



The Use of Augmented Reality for Interactive Synchronous Learning in Introducing the History of Furniture Design Styles

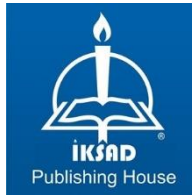
Hayrettin MERİÇ



The Use of Augmented Reality for Interactive Synchronous Learning in Introducing the History of Furniture Design Styles

Hayrettin MERİÇ

DOI: <https://dx.doi.org/10.5281/zenodo.10251290>



Copyright © 2023 by iksad publishing house
All rights reserved. No part of this publication may be reproduced, distributed or
transmitted in any form or by
any means, including photocopying, recording or other electronic or mechanical
methods, without the prior written permission of the publisher,
except in the case of
brief quotations embodied in critical reviews and certain other
noncommercial uses permitted by copyright law. Institution of Economic
Development and Social
Researches Publications®
(The Licence Number of Publicator: 2014/31220)
TÜRKİYE TR: +90 342 606 06 75
USA: +1 631 685 0 853
E mail: iksadyayinevi@gmail.com
www.iksadyayinevi.com

It is responsibility of the author to abide by the publishing ethics rules.

Iksad Publications – 2023©
ISBN: 978-625-367-441-0
Cover Design: İbrahim KAYA
November / 2023
Ankara / Türkiye
Size = 16 x 24 cm

PREFACE

When we look at the educational technology models in the world, it is evident that topics such as artificial intelligence, virtual reality, augmented reality systems and digital assessment systems are trending. While almost all sectors in the world are developing new policies on the transformation of education, we, as educators, must be at the forefront in this development.

The value and importance of using augmented reality applications in education and training processes are escalating day by day. Thanks to these developing technological tools and equipment, it is anticipated that augmented reality applications will become more and more a part of education and training processes. Augmented reality and virtual reality technologies provide a more efficient learning environment because they can provide concrete examples in the learning process. For this reason, augmented reality and virtual reality applications hold immense importance in enriching education. In order for augmented reality technologies to be used successfully in the educational field, it is crucial to develop content suitable for curriculum requirements and to introduce this technology to educators.

The integration of augmented reality technology into education plays a crucial role in increasing student engagement and bringing complex and challenging objects into the learning space as interactive 3D models. In this context, this research is deemed essential in terms of adapting augmented reality technology to education. In addition, since interactive, synchronous and multi-user research and applications are very few and insufficient, it is believed that this research, which intersects the fields of furniture, design, educational technology, and AR, will fill an important gap in the literature on the subject.

CONTENTS

PREFACE.....	i
CONTENTS.....	iii
1.INTRODUCTION.....	5
1.1. Furniture.....	5
1.2. Furniture Styles.....	7
1.3. Augmented Reality in Education	7
1.4. Augmented Reality in Design Education.....	10
1.5. Importance of the Research.....	11
2. AR APPLICATION.....	13
3. AR IMPLEMENTATIONS FOR FURNITURE STYLES.....	15
3.1. Examination Module.....	17
3.2. Training Module.....	19
4.CONCLUSION.....	101
REFERENCES.....	102

1.INTRODUCTION

1.1. Furniture

Furniture encompasses the items that facilitate people's daily life. Modern individuals cannot even envision a world without furniture in their homes, workplaces, vehicles, hotels, hospitals, shops, in short, in all the places where they live. However, some communities worldwide still manage to live without this necessity. Despite its five thousand years of history, ordinary people in many societies met with furniture only two centuries ago. Furniture, though not a vital necessity, but it has always been important for people where it is used.

Furniture offers practical functions such as providing surfaces for dining, storage, seating, and sleeping. However, it extends beyond mere practicality, fulfilling other purposes as well. For example, it can define private spaces, creating boundaries that should not be violated. Even a simple stool can communicate the importance of personal space to others. Certain types of furniture, including seating, tables, and cupboards, among others, are the exclusive property of an individual at home or in a workplace. Their use by others is prohibited. Similarly, this rule holds true for communal public spaces. For instance, it is widely acknowledged that the seat and the surrounding area on a bus must be respected as the property of the person seated there.

The primary and earliest function of furniture is the enhancement of its owner's dignity. Thrones were historically employed to underscore the majesty of monarchs. Fine furniture has always been indicative of pre-eminence. To bolster a nation's prestige in comparison to others, palaces have always been furnished with the most exquisite pieces. Even today, the furniture in our homes and workplaces serves as a tool to validate our social status through its relevance to contemporary fashion, as well as its extravagant appearance and value.

Conversely, furniture serves as a medium of personal identification by providing insight into their personality, education, beliefs, and financial situation, to name a few. As such, it holds significant historical value as a source of information for researchers examining social life, economic power, technological advancements, and other societal features of previous eras.

In furniture making, a vast array of materials is shaped and decorated with an unlimited variety of processes. In every period, it has been a platform for designers and artisans to display their creativity and skill. The objects they produce embody the refined aesthetic sensibilities of their owners as well as themselves. Furniture has also presented opportunities for artists from other disciplines. Painters and sculptors have engraved some subjects on furniture that they could not find the opportunity to express elsewhere.

Furniture has historically been a highly prized commodity. In the past, Affluent individuals were unconstrained in their spending in this field. For example, Louis XIV's interior architecture and furniture expenditures put the French treasury in difficulty, and the debts he left could only be paid by the disposal of some colonies. On the other hand, furniture craftsmen, who were not under financial pressure and were free from subsistence problems, adapted their art with great freedom and created masterpieces with the most valuable materials.

With industrialisation, Furniture makers, tasked with catering to a broader consumer base, were compelled to consider economic factors in their designs. Over time, fine craftsmanship gave way to more cost-effective production methods, and valuable materials were replaced with imitations. Practicality, durability and ease of maintenance have become more sought after. But still, besides the adaptation of furniture to its environment, the visual appreciation of its design is the most important feature. Today's furniture derives value not only from its compatibility with contemporary aesthetic preferences, but also from

the prestige associated with the designer's name and the manufacturing company (1).

1.2. Furniture Styles

Numerous pieces of furniture, tangible evidence of furniture-making practices dating back millennia are still found in museums in some countries. Initially, humankind crafted rudimentary furniture from wood and stone to facilitate comfortable seating. As demands evolved and construction tools and machinery advanced, various models have been developed over time. The art of furniture and architecture are inextricably linked. Furniture is widely recognized as an accessory to architecture, an essential tool for interior furnishing. Consequently, architectural styles have profoundly influenced furniture development throughout history. In each era, artists have infused furniture with their unique aesthetic sensibilities, craftsmanship, and conceptual thinking. As such, furniture serves as a reflection of the prevailing lifestyle and artistic styles of each period. Different construction styles and models of these furniture types emerge in each country as well as among different artisans of the same country (2). Furniture styles are a very wide research subject in itself and there are many books, articles and lecture notes on this subject. In addition, since this book is an application-based research, detailed information about furniture styles is not included in this book.

1.3. Augmented Reality in Education

In today's world, computers and devices working with computer systems have become an integral part of human life. Numerous devices such as televisions, smart mobile phones, ovens, and refrigerators work with computer systems. It has become commonplace to use computers in many sectors such as military, architecture, education, design, and advertising.

With the development of technology, computers, which used to perform only electronic data transfer and complex calculations, can now solve problems that cannot be formulated and solved mathematically, filter and summarise vast datasets, comment on events and even learn on their own. In other words, computers can both make decisions by collecting information about events and learn the relationships between events by interpreting them.

It is possible for computers to have the abilities mentioned above and to improve themselves thanks to artificial intelligence technology. With the advancement of technology, Virtual Reality-VR and Augmented Reality-AR technologies have been frequently used in many sectors such as education, military, design, sports, entertainment and health in the world in the last two decades.

The purpose of virtual reality is to provide people with environments that are not in reality but are very similar to the real ones with the help of computers. VR aims to obtain sensations in a computer environment that cannot be distinguished from the sensations we perceive in the physical world we live in. Thus, a world that can be perceived with all senses is created in the computer environment. VR applications are used in many areas such as computer-aided design, medical diagnosis and treatment, scientific experiments in physical and biological sciences, flight simulators for training pilots and astronauts, and three-dimensional video games as entertainment. AR, on the other hand, integrates the real world and the computer-generated virtual world and enables interaction with the virtual world without detaching from the real world.

The use of AR applications in educational environments increases interaction, and applications integrated into the virtual environment offer students a realistic teaching environment in the virtual environment. With the multimedia materials developed for AR technologies, the student actively participates in the learning process and permanent learning is provided for the student. The basis of these

concepts lies in the new generation of virtual reality glasses that can show another virtual reality, hear virtual sounds and move virtual objects, as well as smartphones and tablets. Since AR technologies can provide concrete examples in the learning process, they provide a more efficient learning environment. For this reason, AR applications have an important place in terms of enriching education.

Today, education has started to go beyond traditional teaching methods with the increase in learning centres that provide distance education opportunities. Developing technology enables students to learn complex subjects in a fun and easy way through virtual reality devices. Students can interact with objects in the virtual environment and learn more about them. For example, students can experience the events and places described in the history lesson as if they were real. Digital tours can be organised to a museum or a zoo in a completely different country, and the lessons can be explained by a teacher as if they were there at that moment. In this way, students learn by experiencing the moment and thus a more permanent form of education emerges. Thanks to augmented reality technology, it is possible to teach the area of the rectangle and triangle with augmented reality technology, to provide flight training to pilots at low costs with flight simulation systems, and to observe the lifestyle of the dinosaur with its eyes and movements (3).

The new possibilities offered by AR technology for education have started to attract the attention of educators over time (4). An educational AR application provides students with more flexible and interesting learning environments and gives students an excitement they have not experienced before (5); increases students' willingness and motivation to learn (6); It helps students to make active observations during the learning process and to form hypotheses as a result of these observations (7); it increases students' learning performance and helps them to establish social interactions within the group (5). Wu, Lee, Chang & Liang (8) stated in their study that AR helps visual learning by presenting the content with three-dimensional perspectives, can

bridge formal and informal learning, and encourages students to collaborative learning.

Using textbooks as virtual learning materials with AR technologies (9,10) can be very useful in terms of concretising some abstract concepts. As a matter of fact, as the similarity and relationship of the content with real life increases, the effectiveness and efficiency of education increases (11). AR technology gives a sense of independence from space, freedom and personalisation; improves the quality of learning (12); enriches educational environments and makes learning more fun and permanent (8) and provides new opportunities in education by encouraging learning. In the last few years, scientific research on the use of AR in education has been published frequently (13-48).

To summarise, being insensitive to a technology that makes the user feel as if he/she is experiencing the environment, increases motivation and concentration and reduces economic costs will lead to being left behind in the international competitive environment; it is thought that artificial intelligence, AR and SG applications should be used more in education.

1.4. Augmented Reality in Design Education

Following the integration of digitalization into the design education process, initiated by the introduction of computers, augmented reality technology has revolutionized expression methods and information visualization techniques. Augmented reality has become the intersection point of design and creativity with its power to enrich interaction by changing the user's perception of reality in the physical world. Due to the increasing use of technology in our daily lives, the enrichment of contemporary design education with the latest technologies and how it can be adapted to the educational process in the most accurate way has turned it into a teaching material that needs to be considered.

Many benefits of AR technology such as visualising abstract concepts in the learning environment, reducing cognitive load, and increasing motivation and learning level were mentioned in the previous section. From this point of view, it is thought that AR applications in a design-based learning method can improve students' advanced thinking skills and spatial intelligence. Creativity, which is the most important starting point of original design ideas, is formed by imagination and its expression. Therefore, to facilitate the expression of thoughts without limiting them and to improve design problems, technological materials should be used in addition to traditional methods. Tools that support creativity can make great contributions to the development of creative designs and products. At the same time, the learning efficiency and motivation of the student, who focuses on the visual appeal of AR applications, increases with books adapted to AR technology compared to traditional textbooks.

AR technology offers an interactive and student-centred learning environment by differentiating what we hear and feel. Thanks to its constructivist approach, it contributes to the development of student creativity as well as providing new opportunities in the teaching process with methods such as learning by doing. Thanks to the advances in mobile technology and mobile-based AR applications; being easily accessible and creating different learning opportunities as a result of the interaction it provides; encouraging active learning and adding depth to the learning process; facilitating the expression of ideas and presenting 3D images; has helped it to become a motivating educational tool in design and art education.

1.5. Importance of the Research

The value and importance of using augmented reality applications in education and training processes is increasing day by day. It is thought that AR applications will take place more and more in education and

training processes thanks to these developing technological tools and equipment.

The use of AR applications in the field of education plays a very important a role both in terms of attracting students to the lesson and allowing the use of objects that are difficult to carry into the classroom environment into the classroom as three-dimensional objects. In this context, this study is considered important in terms of adapting AR technology to education.

Rapidly advancing technology increases individuals' need for access to information. AR provides a different dimension for students to look at the written content in the lessons from a different perspective and to increase their interest in the lesson. Students of the digital age are ready to use such applications since they are trained to be prone to technology. In order to involve students more in education and training processes, applications such as AR should be included in the classroom. Especially today, when internet and mobile applications are widespread, it is important to adapt technological developments to education and to carry out studies in this field. In this context, this research aims to present a sample application to teachers and trainers about the inclusion of applications that attract students' interest in the classroom environment by making the quality of education and training richer and more effective with AR technology.

The research is also thought to be useful for scientists who will research artificial intelligence, virtual reality and augmented reality.

2. AR APPLICATION

The augmented reality (AR) app developed as part of this research comprises a training module and an examination module. Students can use the application both in the classroom environment and in other places by using their smartphones or tablets. The training module is designed to teach furniture styles through visualisation and to provide students with the skills to use AR technology. After completing this training, students can proceed to the exam module of the application, which consists of three different levels.

The application offers features to support individual progress, interactive and synchronous learning from any location, and fast response times.

The application consists of increasingly difficult levels. As the person progresses, he/she realises that he/she can do more difficult things and adapts to the difficulty. For example, the person wants to achieve higher scores with the psychology of reward. Finally, in the time element, seeing a running timer on the screen motivates the person to react faster and finish faster than others.

In the application, the exam section was designed as starting the application, interacting with the questions, selecting the correct answer, transition between questions and levels, and ending the application (Simultaneous multi-user, interactive and synchronous). The purpose of the questions is to allow students to view objects in three dimensions, observe them from various perspectives, and identify the features of each furniture style while providing answers.

In the educational part of the application, regardless of the location, the trainer and students will collaboratively and synchronously explore distinctive characteristics of every furniture style. Moreover, they will have the opportunity to express their thoughts on the similarities between the 3D models and the various furniture styles. The utilization

of augmented reality (AR) technology assists individuals who face challenges in perceiving three-dimensional objects. AR technology allows for the visualization of 3D models from multiple vantage points, aiding in better understanding and interpretation.

3. AR IMPLEMENTATIONS FOR FURNITURE STYLES

In this research book, only the furniture part of the "augmented reality supported art history" application is mentioned.

The software used in the research are as follows:

- Unity 3D (version 2021.1.0f1)
- Vuforia Engine (version 10.5.5)
- ARCore XR Plugin (version 4.1.13)
- Photon Engine (Photon Voice 2)

The application includes 3D models, each of which has the characteristics of various styles. More 3D models are being added to this app. The figures below illustrate screenshots of several 3D models while the application is running.

Demo videos of both this application and my previous applications can be watched on my YouTube channel below:

<https://www.youtube.com/@hayrettinmeric1379/videos>

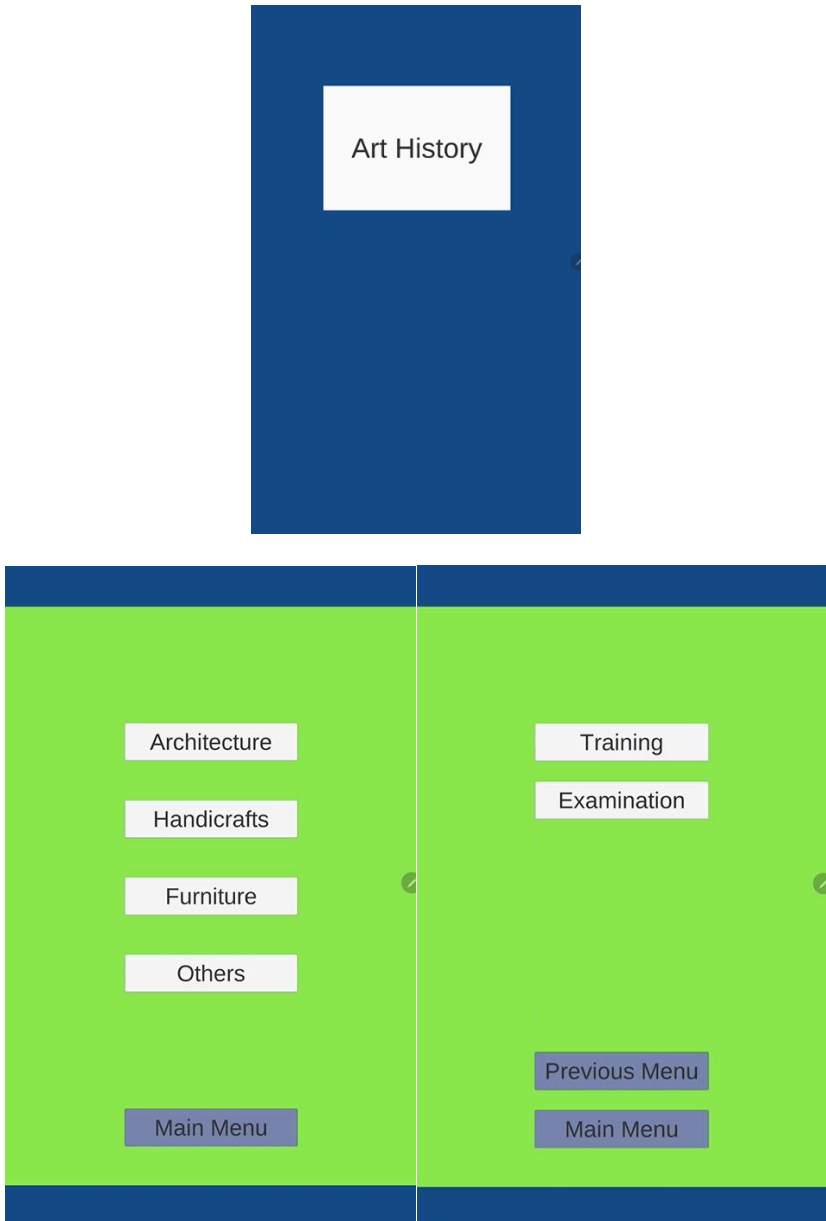
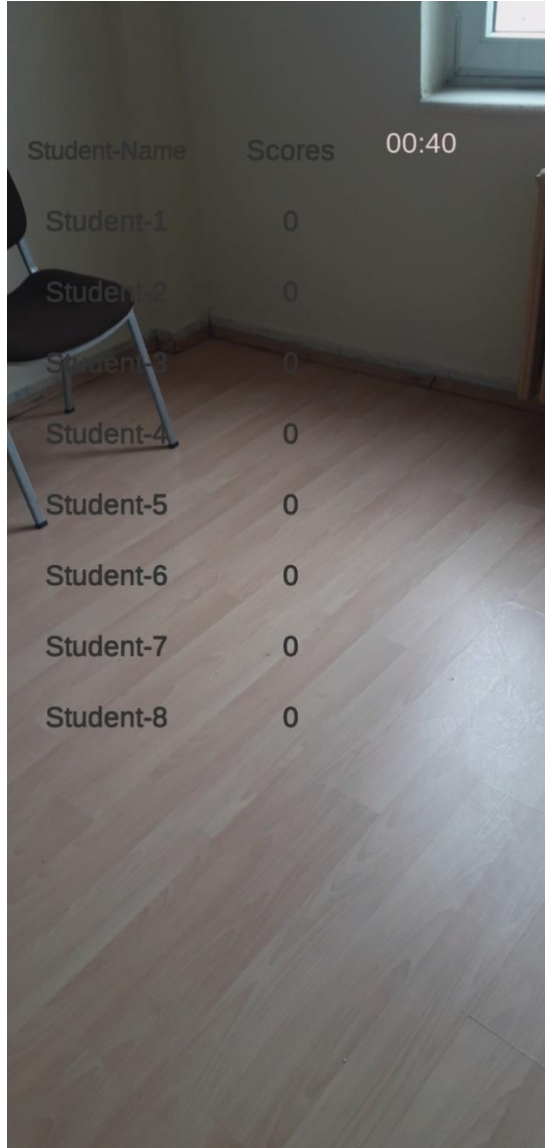


Figure 1. AR application's user interfaces

3.1. Examination Module



Figure 2. Examination module interface (Student screen)



Student-Name	Scores	00:40
Student-1	0	
Student-2	0	
Student-3	0	
Student-4	0	
Student-5	0	
Student-6	0	
Student-7	0	
Student-8	0	

Figure 3. Examination module interface (Trainer screen)

3.2. Training Module



Figure 4. Plane Detection

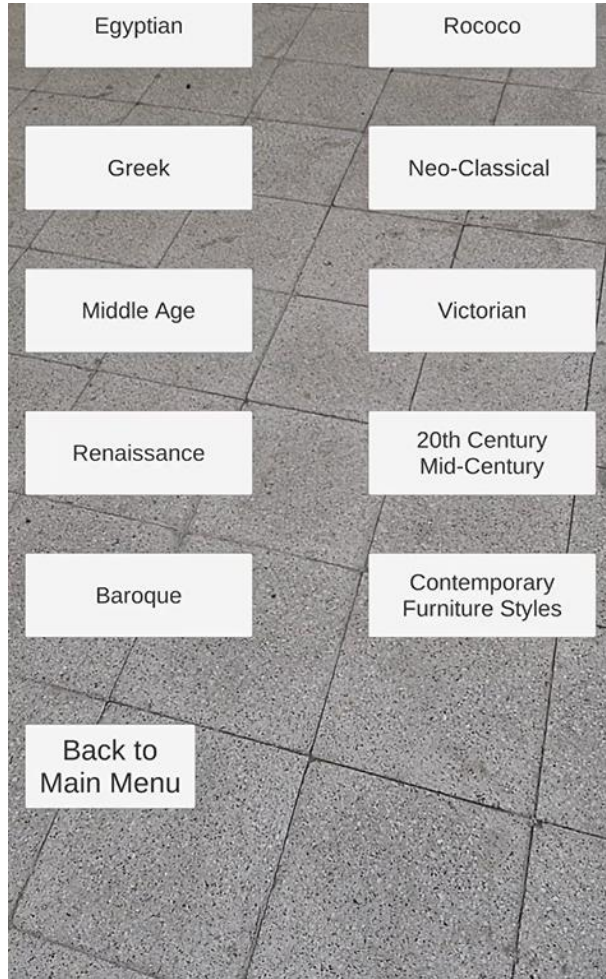


Figure 5. Furniture Styles Selection

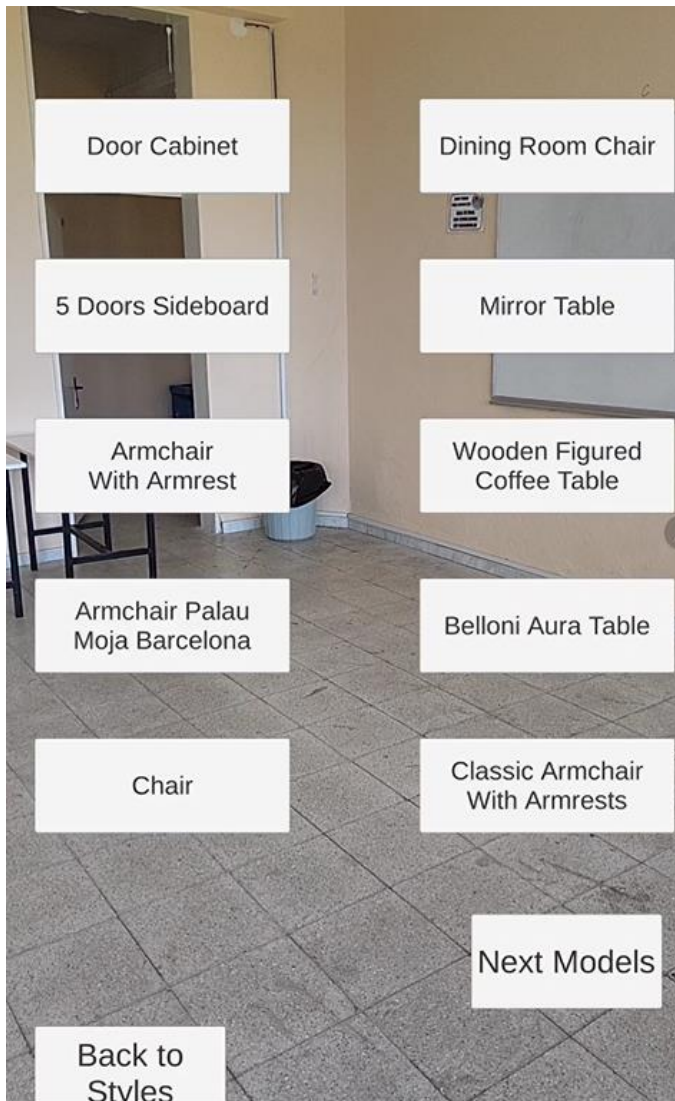


Figure 6. Options for 3D Models



Figure 7. Screenshot of 3D chair positioned in the real world (49)



Figure 8. Screenshot of 3D Storage Chest positioned in the real world (50)



Figure 9. Screenshot of 3D door positioned in the real world (51)



Figure 10. Screenshot of 3D bench positioned in the real world (52)



Figure 11. Screenshot of 3D chair positioned in the real world (53)



Figure 12. Screenshot of 3D chandelier positioned in the real world (54)



Figure 13. Screenshot of 3D light positioned in the real world (55)



Figure 14. Screenshot of 3D mirror positioned in the real world (56)



Figure 15. Screenshot of 3D side chair positioned in the real world (57)



Figure 16. Screenshot of 3D table positioned in the real world (58)



Figure 17. Screenshot of 3D window positioned in the real world (59)



Figure 18. Screenshot of 3D window with painted glass positioned in the real world (60)



Figure 19. Screenshot of 3D window positioned in the real world (61)



Figure 20. Screenshot of 3D window positioned in the real world (62)



Figure 21. Screenshot of 3D dining armchair positioned in the real world (63)



Figure 22. Screenshot of 3D hanging chandelier positioned in the real world (64)



Figure 23. Screenshot of 3D bed positioned in the real world (65)



Figure 24. Screenshot of 3D furniture positioned in the real world (66)



Figure 25. Screenshot of 3D table positioned in the real world (67)



Figure 26. Screenshot of 3D bench positioned in the real world (68)



Figure 27. Screenshot of 3D wooden lamp positioned in the real world (69)



Figure 28. Screenshot of 3D chair positioned in the real world (70)



Figure 29. Screenshot of 3D marble table positioned in the real world (71)



Figure 30. Screenshot of 3D treasure chest positioned in the real world (72)



Figure 31. Screenshot of 3D stool positioned in the real world (73)



Figure 32. Screenshot of 3D table positioned in the real world (74)



Figure 33. Screenshot of 3D chest positioned in the real world (75)



Figure 34. Screenshot of 3D fireplace positioned in the real world (76)



Figure 35. Screenshot of 3D marble topped centre table positioned in the real world (77)



Figure 36. Screenshot of 3D pouf positioned in the real world (78)



Figure 37. Screenshot of 3D dining table positioned in the real world (79)



Figure 38. Screenshot of 3D cabinet positioned in the real world (80)



Figure 39. Screenshot of 3D sideboard positioned in the real world (81)



Figure 40. Screenshot of 3D armchair with armrest positioned in the real world (82)



Figure 41. Screenshot of 3D armchair positioned in the real world (83)



Figure 42. Screenshot of 3D chair positioned in the real world (84)



Figure 43. Screenshot of 3D dining chair positioned in the real world (85)



Figure 44. Screenshot of 3D mirror table positioned in the real world (86)



Figure 45. Screenshot of 3D coffee table positioned in the real world (87)



Figure 46. Screenshot of 3D table positioned in the real world (88)



Figure 47. Screenshot of 3D armchair with armrest positioned in the real world (89)



Figure 48. Screenshot of 3D console positioned in the real world (90)



Figure 49. Screenshot of 3D coffee table positioned in the real world (91)



Figure 50. Screenshot of 3D living room chairs positioned in the real world (92)



Figure 51. Screenshot of 3D living room sofa positioned in the real world (93)



Figure 52. Screenshot of 3D desk positioned in the real world (94)



Figure 53. Screenshot of 3D plywood table positioned in the real world (95)

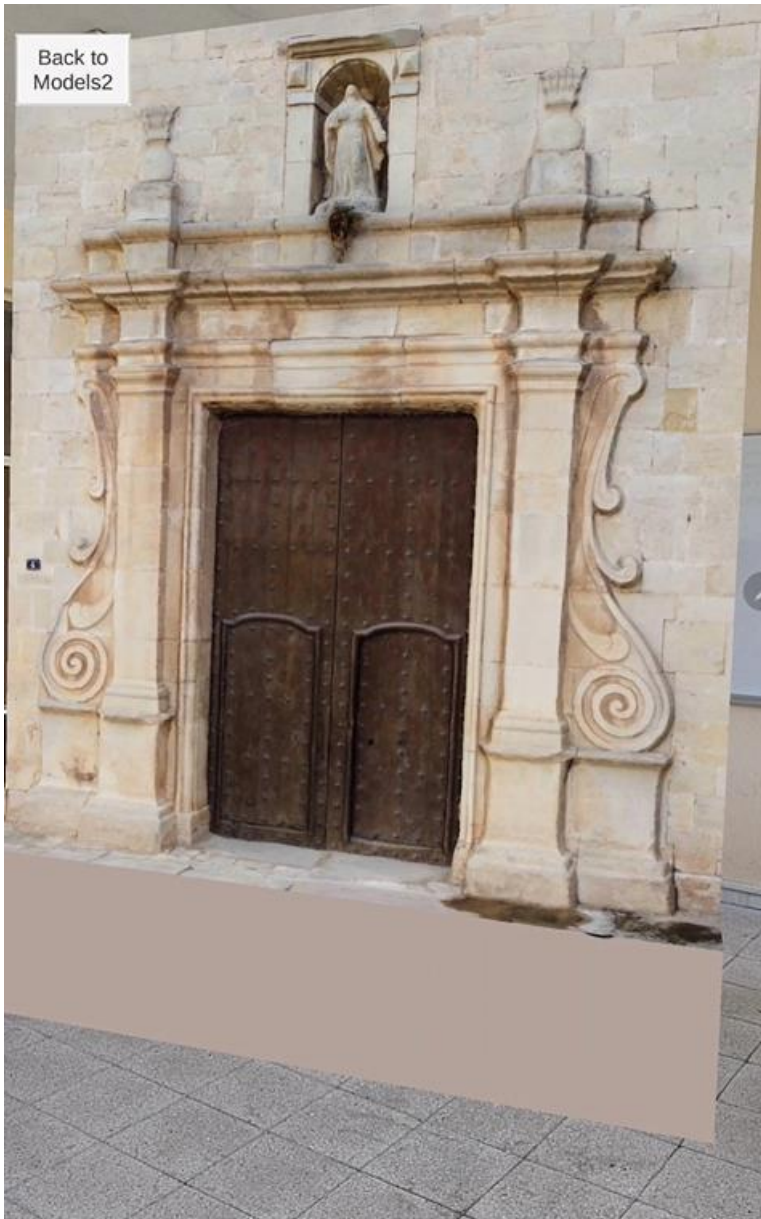


Figure 54. Screenshot of 3D Door of Santa Maria de Solivella church positioned in the real world (96)



Figure 55. Screenshot of 3D small table positioned in the real world (97)



Figure 56. Screenshot of 3D The Church of St. Jakobi positioned in the real world (98)



Figure 57. Screenshot of 3D solid wood console positioned in the real world (99)



Figure 58. Screenshot of 3D vase stand positioned in the real world (100)



Figure 59. Screenshot of 3D rectangular table positioned in the real world (101)



Figure 60. Screenshot of 3D tables positioned in the real world (102)



Figure 61. Screenshot of 3D ornate table positioned in the real world (103)



Figure 62. Screenshot of 3D fireplace positioned in the real world (104)



Figure 63. Screenshot of 3D sofa positioned in the real world (105)



Figure 64. Screenshot of 3D desk positioned in the real world (106)



Figure 65. Screenshot of 3D chair positioned in the real world (107)



Figure 66. Screenshot of 3D mirror positioned in the real world (108)



Figure 67. Screenshot of 3D leather sofa positioned in the real world (109)



Figure 68. Screenshot of 3D wardrobe positioned in the real world (110)



Figure 69. Screenshot of 3D rocking chair positioned in the real world (111)



Figure 70. Screenshot of 3D table positioned in the real world (112)



Figure 71. Screenshot of 3D book wheel positioned in the real world (113)



Figure 72. Screenshot of 3D passage positioned in the real world (114)



Figure 73. Screenshot of 3D armchair positioned in the real world (115)



Figure 74. Screenshot of 3D bed positioned in the real world (116)



Figure 75. Screenshot of 3D chair positioned in the real world (117)



Figure 76. Screenshot of 3D chair positioned in the real world (118)



Figure 77. Screenshot of 3D chair positioned in the real world (119)



Figure 78. Screenshot of 3D chairs positioned in the real world (120)



Figure 79. Screenshot of 3D desk positioned in the real world (121)



Figure 80. Screenshot of 3D dressing table positioned in the real world (122)



Figure 81. Screenshot of 3D lounge sofa positioned in the real world (123)



Figure 82. Screenshot of 3D seat positioned in the real world (124)



Figure 83. Screenshot of 3D sofa positioned in the real world (125)



Figure 84. Screenshot of 3D wooden table positioned in the real world (126)



Figure 85. Screenshot of 3D cabinet positioned in the real world (127)

4. CONCLUSION

It is possible to say that innovations and developments can be made in many areas with the use of augmented reality technology. Especially with the materials developed in the fields of education, it has been proven by research that it attracts the attention of students and makes learning permanent.

The use of 3D materials in teaching furniture styles can contribute to a significant differentiation in students' achievement. Designing and developing such materials in the curriculum can contribute to improving the quality of education and digitalisation in education.

Since it facilitates conceptual understanding of furniture styles and 3D models are more understandable than drawings on paper (in 2D plane), it can facilitate learning from concrete to abstract.

The fact that the materials created with 3D instructional technologies are remarkable increases the interest and curiosity towards the lessons, removes the lesson from boredom, and thus the lesson will become more fun. Such materials can contribute to the enjoyment of the lessons, students' learning by having fun in the lesson with their other friends, curiosity and research.

Consequently, with appropriate planning over time, AR technology can be integrated as an important tool in education, making students' learning experiences more effective and efficient. In addition, standard course curricula can be updated with AR applications and used together with course materials. If the new generation of students, who grow up with technology and have different learning opportunities from traditional education, are educated only with traditional methods; this may prevent them from revealing their talents and developing themselves. Therefore, it is important to reconsider teaching methods and materials suitable for student profiles.

REFERENCES

- 1.Boyla, O. (2012). Mobilya Tarihi, Lecture Notes.
- 2.Kurtođlu, A. (1986). Mobilya Stillerinin Tarihi Geliřimi, Journal of the Faculty of Forestry Istanbul University, 3(36), pages:70-91.
- 3.Boz, M.S. (2019). Eđitimde Artırılmış Gerçeklik Uygulamalarının Deđerlendirilmesi, Innovation and Educational Technologies General Directorate.
- 4.Demirer, V. ve Erbař, Ç. (2015). Mobil Artırılmış Gerçeklik Uygulamalarının İncelenmesi Ve Eđitimsel Açıdan Deđerlendirilmesi, Mersin University Journal of The Faculty of Education, 11(3), 802- 813.
- 5.Lin, T. J., Duh, H. B. L., Li, N., Wang, H. Y. ve Tsai, C. C. (2013). An Investigation of Learners' Collaborative Knowledge Construction Performances and Behavior Patterns in An Augmented Reality Simulation System, Computers & Education, 68, 314-321.
- 6.Ibáñez, M. B., DiSerio, Á., Villarána, D. ve Kloosa, C. (2014). Experimenting With Electromagnetism Usin Augmented Reality: Impact on Flow Student Experience and Educational Effectiveness, Computers&Education, 71, 1–13.
- 7.Chiang, T.H.C., Yang, S.J.H. ve Hwang, G.J. (2014). An Augmented Reality-based Mobile Learning System to Improve Students' Learning Achievements and Motivations in N a t u r a l Science Inquiry Activities, Educational Technology & Society, 17(4), 352–365.
- 8.Wu, H. K., Lee, S. W. Y., Chang, H. Y. ve Liang, J. C. (2013). Current Status, Opportunities and Challenges of Augmented Reality In Education, Computers and Education, 62, 41–49.

9. İbili, E. ve Şahin, S. (2015). Investigation Of the Effects on Computer Attitudes and Computer Self-Efficacy To Use Of Augmented Reality In Geometry Teaching, Necatibey Faculty of Education Electronic Journal of Science & Mathematics Education, 9(1), 332-350.
10. Billinghamurst, M., Kato, H., ve Poupyrev, I. (2001). The Magic Book-Moving Seamlessly Between Reality and Virtuality, Computer Graphics and Applications, 21(3), 6-8.
11. Klopfer, E., ve Squire, K. (2008). Environmental Detectives—The Development of An Augmented Reality Platform For Environmental Simulations, Educational Technology Research and Development, 56, pages203–228.
12. Etlican G. (2012). X ve Y Kuşaklarının Online Eğitim Teknolojilerine Karşı Tutumlarının Karşılaştırılması, Master's Thesis, Bahçeşehir University, Institute of Social Science.
13. Wang, T., & Tan, L. (2023). The Conceptualisation of User-App Interactivity in Augmented Reality-Mediated Learning: Implications for Literacy Education. *Sustainability*, 15(14),
14. Valladares Ríos, L., Acosta-Díaz, R., & Santana-Mancilla, P. C. (2023). Enhancing Self-Learning in Higher Education with Virtual and Augmented Reality Role Games: Students' Perceptions. *Virtual Worlds*, 2(4), 343–358.
15. Hsu, H.-P., Cheah, Y. H., & Hughes, J. E. (2023). A Case Study of a Secondary Biology Teacher's Pedagogical Reasoning and Action with Augmented Reality Technology. *Education Sciences*, 13(11), 1080.
16. Czok, V., Krug, M., Müller, S., Huwer, J., & Weitzel, H. (2023). Learning Effects of Augmented Reality and Game-Based Learning for Science Teaching in Higher Education in the

Context of Education for Sustainable Development. *Sustainability*, 15(21), 15313.

- 17.Moesl, B., Schaffernak, H., Vorraber, W., Braunstingl, R., & Koglbauer, I. V. (2023). Performance, Emotion, Presence: Investigation of an Augmented Reality-Supported Concept for Flight Training. *Applied Sciences*, 13(20), 11346.
- 18.Efe, I. E., Çinkaya, E., Kuhrt, L. D., Bruesseler, M. M. T., & Mührer-Osmanagic, A. (2023). Neurosurgical Education Using Cadaver-Free Brain Models and Augmented Reality: First Experiences from a Hands-On Simulation Course for Medical Students. *Medicina*, 59(10), 1791
- 19.Krug, M., Thoms, L.-J., & Huwer, J. (2023). Augmented Reality in the Science Classroom—Implementing Pre-Service Teacher Training in the Competency Area of Simulation and Modeling According to the DiKoLAN Framework. *Education Sciences*, 13(10), 1016
- 20.Obradović, M., Mišić, S., Vasiljević, I., Ivetić, D., & Obradović, R. (2023). The Methodology of Virtualizing Sculptures and Drawings: A Case Study of the Virtual Depot of the Gallery of Matica Srpska. *Electronics*, 12(19), 4157
- 21.Wang, T., & Tan, L. (2023). The Conceptualisation of User-App Interactivity in Augmented Reality-Mediated Learning: Implications for Literacy Education. *Sustainability*, 15(14), 10949
- 22.Lazou, C., & Tsinakos, A. (2023). Critical Immersive-Triggered Literacy as a Key Component for Inclusive Digital Education. *Education Sciences*, 13(7), 696
- 23.Challenor, J., White, D., & Murphy, D. (2023). Hand-Controlled User Interfacing for Head-Mounted Augmented Reality Learning

Environments. *Multimodal Technologies and Interaction*, 7(6), 55

24. Kleftodimos, A., Evagelou, A., Triantafyllidou, A., Grigoriou, M., & Lappas, G. (2023). Location-Based Augmented Reality for Cultural Heritage Communication and Education: The Doltso District Application. *Sensors*, 23(10), 4963
25. Ortega-Gras, J.-J., Gómez-Gómez, M.-V., Bueno-Delgado, M.-V., Garrido-Lova, J., & Cañavate-Cruzado, G. (2023). Designing a Technological Pathway to Empower Vocational Education and Training in the Circular Wood and Furniture Sector through Extended Reality. *Electronics*, 12(10), 2328
26. Luo, Y.-J., & Hsiao, P.-W. (2023). Design of Interactive Learning Materials with Concept of Sustainability Integrated into Macau Drunken Dragon Dance. *IEEE ICEIB 2023*
27. Grammatikopoulou, A., & Grammalidis, N. (2023). Artful—An AR Social Self-Guided Tour App for Cultural Learning in Museum Settings. *Information*, 14(3), 158.
28. Kleftodimos, A., Moustaka, M., & Evagelou, A. (2023). Location-Based Augmented Reality for Cultural Heritage Education: Creating Educational, Gamified Location-Based AR Applications for the Prehistoric Lake Settlement of Dispilio. *Digital*, 3(1), 18–45.
29. Blattgerste, J., Behrends, J., & Pfeiffer, T. (2023). TrainAR: An Open-Source Visual Scripting-Based Authoring Tool for Procedural Mobile Augmented Reality Trainings. *Information*, 14(4), 219
30. Guaya, D., Meneses, M. Á., Jaramillo-Fierro, X., & Valarezo, E. (2023). Augmented Reality: An Emergent Technology for Students' Learning Motivation for Chemical Engineering

- Laboratories during the COVID-19 Pandemic. *Sustainability*, 15(6), 5175.
- 31.Liang, L., Zhang, Z., & Guo, J. (2023). The Effectiveness of Augmented Reality in Physical Sustainable Education on Learning Behaviour and Motivation. *Sustainability*, 15(6), 5062.
- 32.Khoirunnisa, A. N., Munir, & Dewi, L. (2023). Design and Prototype Development of Augmented Reality in Reading Learning for Autism. *Computers*, 12(3), 55
- 33.Paulauskas, L., Paulauskas, A., Blažauskas, T., Damaševičius, R., & Maskeliūnas, R. (2023). Reconstruction of Industrial and Historical Heritage for Cultural Enrichment Using Virtual and Augmented Reality. *Technologies*, 11(2), 36
- 34.Uriarte-Portillo, A., Ibáñez, M. B., Zatarain-Cabada, R., & Barrón-Estrada, M. L. (2023). Comparison of Using an Augmented Reality Learning Tool at Home and in a Classroom Regarding Motivation and Learning Outcomes. *Multimodal Technologies and Interaction*, 7(3), 23
- 35.Fernandes, J., Brandão, T., Almeida, S. M., & Santana, P. (2023). An Educational Game to Teach Children about Air Quality Using Augmented Reality and Tangible Interaction with Sensors. *International Journal of Environmental Research and Public Health*, 20(5), 3814
- 36.Mercier, J., Chabloz, N., Dozot, G., Ertz, O., Bocher, E., & Rappo, D. (2023). BiodivAR: A Cartographic Authoring Tool for the Visualization of Geolocated Media in Augmented Reality. *ISPRS International Journal of Geo-Information*, 12(2), 61
- 37.Ventoulis, E., & Xinogalos, S. (2022). “AR The Gods of Olympus”: Design and Pilot Evaluation of an Augmented Reality

Educational Game for Greek Mythology. *Multimodal Technologies and Interaction*, 7(1), 2

38. Castaño-Calle, R., Jiménez-Vivas, A., Poy Castro, R., Calvo Álvarez, M. I., & Jenaro, C. (2022). Perceived Benefits of Future Teachers on the Usefulness of Virtual and Augmented Reality in the Teaching-Learning Process. *Education Sciences*, 12(12), 855
39. Kapp, K., Sivén, M., Laurén, P., Virtanen, S., Katajavuori, N., & Södervik, I. (2022). Design and Usability Testing of an Augmented Reality (AR) Environment in Pharmacy Education—Presenting a Pilot Study on Comparison between AR Smart Glasses and a Mobile Device in a Laboratory Course. *Education Sciences*, 12(12), 854.
40. Martínez-Graña, A. M., Díez, T., González-Delgado, J. Á., Gonzalo-Corral, J. C., & Merchán, L. (2022). Geological Heritage in the “Arribes del Duero” Natural Park (Western, Spain): A Case Study of Introducing Educational Information via Augmented Reality and 3D Virtual Itineraries. *Land*, 11(11), 1916.
41. Papakostas, C., Troussas, C., Krouska, A., & Sgouropoulou, C. (2022). Personalization of the Learning Path within an Augmented Reality Spatial Ability Training Application Based on Fuzzy Weights. *Sensors*, 22(18), 7059.
42. Cordero-Guridi, J.-J., Cautle-Gutiérrez, L., Alvarez-Tamayo, R.-I., & Caballero-Morales, S.-O. (2022). Design and Development of a I4.0 Engineering Education Laboratory with Virtual and Digital Technologies Based on ISO/IEC TR 23842-1 Standard Guidelines. *Applied Sciences*, 12(12), 5993
43. Cabero-Almenara, J., Llorente-Cejudo, C., & Martínez-Roig, R. (2022). The Use of Mixed, Augmented and Virtual Reality in History of Art Teaching: A Case Study. *Applied System Innovation*, 5(3), 44.

44. McCord, K. H., Ayer, S. K., Perry, L. A., Patil, K. R., London, J. S., Khoury, V., & Wu, W. (2022). Student Approaches and Performance in Element Sequencing Tasks Using 2D and Augmented Reality Formats. *Education Sciences*, 12(4), 247
45. Gattullo, M., Laviola, E., Boccaccio, A., Evangelista, A., Fiorentino, M., Manghisi, V. M., & Uva, A. E. (2022). Design of a Mixed Reality Application for STEM Distance Education Laboratories. *Computers*, 11(4), 50
46. Wyss, C., Degonda, A., Bühner, W., & Furrer, F. (2022). The Impact of Student Characteristics for Working with AR Technologies in Higher Education—Findings from an Exploratory Study with Microsoft HoloLens. *Information*, 13(3), 112.
47. Campos-Mesa, M.-C., Castañeda-Vázquez, C., DelCastillo-Andrés, Ó., & González-Campos, G. (2022). Augmented Reality and the Flipped Classroom—A Comparative Analysis of University Student Motivation in Semi-Presence-Based Education Due to COVID-19: A Pilot Study. *Sustainability*, 14(4), 2319
48. Okanovic, V., Ivkovic-Kihic, I., Boskovic, D., Mijatovic, B., Prazina, I., Skaljo, E., & Rizvic, S. (2022). Interaction in eXtended Reality Applications for Cultural Heritage. *Applied Sciences*, 12(3), 1241
49. Ancient gothic chair - Download Free 3D model by Stefan-Limon (@Stefan-I-O) [f7bf118] (sketchfab.com)
50. 15th Century Gothic Storage Chest - Download Free 3D model by Jordan F (@JordanF) [9c93b74] (sketchfab.com)
51. French Gothic Door - Download Free 3D model by ihs (@ihs) [bc9b404] (sketchfab.com)
52. Gothic Bench | 3D CAD Model Library | GrabCAD

53. Gothic Chair - Download Free 3D model by ilaida (@ilaida) [4373435] (sketchfab.com)
54. Gothic chandelier - Download Free 3D model by KZNYKN (@KZNYKN) [692b0d0] (sketchfab.com)
55. Gothic Light - Download Free 3D model by Vinny Passmore (@HPrendering) [1119f1f] (sketchfab.com)
56. Gothic Mirror - Download Free 3D model by croklin (@croklin) [17c53af] (sketchfab.com)
57. Gothic Side Chair - Preview - Download Free 3D model by Connections XR (@connectionsxr) [c479d0c] (sketchfab.com)
58. Gothic Table - Download Free 3D model by Dirtrock (@dirtrock) [ad27208] (sketchfab.com)
59. Gothic Window - Download Free 3D model by Mário Mendes (@mariomendesdeveloper) [371f87b] (sketchfab.com)
60. Gothic window with painted glass - Download Free 3D model by FunWithBlender (@HolmH) [51398c3] (sketchfab.com)
61. Gothic window - Download Free 3D model by Paulina (@Byakko) [b089072] (sketchfab.com)
62. <https://sketchfab.com/3d-models/gothic-window-25299f93ffca4a058a7572e084e2fd2f>
63. Grand Classic Edwardian Dining Armchair - Download Free 3D model by Michaela Blanchfield (@michaelablanchfield) [f0fc141] (sketchfab.com)
64. Hanging Chandelier Medieval - Download Free 3D model by attilakozma (@attilakozma) [11f0732] (sketchfab.com)

65. Medieval Bed - Download Free 3D model by Jordan F (@JordanF) [59ccf6a] (sketchfab.com)
66. Medieval-Gothic Furniture - Download Free 3D model by sduerk (@sduerk) [ab26581] (sketchfab.com)
67. Stylized gothic table - Download Free 3D model by Rson (@DimanRson) [22da429] (sketchfab.com)
68. The Kungsåra Bench - Download Free 3D model by Historiska (@historiska) [3c2b1eb] (sketchfab.com)
69. Wooden Lamp Post Medieval Fantasy Lantern - Download Free 3D model by attilakozma (@attilakozma) [7272ba8] (sketchfab.com)
70. <https://sketchfab.com/3d-models/ancient-roman-chair-9f36ce03f9fd4397bb2371d292e3b3f5>
71. Marble table - Download Free 3D model by diapant95 (@3DCraftsman) [7b7f0f8] (sketchfab.com)
72. Old Roman Style Treasure Chest [animated] - Download Free 3D model by Theo Kain (@TheoKain) [a4f29fc] (sketchfab.com)
73. Roman Stool - Download Free 3D model by plasmaernst (@plasmaernst) [b4b4b0a] (sketchfab.com)
74. 3d obj antique table (turbosquid.com)
75. Chest - Download Free 3D model by Virtual Museums of Małopolska (@WirtualneMuzeaMalopolski) [c580f18] (sketchfab.com)
76. Fireplace Mantle, Santa Fiora, Tuscany - Download Free 3D model by Global Digital Heritage (@GlobalDigitalHeritage) [11a77c5] (sketchfab.com)

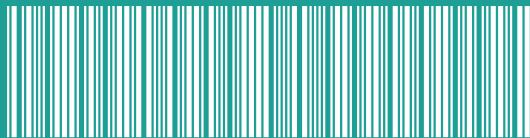
77. Marble Topped Centre Table - Download Free 3D model by artfletch (@artfletch) [ac8d7d2] (sketchfab.com)
78. Pouf - Download Free 3D model by __Maros__(oooFFFFEDDMODELS) (@pierre.marcos.19) [01d7f14] (sketchfab.com)
79. Renaissance Round Dining Table - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [a3b0808] (sketchfab.com)
80. 1-door Cabinet - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [d51b8a1] (sketchfab.com)
81. 5 doors sideboard - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [be4f662] (sketchfab.com)
82. Baroque Armchair With Armrest - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [66cb29c] (sketchfab.com)
83. Baroque armchair. Palau Moja (Barcelona) - Download Free 3D model by Burzon*Comenge (@BurzonComenge) [57136c4] (sketchfab.com)
84. Baroque Chair - Download Free 3D model by Sebastian.Dohnal (@Sebastian.Dohnal) [abcd019] (sketchfab.com)
85. free obj mode ready corona (turbosquid.com)
86. free baroque mirror table 3d model (turbosquid.com)
87. Baroque Wooden Figured Coffee Table - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [7226d55] (sketchfab.com)
88. free belloni aura table subliminal 3d model (turbosquid.com)

89. Classic Armchair With Armrests - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [580ef2f] (sketchfab.com)
90. Classic Console Made In Italy - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [535c8bd] (sketchfab.com)
91. Gold Baroque Round Coffee Table - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [8d38ba0] (sketchfab.com)
92. free chair luxury living 3d model (turbosquid.com)
93. free x model sofa living room (turbosquid.com)
94. Old Desk - Download Free 3D model by Maxence Rouillet (@maxencerouillet) [15997fe] (sketchfab.com)
95. Plywood Baroque Table - Download Free 3D model by biserborislawow (@biserborislawow) [1c165fd] (sketchfab.com)
96. Porta de l'església de Santa Maria de Solivella - Download Free 3D model by Joan Mateo Franch (@joanmateofranch) [1d625f0] (sketchfab.com)
97. Small baroque table - Download Free 3D model by biserborislawow (@biserborislawow) [e6f1132] (sketchfab.com)
98. The Church of St. Jakobi- Braunschweig - Download Free 3D model by Mohammad Reza Abdollahi (@mhmdrza) [4e2fe9a] (sketchfab.com)
99. White Solid Wood Console - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [0f4fea7] (sketchfab.com)

100. 12671 Vase Stand - Modenese Gastone - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [bc5c917] (sketchfab.com)
101. 14602 Rectangular table - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [31efe90] (sketchfab.com)
102. free max mode jumbo regency tables reg-14 (turbosquid.com)
103. Ornate Table - Download Free 3D model by satto3 (@sungminbyun) [107cd01] (sketchfab.com)
104. Rococo fireplace - Download Free 3D model by RUBen (@Begalov) [c3a5d18] (sketchfab.com)
105. Sofa by Modenese Interiors - Download Free 3D model by Modenese Gastone Interiors (@modeneseinteriors) [88abda2] (sketchfab.com)
106. Antique Desk - Download Free 3D model by Matthew Collings (@mtcollings) [c491f64] (sketchfab.com)
107. Chair - Victorian Style - Download Free 3D model by mendao37 (@mendao37) [d559efd] (sketchfab.com)
108. Mirror A - Download Free 3D model by DudleyLong (@DudleyLong) [a1c6daa] (sketchfab.com)
109. Old Victorian Leather Sofa - Download Free 3D model by Oleksandr Tserkovniy (@4882262) [beaff7c] (sketchfab.com)
110. Old Wardrobe - Download Free 3D model by SebastianSosnowski (@SebastianSosnowski) [6f58d3b] (sketchfab.com)
111. Rocking Chair - Download Free 3D model by Gennady.Tihonov (@Gennady.Tihonov) [922babc] (sketchfab.com)

112. Table - Victorian Style - Download Free 3D model by mendao37 (@mendao37) [a5e141f] (sketchfab.com)
113. The Bookwheel - Download Free 3D model by sergeilhandristov (@sergeilhandristov) [ae026cc] (sketchfab.com)
114. The Victorian Passage - Download Free 3D model by Jasmine2399 (@Jasmine2399) [b01a9c9] (sketchfab.com)
115. Victorian Armchair - Download Free 3D model by Graham (@Graham.Jolliffe) [8ab8caf] (sketchfab.com)
116. Victorian Bed - Download Free 3D model by alefarfer (@alefarfer) [c1ab8d1] (sketchfab.com)
117. Victorian chair - Download Free 3D model by BATRIC_18 (@BATRIC_18) [6479a19] (sketchfab.com)
118. Victorian chair - Download Free 3D model by inter_net (@inter_net) [8f5ba2a] (sketchfab.com)
119. Victorian chair - Download Free 3D model by Valentine_vanSteenbergen (@Valentine_vanSteenbergen) [7dbbf8b] (sketchfab.com)
120. Victorian Chairs - Download Free 3D model by Matthew Collings (@mtcollings) [a12b3c2] (sketchfab.com)
121. Victorian Desk - Download Free 3D model by Faheem Yusuf (@FameProductions) [ac061b3] (sketchfab.com)
122. Victorian dressing table - Download Free 3D model by stanislau.see (@stanislau.see) [0bef89a] (sketchfab.com)
123. Victorian Lounge Sofa - Download Free 3D model by Jamie McFarlane (@jamiemcfarlane) [c7b7999] (sketchfab.com)

124. Victorian Seat - Download Free 3D model by FordVFX (@FordVFX) [38b7abc] (sketchfab.com)
125. Victorian Style Sofa - Download Free 3D model by ryankentpaule (@ryankentpaule) [9198547] (sketchfab.com)
126. Victorian Wooden table - Download Free 3D model by Enzo Amanrich (@ImaGeniusMan) [1fe1339] (sketchfab.com)
127. Vintage Cabinet - Download Free 3D model by thiezubu (@thiezubu) [38f9688] (sketchfab.com)



ISBN: 978-625-367-441-0