

# **Revolutionizing 3D Animation & 3D Modeling Education: A Comprehensive Study on the Impact of Blended Learning**

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*The educational environment has undergone a significant transformation due to the widespread impact of the COVID-19 pandemic. Prompting creative solutions to issues in teaching and learning. This study explores the integration of blended learning, focusing on 3D animation and modeling education. Blended learning, which combines conventional and online approaches, is emerging as an effective method for increasing student engagement and performance. The research delves into the complexities of 3D animation and modeling courses, emphasizing the importance of creative thinking and mastery of animation principles. The study showcases the effectiveness of blended learning through improved student outcomes, emphasizing adaptability, and interactive learning. This research provides valuable insights for educators, highlighting the significance of flexible teaching methodologies and the integration of technology in shaping the future of 3D animation and 3D modeling education.*

*Keywords: COVID, blended learning, 3D modeling, 3D animation, educational challenges, student performance, teaching methodologies*

## **INTRODUCTION**

The global coronavirus pandemic (COVID-19) has had an intense and far-reaching impact on the educational system, leading to numerous challenges and unanswered dilemmas (Butler-Henderson et al., 2020). These complexities have given rise to complications that educators continue to grapple with, striving tirelessly to find innovative solutions and navigate uncharted territories in the realm of teaching and learning. As the educational landscape continues to evolve amidst this ongoing crisis, educators are faced with the task of adapting to new methodologies and technologies while addressing the diverse needs of students, making their efforts to surmount these challenges both crucial and commendable (Crawford, 2021). In the wake of the pandemic, many educational institutions and universities swiftly adopted blended learning for specific courses, integrating traditional and online methods. This shift aimed to provide students with flexibility and enhance the learning experience. Blended learning combines traditional classroom and online experiences, gaining popularity for improving learning standards, increasing exam passing rates, and offering flexibility. It integrates digital content with in-class activities, bridging the gap between traditional and fully online learning. Blending courses enhances content accessibility, pedagogical effectiveness, and teacher flexibility, but requires a well-planned pedagogical model for effective student engagement (Kumar, et. al, 2021). Students' familiarity with technology, accelerated by the pandemic, led to a surge in online teaching methods like Zoom, enabling interactive learning. Although the return to face-to-face teaching has begun, many subjects still rely on online formats. However, this shift has sparked

debates on the value of online classes versus traditional methods. The introduction of digital technologies like artificial intelligence and augmented reality reshaped distance learning, making it more appealing. While some students prefer online classes, others seek hybrid models blending virtual and physical engagement. Management educators face challenges balancing these diverse preferences, requiring a nuanced approach tailored to individual needs (Aguinis et al., 2019). The evolving landscape demands flexible teaching models that incorporate digital tools, ensuring an enriching student experience amidst varying expectations (Jones et al., 2019; Bell et al., 2018). Blended learning literature lacks a comprehensive understanding of the challenges within its online component. Blended learning merges face-to-face and online elements, yet existing literature often overlooks the face-to-face aspect. Consequently, students and teachers are shifted to the online component, requiring self-regulation and technology usage at their own pace (Rasheed, Kamsin, & Abdullah, 2020). Emerging as crucial skills, 3D modeling technologies and related techniques have gained prominence. Conventional teaching methods for 3D modeling often rely on three-view diagrams to aid students in spatial cognition. However, the effectiveness of such teaching materials is hindered by learners' limited three-dimensional and spatial abilities. Moreover, the instructional impact is constrained by students' existing spatial skills. In traditional technical education, students typically play passive roles, and teaching methods tend to prioritize rote learning. However, these approaches are currently transforming (Huang & Lin, 2017). Therefore, significant challenges arise in undergraduate-level courses, especially in the context of teaching 3D modeling. This paper presents a test case conducted within a university's 3D animation and modeling course. The findings suggest that students who have been learning 3D animation and 3D modeling through blended learning demonstrated a better understanding of the course material. Their performance in practical exams was notably superior compared to students who had not been exposed to blended learning before the COVID-19 pandemic. The paper is structured as follows: Section 2 outlines blended learning and its methodology, while Section 3 discusses the results obtained from 3D animation and 3D modeling classes. Section 4 the importance of 3D animation and 3D modeling education. while Section 5 concludes the paper and provides detailed insights into the findings.

## **BLENDED LEARNING**

Teaching 3D graphics courses involves balancing theory with hands-on practice. Students delve into complex geometry and programming concepts, laying the groundwork for visually captivating creations. To bridge the gap between theory and application, educators incorporate frequent authoring assignments. These tasks ground technical knowledge and clarify abstract concepts by providing practical contexts (Brutzman, 2002). Blended learning assessments serve as the foundation for tailored student guidance, enabling adaptive instruction. They also equip teachers with personalized approaches, focusing on challenging offline class topics. This strategy encourages educators to integrate in-class discussions with online self-study and 3D modeling, fostering an engaging learning environment. This innovative teaching method significantly enhances students' enthusiasm, improves classroom dynamics, refines teaching effectiveness, and boosts their professional graphical literacy and sustainable development skills (Xie, 2023). It is imperative for faculty members to embrace and prepare for Blended Learning strategies, particularly in the wake of challenges like pandemics. Therefore, there should be a balanced integration of online and traditional formats, highlighting the importance of adaptability and continuous feedback from students in the development and implementation of effective educational models (Megahed, & Hassan, 2021). The integration of online and in-person learning options has seamlessly evolved, resulting in a growing need for on-site workshops and certifications. This increasing demand presents a challenge to devise novel forms of university credentialing that combine online learning with educational experiences in informal environments. The importance of teachers investing additional time and effort in lesson preparation. This involves gaining a comprehensive understanding of course objectives, content, as well as innovative and challenging materials. Furthermore, teachers must grasp students' knowledge base, personality traits, and dynamic learning environments to effectively design hybrid teaching methods. Additionally, students play a central role in this process. They must transition from traditional lecture-based

learning to independent inquiry and self-directed learning to enhance their self-learning capabilities and foster creativity. Ultimately, the effectiveness of teaching methods and quality should be evaluated through students' acceptance and course outcomes. Tailored solutions, based on diverse student needs, are essential to achieve the most optimal teaching outcomes (Zeng, 2023). Blended learning integrates various multimedia materials and technologies to cater to instructional needs. This study exemplified this approach by incorporating technologies in a school course. The experimental results indicated that students found the learning activities enjoyable and engaging. Utilizing technologies in blended learning enabled students to independently identify specific points. Teachers also noted a reduced need for lengthy explanations with this method. Computer-assisted instruction clarified abstract concepts, and in cases involving 3D geometry facilitated understanding within real-world contexts. By offering a unique perspective on the explained course material, it demonstrates the effectiveness of technology-enhanced blended learning, showcasing its potential as a valuable tool in diverse educational environments (Chen, Huang, & Chou, 2017). This study (Fong, Leroy & Poon, Stephen, 2021) delves into the challenges and perceptions of educators involved in teaching 3D animation within blended learning environments in higher education. Despite a generally positive outlook, there exists ambiguity regarding the precise definition and practical implementation of blended learning, particularly in the specialized context of 3D animation education. While educators recognize the benefits of incorporating technology, the distinction between traditional teaching methods and the integration of 3D animation tools remains unclear. The study underscores the crucial role of clear management policies, purposeful tools, and skill development specifically tailored for teaching 3D animation within a blended learning framework. It emphasizes the necessity of establishing precise guidelines and distinctions to align institutional objectives with the unique challenges and opportunities presented by 3D animation education. Additionally, the study highlights the need for comprehensive training programs to ensure educators possess the essential expertise to effectively integrate 3D animation techniques into their teaching methodologies within the realm of blended learning. (Lam & Su, 2016) presented a fresh teaching model for three-dimensional animation. Unlike previous techniques, this approach promotes the development of creative thinking above the acquisition of specialized software abilities. The emphasis is on leading students through the exploration of various 3D animation tools and features in order to generate new animation masterpieces. The paper describes the experimental teaching approach, examines animated figure design and motion, and offers a new paradigm for 3D animation education that emphasizes creative thinking.

### **THE IMPACT AND SIGNIFICANCE OF BLENDED LEARNING IN TEACHING 3D ANIMATION AND 3D MODELING COURSE**

There are numerous courses in the computer graphics and animation major that are directly related to animation and modeling. However, this research will specifically concentrate on two fundamental ones: 3D animation and 3D modeling.

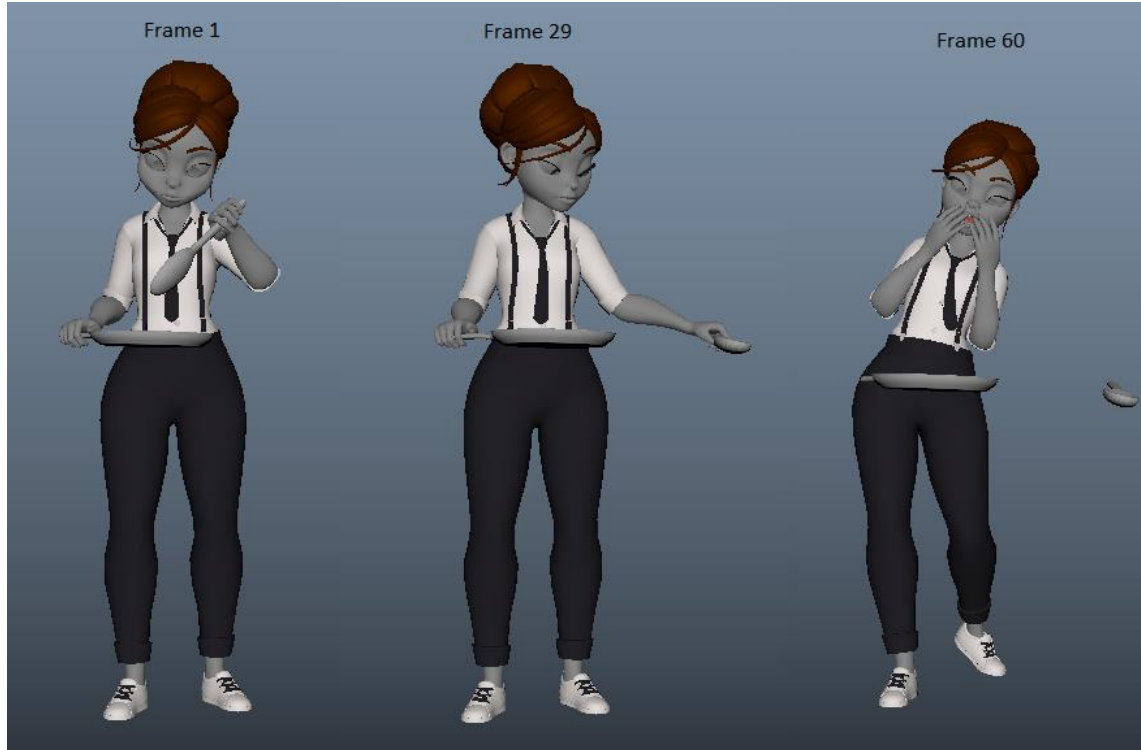
In the 3D animation course, and as part of the final exam, students are requested to animate a 3D scenario that comprises a character expressing emotions in a specific circumstance using facial expressions and body movements.

The final exam's objectives and standards must be at a high level in order to drive students to achieve their best. Some of these requirements include: applying the 12 principles of animation, acting out the 3D scene to use it as a reference, and ensuring the animation's seamless quality. Figure 1 and 2 show frames of two sample animations of the final exam.

**FIGURE 1**  
**SOME FRAMES OF A 3D ANIMATED SCENE SAMPLE**



**FIGURE 2**  
**SOME FRAMES OF A 3D ANIMATED SCENE SAMPLE**



**FIGURE 3**  
**GRAPH EDITOR OF THE ANIMATION**

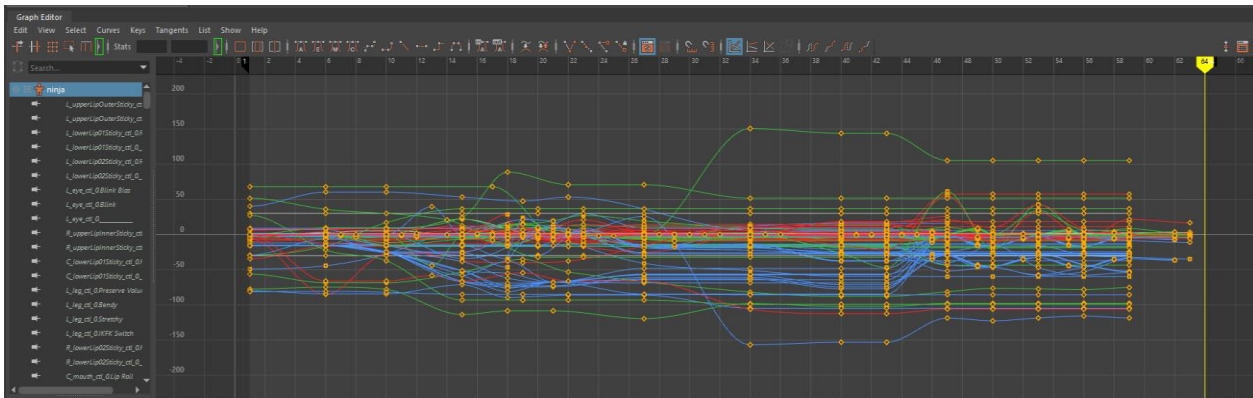
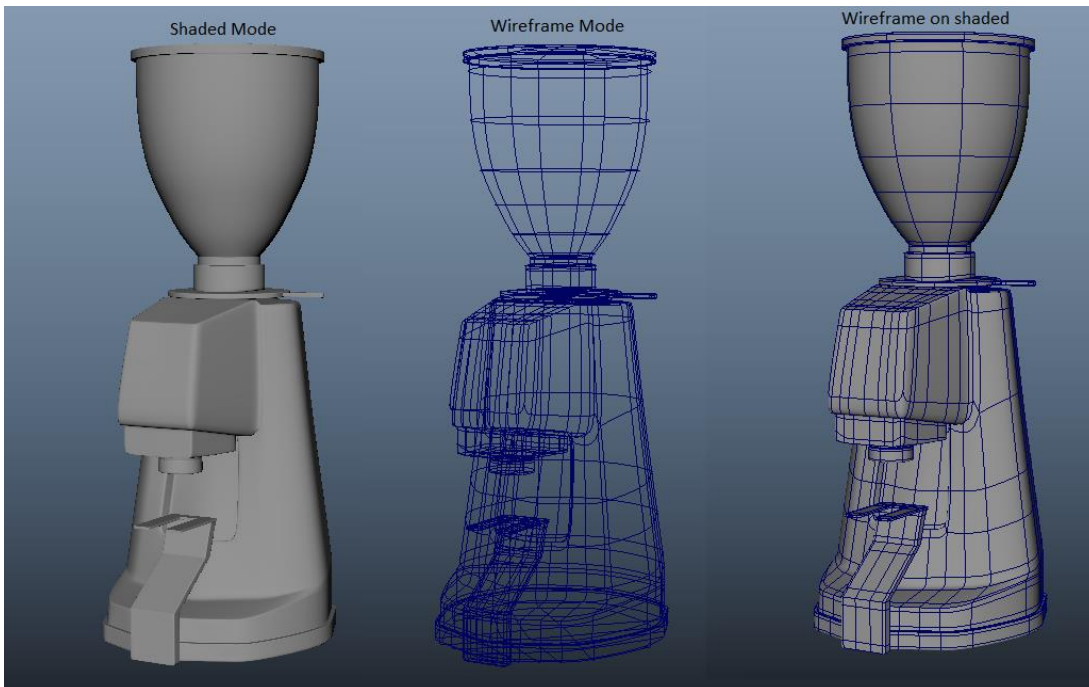


Figure 3 shows the graph editor of a sample animation. The animation's keyframes are represented by yellow dots, while the 3D program generates animation curves by connecting these keyframes through tweening. It is evident that the animation curves are smooth indicating the absence of unnecessary keyframes, leading to a seamless animation.

Conversely, in the 3D modeling course, students are required to create complex 3D geometries and props within the confines of the 3D modeling course, while also adhering to the fundamental rules and aesthetics that govern 3D modeling. Students are challenged by this project to put their theoretical understanding of 3D modeling laws and concepts into practice.

**FIGURE 4**  
**3D MODEL EXAM SAMPLE**



**FIGURE 5**  
**3D MODEL EXAM SAMPLE 2**

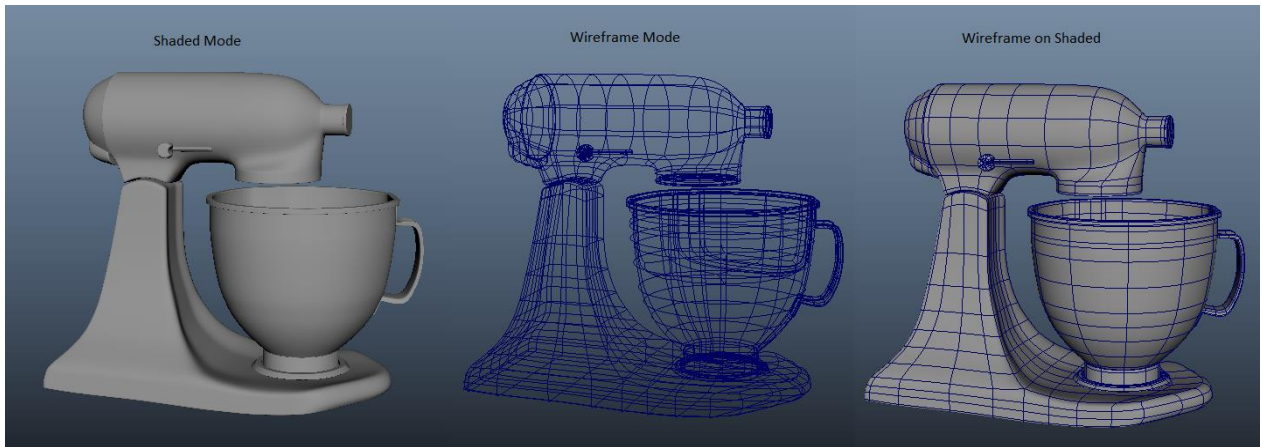


Figure 4 demonstrates how the sample 3D model complies with the specifications and is appropriately detailed. The model achieves a decent balance between accuracy and efficiency, adhering to the essential modeling rules and appeal. Additionally, the polycount of the shown sample models are adequate, no non-quad faces or intersections between components, and proper appeal and proportions.

**FIGURE 6**  
**3D ANIMATION COURSE RESULTS**

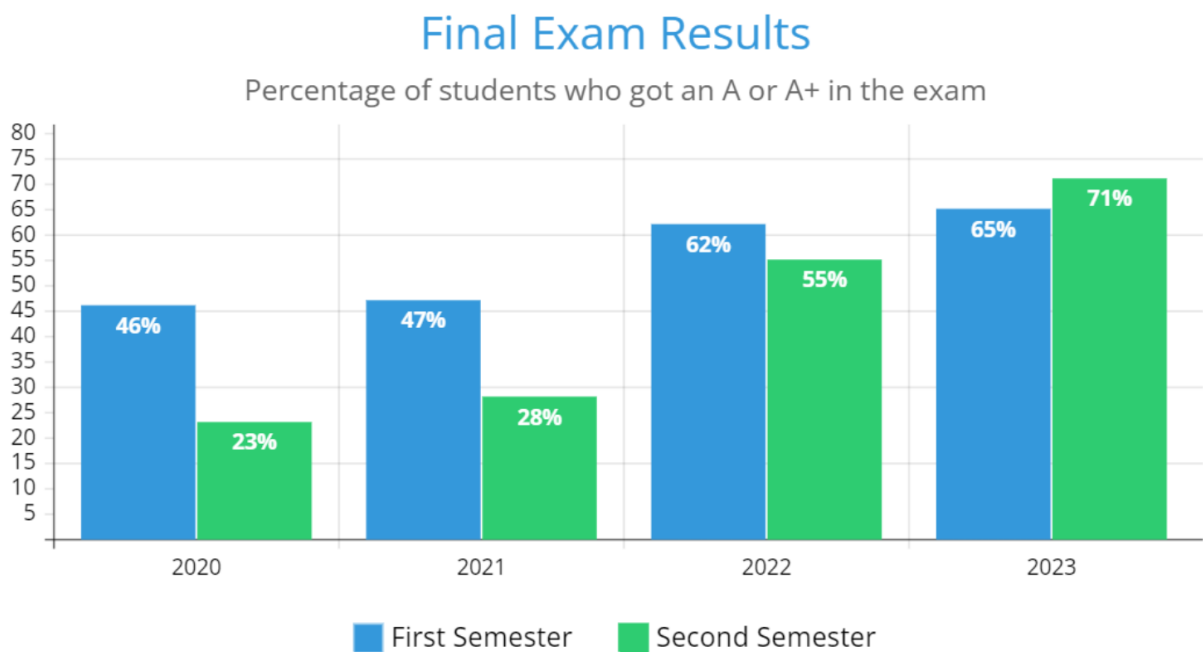
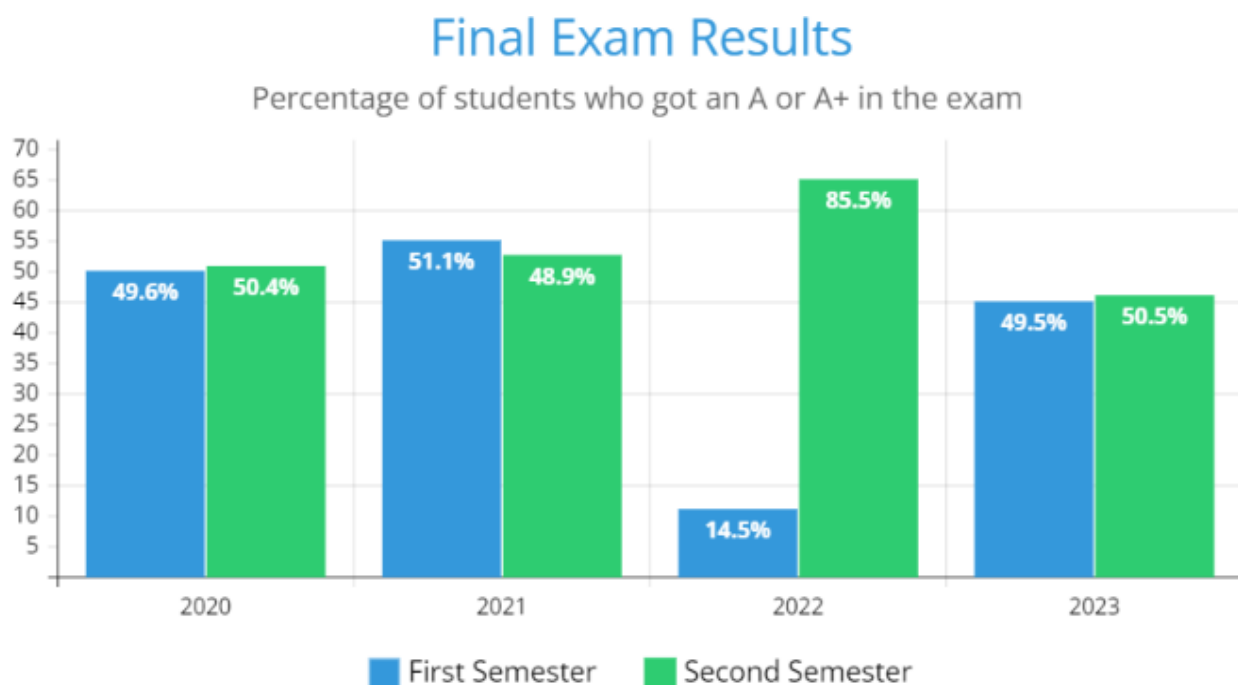


Figure 6 shows the 3D animation course results over four consecutive years, each comprising two semesters. The data clearly demonstrates that combining blended learning with traditional teaching methods significantly enriches the educational experience for students in the 3D animation course. In the years 2020 and 2021 students were only exposed to online teaching in the midst of the COVID pandemic. The impact of online teaching on 3D animation was evident, highlighting its unsuitability for the course. While the

online results were mediocre, the 3D animation course thrives under traditional face-to-face instruction. The introduction of blended teaching materials further enhanced the learning experience, emphasizing the significance of incorporating varied methods to optimize education. Despite challenges, students' achievements illustrate the transformative potential of diverse teaching approaches. It is evident that the performance of students in both semesters of each year is inadequate compared to the following years. Furthermore, after examining the outcomes from the subsequent years of 2022 and 2023, introducing blended learning with traditional learning is a proof to enhance the performance of students immensely, providing an extensive and successful instructional strategy. This comprehensive approach to teaching enhances students' involvement and comprehension while also producing better academic results.

**FIGURE7**  
**3D MODELING COURSE RESULTS**



Nevertheless, the teaching approach for the 3D modeling course remained unaffected by the significant shift to online learning during the years 2020 and 2021 due to the COVID pandemic. Interestingly, even after the transition to blended learning in 2022 and 2023, students' outcomes did not suffer adverse effects. The sole exception was the first semester of 2022, where students did not engage in blended learning. Figure 7 illustrates a noticeable decline in results during this period, marking the lowest performance levels.

It is essential to note that the quality of students' 3D models during this time was subpar, containing numerous errors and failing to adhere to established modeling guidelines and rules. This underscores the fact that blended learning not only enhances students' performance but also equips them with the ability to improve their skills significantly.

Furthermore, even though students faced difficulties with online and blended learning, they showed they could adapt and improve their 3D modeling skills. This change in how they learned taught them to be flexible and resilient. It also emphasized the need for ongoing support and new ways of teaching. Students excelled due to their determination and effective teaching techniques that they are receiving, demonstrating the significant impact alternative learning approaches can have on education.

## **THE IMPORTANCE OF 3D ANIMATION AND 3D MODELING EDUCATION**

Mastering 3D modeling is essential for students aspiring to enter the animation or gaming industry. This skill empowers them to craft captivating characters and immersive environments. Beyond its creative applications, 3D modeling can also enhance the educational experience across various fields. The ability to create visually engaging content can be a valuable tool for educators, it gives the opportunity for students to understand and engage in complex courses. By honing this skill, students can not only pursue their passion in the entertainment industry but also contribute to innovative teaching methods in diverse educational areas (Surynková, 2020).

3D Animation, on the other hand, is recognized as one of the most essential disciplines that may be utilized for a variety of objectives, including entertainment, gaming, and reducing issues related to mental health. The Character animators create the performance of the characters and are often seen as actors in animated productions. The animators must persuade the viewer that what they see onscreen is genuine and alive. Character animators must have an in-depth knowledge and understanding of weight and timing, but they must also be able to offer a physical acting performance that develops a personality for the character that is understandable onscreen (Beane, 2012). Understanding the 12 animation principles is critical for anybody working in the art of animation. These concepts, developed by Disney animators Frank Thomas and Ollie Johnston, are the basis for generating appealing and lifelike animated scenes. Animators may infuse life into characters and things on screen by mastering principles like squash and stretch, anticipation, timing, and exaggeration. Animators who understand these concepts may design motions that are not only visually appealing but also emotionally resonant, captivating viewers and effectively communicating tales (Williams, 2001). A good understanding of these concepts increases the quality of animation, making it a crucial knowledge basis for aspiring animators and professionals similarly, whether in the realms of cinema, gaming, or multimedia arts.

## **CONCLUSION**

In conclusion, our study focusing on 3D modeling and animation courses in the context of the COVID-19 pandemic highlights the critical role of blended learning in shaping the future of creative education. The integration of traditional teaching methods with online learning platforms has proven to be a transformative approach, significantly enhancing students' abilities and outcomes. The findings clearly show that implementing blended learning improved students' performance in 3D animation and modeling courses. Students displayed adaptation and devotion despite the limitations of online and blended learning, demonstrating considerable increases in their skills. The use of blended learning not only engaged students but also provided them with the skills they needed to flourish in demanding tasks like character animation and 3D modeling.



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