in the literature. For example, Tychsen & Foeller (2020) stated in their study that various discomforts and side effects occurred after the use of 3D virtual reality glasses in children aged 5-10 years. In studies examining the relationship between technology use and emotional states in the literature, it was reported that cognitive support, cognitive complexity and learning status had a relationship with positive emotions at high rates in technology-based learning environments, whereas negative emotions had a relationship at low rates (Loderer et al., 2020; Noteborn et al., 2012; Parks & Roberts, 1998). For example, Park & Roberts (1998) stated that the use of technology strengthened friendship relations, facilitated communication and interpersonal communication and enabled the development of new social relations. Noteborn, Carbonell, Hebert & Gijsselaers (2012), on the other hand, stated that the emotion of fun increased according to the students' carrying out activities in the virtual school environment and that these emotions were reflected in their positive emotions. In this respect, it could be stated that the use of the 3D virtual reality environment had a positive effect on the positive emotions of friendship, love, confidence, happiness, curiosity and fun, and it could be stated that it was in parallel with the studies in the literature. Loderer, Pekrun & Lester (2020) stated that there was a relationship between the emotions of anxiety control and anxiety involvement in technology-based learning environments. At this point, it could be stated that with the increase in the immigrant students' emotion of control and inclusion in the 3D virtual reality environment, negative emotions decreased in the process, and these emotions were taken under control.

As a result of the study, it was revealed in qualitative and quantitative findings that the number of immigrant students' belonging to school increased. It was revealed that there was a significant difference with the use of 3D virtual reality environment in terms of attitude towards school and adaptation to school. It could be stated that the 3D virtual reality environment positively changed immigrant students' adaptation to school and made a significant contribution. As a result of the study, it was seen that the immigrant students felt more secure and comfortable at school. It was also revealed that the immigrant students who felt comfortable adapted to the school environment more easily and were able to establish more positive relations with their Turkish friends in the process. In addition, it was thought that increasing the connections of immigrant students with school components had a positive effect on their school cohesion. Altunay and Dede (2020) stated that establishing links with the organisations around the schools in order to control their environment, establishing partnerships with innovation and research projects, and orientation studies will increase the confidence and harmony of immigrant students towards the school. It could be stated that the immigrant students who developed the emotions of confidence and love for school easily overcame the adaptation process to school and adapted to school in a short time. When the adaptation status of the immigrant students to school was examined, it could be stated that the 3D virtual reality environment had changed the school cohesion positively and contributed significantly. At the end of the application, it was seen that the students at the school felt peaceful, and the people at the school felt close to them during the interviews conducted with the immigrant students. It was thought that when the immigrant students felt close to other people in the school and felt as a part of the school, their adaptation skills increased. Sivan (2008) stated that collaborative work in the 3D virtual learning environment had an effect on entertainment, safety, cultural influence, inclusion and social behaviour. Reisoğlu et al. (2017) stated that 3D virtual learning environments were effective in collaborative working and communication studies. Wang, Lan, Tseng, Lin & Gupta (2019) emphasised the importance of students helping each other in language learning in a 3D virtual learning environment. In this respect, it could be

stated that the simultaneous studies with immigrant students and Turkish students in the 3D virtual reality environment contributed positively to the adaptation of the immigrant students to school.

According to the results of the achievement test carried out to determine the development of the immigrant students in the 3D virtual reality environment and to what extent they had acquired the relevant achievements at the end of the application process, it was seen that there was a generally significant difference between the achievement scores before and after the application. It was seen that there was a significant change between the immigrant students' expressions of getting to know each other before and after the study and the achievements of introducing themselves, recognising the school and school units, expressing where they lived, knowing the school staff, knowing the duties of the school staff, knowing the places where the school staff were and knowing the classroom rules. In studies in the literature examined, Temiz (2020) stated that social activities had an effect on Turkish speaking skills in the orientation studies conducted at schools for immigrant and refugee students. In addition, studies conducted on immigrant students in a 3D virtual reality environment indicated that emotions or emotional experiences could be overcome in a 3D environment (Camilleri et al., 2017; Passing & Eden, 2007; Passing & Miler, 2014). In this respect, it could be stated that 3D virtual reality environments could be used to reduce the negative effects of adapting to the school climate experienced during school periods.

In the study, after the use of the 3D virtual reality environment, it was seen that the immigrant students and Turkish students developed a sense of belonging to the school with the innovative effect of technology. For this reason, technology-supported tools could be used more in the orientation studies of students who have just started school. Similarly, it was seen that the immigrant students' attitudes towards school changed positively as a result of the use of the 3D virtual reality environment. In this respect, technology-supported tools could be used to strengthen the participation of immigrant students in school and their adaptation to social life. Supporting the use of the 3D virtual reality environment in education with the triangle of counselling services, school and family will accelerate the integration of such disadvantaged students as immigrant students into education. For this reason, the inclusion of the school environment in the 3D virtual reality environment applications to be developed in the future may accelerate the adaptation process. Finally, 3D virtual reality environments allow students to learn by themselves, explore places of their interest and interact with objects. For this reason, it is important to make realistic and real-life designs in students' 3D virtual learning environments. In the study, only the use of the 3D virtual reality environment in the context of immigrant students' adaptation to school was discussed. Various studies on the adaptation problems of immigrant students could be designed with different information technology tools used in education. By developing 3D virtual reality environments for students with different disadvantages, the effectiveness of these environments could be examined through qualitative research. In addition, causal studies could be conducted to examine the effect of education given in 3D virtual reality environments on academic achievement.

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