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# Exploring the Integration of Hard Skills for Animation Students in the Metaverse: Nexus of Project Management Strategies and Outcomes

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**Abstract**
This research seeks to examine the integration and relative significance of the hard skills necessary for Metaverse development, with a particular focus on their impact on project outcomes. Adopting a qualitative methodology grounded in grounded theory, the study conducted semi-structured interviews with 10 Metaverse managers, 10 animation educators, and 10 animation students. The findings indicate that 3D modelling, animation character and scene design, and virtual reality software are regarded as the most essential skills for the success of Metaverse projects, as they significantly enhance

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user immersion and engagement. Model mapping, animation special effects, and scriptwriting were considered of moderate importance, while video editing was viewed as less critical. These results address a gap in the existing literature by providing a comprehensive understanding of how various skills are prioritised and integrated into practice. The originality of this study lies in its holistic approach to analysing skill requirements from multiple stakeholder perspectives, offering actionable insights for educational programmes and industry practices. By addressing these gaps, the research contributes valuable knowledge to both the academic field and the Metaverse development industry, informing curriculum design and project management strategies.

**Keywords:** Metaverse, Hard Skills, Project Management, Virtual Learning, Thematic Analysis.

## Introduction

Metaverse users can achieve full immersion in computer-generated environments, thereby enhancing the experience of virtual reality (VR), which has significant implications for digital interactions. This encompasses 3D modelling, animation, and VR applications beyond the scope of online gaming. The Metaverse is poised to revolutionise sectors such as education, entertainment, and social interaction, as highlighted by Alam and Mohanty (2022). As the Metaverse continues to develop, the creation of realistic and engaging virtual environments will necessitate advanced technological expertise. Research indicates that the Metaverse requires capabilities in scenario creation, character animation, and 3D modelling (Deng et al., 2021), which are essential for fostering deep, meaningful interactions. Oliveira and Cruz (2023) note that these technologies present both unique opportunities and challenges, demanding a blend of technical proficiency and creative skills. This study aims to examine the specific hard skills that influence the development of Metaverse projects.

Empirical studies highlight that the development of the Metaverse necessitates both technical and creative expertise (Alam & Mohanty, 2022). Research underscores the importance of 3D modelling in crafting vibrant and intricate virtual worlds. Yanto et al. (2022) advocate for 3D modelling as a crucial tool for creating immersive environments that effectively captivate consumers. Çakıroğlu et al. (2021) emphasise the role of dynamic and engaging animations within the Metaverse, noting that well-designed animations are key to user engagement and entertainment. Further studies have explored how virtual reality software enhances rendering and interaction speeds, which are vital for ensuring continuous and immersive virtual experiences (Stadlinger et al., 2021). However, additional research is required to explore how these skills are integrated into project management and their impact on the success of Metaverse initiatives.

Preliminary studies have identified various capabilities in Metaverse development;

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however, the integration and management of projects remain unclear. Much of the existing research has focused on individual skills or technological advancements, overlooking the fact that the success of Metaverse ventures relies on collaborative efforts. While several studies have demonstrated the effectiveness of 3D modelling and animation, there is limited research on their application within project management contexts (Cruz et al., 2022; Oliveira & Cruz, 2023). Few studies have also explored the perspectives of Metaverse administrators, animation educators, and students on the role of hard skills (Ji, 2021). Given the scarcity of literature in this area, further research is needed to investigate the inclusion and evaluation of talent in Metaverse development projects.

This study aims to address these gaps by evaluating the integration and relative importance of key hard skills in Metaverse development. It will explore how 3D modelling, animation, and virtual reality technologies are utilised, and how these skills impact project outcomes. By incorporating perspectives from Metaverse administrators, animation instructors, and students, the research seeks to gain a deeper understanding of the hard skills essential for the success of Metaverse initiatives. Identifying the most critical abilities will provide valuable insights for educational and industry recruitment strategies. Additionally, the exploration of talent inclusion and evaluation will contribute to improving project management approaches. Ultimately, this study aims to enhance educational programmes and industry practices, fostering more engaging and efficient Metaverse projects in the future.

## Literature Review

Hard skills in animation education, particularly within the rapidly evolving Metaverse landscape, have become a significant topic of discussion in both academic and industry circles. As digital environments grow increasingly complex, specialised animation skills and effective project management are essential (Liu & Wang, 2021). Research into the Metaverse and its underlying technologies reveals substantial expansion and a multitude of applications within the emerging digital universe. VR and AR play pivotal roles in creating immersive digital environments, and the success of the Metaverse is closely tied to the advancement of these technologies (Kato et al., 2022). The Metaverse, which blends VR and AR, enables users to interact with computer-generated environments in a manner akin to real life (Zhang et al., 2021). While VR recreates past experiences to provide an authentic encounter, AR overlays digital information onto the real world to enhance the user experience. Both technologies significantly contribute to real-time processing and graphical advancements, enriching the immersive quality of Metaverse experiences (Şılbır et al., 2020).

The development of the Metaverse relies heavily on VR, AR, and advanced 3D

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modelling and animation. Kellems et al. (2020) assert that creating realistic virtual worlds necessitates high-quality 3D modelling. Tools such as Blender and MAYA are essential for generating interactive characters and objects. The lifelike quality of virtual worlds is enhanced through model mapping and animation special effects (Lee et al., 2021). These techniques, combined with effective project management, are crucial for maintaining the quality and consistency of Metaverse operations. Competent project management ensures that scene design, character animation, and interactive elements align with the intended goals of the virtual environment (Oliveira & Cruz, 2023).

The growing importance of user-generated content (UGC) and interoperability in the Metaverse is also noteworthy. Interoperability enables programs and virtual worlds to share data and communicate, fostering a highly integrated digital environment (Kato et al., 2022). Zhao et al. (2022) suggest that UGC allows users to customise their virtual experiences, adding uniqueness to the Metaverse. This trend reflects a shift towards a collaborative and interactive digital world where users have greater control over their virtual surroundings. As the Metaverse expands, there is a need for further exploration of new technologies and applications to enhance digital capabilities and experiences (Lan et al., 2024). For truly immersive and engaging experiences, 3D modelling remains fundamental to VR. The creation of realistic virtual environments relies on 3D modelling techniques (Yan et al., 2024). Virtual world developers utilise these digital models to craft complex, realistic scenes that heighten user immersion. Picciotto (2020) emphasises that visually captivating virtual experiences depend on robust 3D modelling, which users find highly engaging and which significantly enhances the overall VR experience.

3D modelling is essential for creating visually appealing virtual worlds. It allows for the accurate representation of complex structures and objects, enabling realistic physics simulations and dynamic interactions, which are crucial for immersive VR experiences (Untari et al., 2020). Model mapping further enhances the realism and complexity of 3D environments, contributing to the depth and authenticity of virtual spaces (Patete & Marquez, 2022). By bridging the virtual and real worlds, 3D modelling plays a key role in immersing users within these environments. In sectors such as virtual education, training, simulation, and entertainment, 3D modelling is widely employed to deliver realistic and engaging experiences. Lan et al. (2024) note that educational simulations and training programs utilise 3D models to provide immersive learning opportunities that would otherwise be impossible to replicate. The ability to present complex systems and events in an immersive 3D format has been shown to enhance memory retention and improve learning outcomes (Lan et al., 2024). As technology continues to evolve, the need for advanced 3D modelling skills will grow, becoming increasingly vital for the development of virtual worlds and digital interactions (Untari et al., 2020).

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Virtual environment and character animation influence digital information intake and attention. Increased animation makes virtual people and places appear more lifelike. Laine et al. (2022) found that animation enhances avatars and emotional connection. Precise animations evoke emotions, enriching interactions. Bailenson et al. (2008) assert emotional connection is essential for user focus and interaction. Character design impacts virtual world participation, with appearance and traits affecting perceptions (Yee & Bailenson, 2007). MacDonald et al. (2018) suggest well-designed characters enhance user enjoyment and engagement. Characters drive narratives, fostering exploration and engagement (Baker & Nelson, 2005). Dynamic character design is vital for keeping users engaged. Animation and character design influence plot and user interaction, with engaging stories increasing connection (Schmidt, 2016; Turnley et al., 2017). Effective character interactions boost engagement (Pohl et al., 2021). Future technologies will enhance interface animation and character design, reshaping information consumption (Scholz, 2020).

Animation scripts and narratives influence Metaverse app use by guiding virtual world interactions. Bailenson et al. (2008) argue that animation scripts facilitate user exploration by telling engaging, educational, and entertaining stories. Unique storylines enhance app engagement (Schmidt, 2016). Metaverse narratives adapt to user actions, with dynamic settings and competing narratives increasing interest (Vasalou et al., 2008). Personalised stories make virtual reality more emotive (Yee & Bailenson, 2007). Scripts should reflect user choices for a more engaging experience. Strong narratives and animations enhance realism and user satisfaction (Turnley et al., 2017), while complex plots improve interactions (Pohl et al., 2021). Animation scripts will shape the emotional impact of Metaverse experiences (Scholz, 2020).

Metaverse content is enhanced using video editing and special effects, contributing significantly to the immersive nature of virtual experiences. High-quality video footage showcasing Metaverse app features can be manipulated to create engaging, well-organised presentations that highlight the best aspects of the virtual experience. According to MacDonald et al. (2018), such high-quality editing can influence viewers' perceptions and engagement by providing them with clear and captivating information. Pohl et al. (2021) argue that incorporating effects such as pyrotechnics, flames, and particle effects into advertising makes it more engaging and realistic, further elevating the Metaverse's marketing potential. Video editing and special effects are pivotal to enhancing both marketing strategies and user experiences in the Metaverse. By integrating complex transitions and effects, virtual environments can become more dynamic and engaging (Schmidt, 2016). Turnley et al. (2017) also assert that dynamic and human-sensitive special effects make virtual interactions more lifelike, adding to the overall appeal. As Metaverse applications aim to captivate users, improved visuals and interactivity are essential. Baker and Nelson (2005) highlight that video editing and special effects enhance virtual interactions, encouraging longer and more frequent user engagement, which is crucial for consumer retention in the

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Metaverse.

VR is essential for delivering authentic Metaverse experiences. The creation of complex and immersive VR environments relies on powerful platforms such as Unreal Engine 4 and Unity3D (Scholz, 2020). According to Scholz (2020), VR software must seamlessly integrate real-time graphics with intricate virtual environments to generate truly immersive Metaverse experiences. These platforms allow developers to replicate physical interactions and spatial dynamics in VR, enhancing user immersion and presence (Yee & Bailenson, 2007). The combination of high-quality 3D modelling and animation within VR software further refines virtual environments, making them more structured and visually appealing (Schmidt, 2016). As technology continues to advance, the role of VR in Metaverse development is set to increase, driving the creation of increasingly immersive and complex virtual worlds. These developments will play a significant role in improving digital interactions, making them more engaging and lifelike.

## Methodology

### Research Design

The acquisition of hard skills by Metaverse animation students was investigated using qualitative and grounded theory methods, chosen for their ability to capture participants detailed and nuanced perspectives on complex, context-dependent phenomena. Qualitative methods are particularly effective for explaining subjective experiences and generating empirical hypotheses, while grounded theory facilitates the development of new theories through systematic data analysis and the identification of recurring patterns and themes. The study collected rich and detailed data through semi-structured interviews with Metaverse management, animation educators, and students, focusing on technical skills and project management methodologies. This approach provides valuable insights into the integration of these skills and the factors influencing both educational and business practices, enhancing the understanding of the Metaverse development process.

### Participants

The researcher used purposive sampling to select initial pre-interview respondents, aiming to determine whether Metaverse employers were aware of animation majors and whether animation teachers and students were familiar with the Metaverse. Senior animation students were chosen as the primary sample group due to their more extensive work experience compared to students in earlier years. The snowball method was then employed, with initial respondents (Metaverse employers familiar with the animation profession, and animation teachers and students knowledgeable about the Metaverse) helping identify further suitable participants. This approach expanded the sample until the final group consisted of ten project managers from

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Metaverse-related companies, ten animation teachers, and ten senior animation students from universities in the Beijing area. Beijing was chosen for this study due to its high concentration of Metaverse companies. According to the "Hurun China Metaverse Companies with the Greatest Potential 2022" report by Hurun Research Institute, Metaverse companies in Beijing account for over 25% of the total, providing animation students in the region with more opportunities for Metaverse-related internships compared to other areas. Students with such internship experience can offer more detailed insights into the soft skills required by Metaverse companies and identify strategies to enhance these skills. Additionally, many Metaverse-related activities are organised by universities in Beijing that offer animation majors.

**Data Collection**

This study employed semi-structured interviews to gather detailed responses from participants, providing a flexible and comprehensive approach for investigating technical competence in Metaverse animation training.

**Table 1:** Stakeholders' Interview Questions

| Interview Questions for Managers | Interview Questions for Teachers | Interview Questions for Students |
|---|---|---|
| Do you understand the hard skills of animation students? | Do you know the Metaverse? | Have you worked on any Metaverse-related projects? |
| What do you think about the importance of hard skills in the Metaverse industry? | What do you think about the importance of hard skills in the Metaverse industry? | What do you think about the importance of hard skills in the Metaverse industry? |
| What do you think are some of the hard skills that will help animation students find work in the Metaverse job market? | What do you think are some of the hard skills that will help your students find work in the Metaverse job market? | What do you think are some of the hard skills that will help you find work in the Metaverse job market? |
| Why do you think these hard skills will help animation students find jobs in the Metaverse job market? | Why do you think these hard skills you mentioned help your students find jobs in the Metaverse job market? | Why do you think these hard skills you mentioned help you find jobs in the Metaverse job market? |
| What do you want universities and teachers to do to help animation students develop the hard skills you just mentioned? | What do you want the university and teachers to do to help your students develop the hard skills you just mentioned? | What do you want the university to do to help you develop the hard skills you just mentioned? |

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Open-ended questions allowed interviewees to express their thoughts, feelings, and observations, while also giving them the opportunity to address important issues. Individual interviews were conducted in private settings, encouraging candid and unfiltered responses. Participants gave consent to have their interviews audio-recorded for accuracy. A robust interview guide ensured consistency and thoroughness, although the interviewer was able to probe further based on participants' comments, enhancing the depth of subject analysis and understanding of Metaverse animation applications. Following the interviews, the data was transcribed verbatim to accurately capture participants' responses. The transcripts were then systematically categorised and analysed using NVivo, allowing for the identification of common patterns and trends across participant groups. This rigorous approach to data collection and analysis, combined with the use of qualitative methods, ensured the validity of the study's findings, leading to a strong understanding of the integration of hard skills within the Metaverse. The researcher used both online (network teleconference) and offline (face-to-face) methods for interviews, depending on participants' preferences regarding efficiency and data collection quality. The main questions of the interview are outlined in Table 1.

**Data Analysis**

The qualitative data from semi-structured interviews was managed and analysed using NVivo. Open coding was initially applied to the transcribed interview material to identify key themes and subjects pertinent to Metaverse animation, with initial codes assigned to the data based on content and significance. This stage involved annotating the data to capture its relevance. Following open coding, axial coding was employed to consolidate core codes into larger thematic groups. This phase aimed to refine and organise emergent themes by identifying linkages and patterns among the codes. Axial coding also served to explain the relationship between animation instruction and Metaverse development. Finally, selective coding was used to synthesise and refine the topics, forming a cohesive theoretical framework. The data was integrated to better understand how technical abilities are assimilated into Metaverse projects. NVivo's data structure, query mechanisms, and visualisation tools facilitated the identification and validation of major themes, supporting a thorough analysis of the qualitative data. The findings illuminated the alignment between industry practices in Metaverse development and animation education, offering insights into how these fields interact and contribute to one another.

**Ethical Consideration**

Participants' confidentiality and autonomy were ensured in accordance with ethical guidelines. They were fully informed of the study's purpose, methods, risks, and benefits before participation, with proper informed consent obtained. Participants provided explicit consent to be interviewed and filmed, with the right to withdraw at any time without penalty. Interview data was securely stored and anonymised to

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protect confidentiality, with personal information removed from transcripts and replaced with participant codes to prevent individual identification. Data access was restricted to the study team, and findings were reported collectively. The study received ethical approval from the ethics committee, which conducted a thorough review to ensure compliance with human research guidelines and participant rights.

## Findings

The study identified eight essential hard skills required by animation students to work in the Metaverse, based on interviews with Metaverse executives, animation educators, and students.

**Table 2:** Number of Respondents for Hard Skills

| Selective Coding | Axial Coding | Open Coding | Number of Respondents | | | |
|---|---|---|---|---|---|---|
| | | | Manager | Teacher | Student | Total |
| Hard Skills | 3D Modelling | Modelling of 3D Objects | 10 | 10 | 10 | 30 |
| | | Model Mapping | 2 | 2 | 4 | 8 |
| | Animation Creation Skills | Animation Character Design | 8 | 9 | 9 | 26 |
| | | Animation Scene Design | 9 | 9 | 10 | 28 |
| | | Animation Scriptwriting | 3 | 2 | 1 | 6 |
| | Animation Post-Production Skills | Video Editing | 2 | 1 | 0 | 3 |
| | | Animation Special Effects | 3 | 2 | 2 | 7 |
| | Virtual Reality | Use of Virtual Reality Software | 6 | 5 | 8 | 19 |

With a preliminary understanding of the structure and distribution of the nodes, this study will provide a microscopic description of the nodes.

### Modelling of 3D Objects

3D object modelling involves using 3D production software to create models with 3D data in a virtual space. It plays a crucial role in Metaverse development, particularly in scene building and character design, and is considered an essential skill for future Metaverse content production. Stakeholders in this study agreed that 3D modelling is one of the most valued skills by Metaverse companies.

Manager10: The company is looking for candidates with advanced 3D modelling skills to create models similar to real-world objects. Highly accurate 3D models enhance users' immersion in the Metaverse, thus increasing their frequency of use.

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Teacher 1: Students proficient in using 3D modelling software, such as MAYA, will be able to model realistic characters and scenes accurately. This will provide companies with animation materials that can meet the visual needs of Metaverse users and, in doing so, will enhance students' competitiveness in the Metaverse job market.

Student 5: Students with 3D modelling skills can adapt to different types of projects and needs, including Metaverse projects, where they can translate employer's or client's reasonable needs into visual 3D models, which can go a long way in meeting the needs of the company's leaders and clients in animating characters and scenes.

**Model Mapping**

Model mapping refers to applying textures to a 3D model. By default, a 3D model in software appears grey or white, lacking the textures of the original object, such as metal, glass, or plastic. Since the goal of Metaverse construction is to create a virtual world closely resembling the real world, the ability to perform model mapping is crucial for animation designers involved in building the Metaverse.

M3: Employees with model mapping ability can quickly show the model's texture, thus enhancing the realistic effect of the model. At the same time, the company needs employees responsible for model mapping to regularly design new maps and update the company's internal mapping library to facilitate the sharing of these maps between different models by colleagues and to improve work efficiency.

T5: The higher the number of polygon faces in a 3D model, the higher the model's accuracy, which also requires higher computer quality and a longer time to render the model. A good model mapping technique can cause the details and effects of a high polygon model in a low polygon model, thus making the model more realistic. Students with this ability can save time and cost for companies needing to update their Metaverse products promptly, thus being competitive in the job market.

S1: Often, when I complete a 3D model, I find that some regions of the model are flawed. However, the time it takes to modify the model can be longer than the time it takes to hide these model flaws through mapping, which allows me to complete the tasks assigned to me by the company on time.

**Animated Character and Scene Design Skills**

The success of the Metaverse depends significantly on advanced animation character and scene design skills. These skills enhance the visual appeal of the virtual world, adding vibrant representations and enriching the content and structure of scene-building elements.

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M1: The companies seek animation students with excellent animation creation skills. This is because excellent animation creation skills can usually accurately express the characters' external features and the characteristics of the scenes that can attract the users to participate and then trigger the users' willingness to participate.

T4: In all types of Metaverse games, the styling of animated characters and scenes is the foundation of the entire game, and they dominate the artistic style of the whole play. If a match fails to win consumers' approval regarding character and scene design, it is difficult for the game to gain high sales and for the company to profit from it. Therefore, students must be able to design animated characters and scenes.

S8: In the Metaverse, many users change their hair, makeup, and clothing in their Metaverse avatars at any time according to their moods. To meet the market demand, we need to anticipate the needs of different types of people and use them to design the characters and scenes the users need. This ability can enhance the competitiveness of our animation students in the Metaverse job market.

**Animation Scriptwriting**

Games in the Metaverse are based on scripts and follow a storytelling narrative model, with plot development being central to the Metaverse. This highlights the importance of storylines in shaping the Metaverse gaming industry, alongside the visualisation and technical presentation of special effects.

M4: A good animation script is essential for developing some of the more miniature Metaverse games our company releases. This is because the player needs to participate in the quests and plot development in the game. If the game's plot or missions are boring, players may be lost, eventually leading to the game's production costs not being recovered.

T7: Rich storylines help stimulate the emotional resonance of Metaverse users, so students must be able to write animation scripts while avoiding cultural clashes between what they create and the real world.

S10: There are multiple ways to combine interactive elements and plot in the Metaverse. An excellent interactive experience can enhance the effectiveness of a company's Metaverse product. However, to avoid unreasonable combining ways, it is necessary to keep some control in the animation plot design.

**Video Editing**

The Metaverse is still in its early stages in China, and the short video format offers favourable conditions for its development. As a result, organisations promoting

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the Metaverse are focusing on integrating and editing existing video footage to convey rich Metaverse content to viewers within a limited time. However, it is primarily managers and teachers who emphasise the need for animation students to acquire video editing skills.

M9: Our company is currently working on the Metaverse Museum project. To show the audience the relevant historical background and stories in the Museum more clearly, we are also looking for talents who can organize and edit the filmed live-action materials effectively.

T2: When promoting Metaverse products, animated videos are needed to demonstrate to users the construction, functions, and user operations of the Metaverse. Therefore, animation students need to have the ability to edit videos to make the promotional content more attractive.

The researcher conducted follow-up interviews with some students to identify the perception gap among stakeholders. The students stated:

S2: Video editing software is not complicated for me at all. Many online learning resources teach editing, which I learned in a few days based on the online learning materials.

This student's response highlights the perception gap regarding video editing skills between students, teachers, and managers. Students may view video editing as simply using editing software, while teachers and managers focus on achieving a cohesive plot flow by combining different video clips.

**Animation Special Effects**

Animated special effects are three-dimensional, virtual effects created using computer software. For example, realistic flames, smoke, and explosions can be generated through particle systems to enhance visual expression and consumer appeal. This skill improves the user experience in the Metaverse and intensifies their subjective perception.

M6: In the field of game production in the Metaverse, companies now have an increasing demand for animation effects artists. This is because animation effects can significantly enrich the game's visual effects and create a more novel experience for the player.

T3: Animation special effects are essential to developing Metaverse products because they can enrich the diversity of virtual environments and enhance the user's sense of experience. For example, in a virtual house display, animation special effects can present realistic natural phenomena, such as sunshine, rain, and snowflakes, and this kind of experience will bring a distinctive entertainment

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experience for consumers.

S3: Virtual environments constructed through special effects technology reduce production costs and ensure that the virtual scenes in the Metaverse are as vivid as the real world, thus allowing users to be immersed in the experience, an immersion that may motivate them to stay engaged for an extended period.

**Use of Virtual Reality Software**

VR is a comprehensive technology that integrates computer graphics, sensor technology, human-computer interaction, and artificial intelligence. It uses computers to create realistic three-dimensional visual, auditory, and other sensory experiences, allowing users to interact with the virtual world through devices and experience detailed sensory information. As the core of the Metaverse, VR lays the foundation for immersive user experiences. Despite its critical role in Metaverse development, animation students have limited time to systematically learn VR technology while completing their primary animation courses. In response, some universities have introduced VR software courses for animation students, an initiative supported by the stakeholders in this study.

M2: We are looking for candidates who not only have the ability to 3D model but also, ideally, have proficiency in software related to virtual reality. These skills will enable them to better understand Metaverse-related work from a multidisciplinary perspective.

T9: I think animation students should have some knowledge of virtual reality technology when they work in companies that do Metaverse projects. Because the rendering function of the 3D modelling software taught in school is not real-time, it may lead to the dilemma of students being unable to observe when mistakes are made in their models and facing the difficulty of modifying their models over time. The current software related to virtual reality, such as UE4, has a real-time rendering function, which allows students to find the errors in the models and make modifications in time. They can also put the constructed models into UE4 to observe whether these models have achieved the immersive effect required to conform to the virtual environment of the Metaverse.

S9: Before entering a company related to the Metaverse, it would be more beneficial for us to get a job if we could master some virtual reality technology beforehand, such as using software like Unity3D. This is because being familiar with the use of the relevant software enables us to design animated characters or scenes that apply to the Metaverse based on the limiting factors of this technology, as well as to increase the speed of progress of the project.

Analysis of the stakeholder interview data identified key hard skills necessary for

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animation students to enter the Metaverse job market and succeed in securing employment. Among these, 3D object modelling was universally recognised as a critical skill. Additionally, the ability to design animation characters (87%), animation scenes (93%), and proficiency in using virtual reality software (around 63%) were also widely cited as essential. However, skills such as model mapping (27%), animation special effects (23%), animation scriptwriting (20%), and video editing (10%) were mentioned less frequently.

**Educational Programs with Industry Expectations**

The study found that teachers and students had varying expectations for Metaverse career preparation in schools, reflecting industry changes and the demand for a technically skilled workforce. Managers emphasised the need for programmes that focus on hands-on Metaverse development tools and technologies. One manager stated that students must not only understand virtual reality and animation theory but also gain practical experience with commercial tools like Unity and Maya (Participant 004). Another manager highlighted the expectation for graduates to possess advanced skills in 3D modelling, animation, and special effects (Participant 001). These views align with research indicating that hands-on experience and industry-specific training are crucial for preparing students for fast-evolving industries like the Metaverse (Liu & Wang, 2021).

Managers also stressed the importance of collaboration and interdisciplinary learning, as the Metaverse requires seamless cooperation among content creators, developers, and designers. One manager (Participant 007) suggested that schools encourage students to integrate multiple skills. However, students noted a gap between the skills employers require and those offered by educational programmes. A student expressed the need for Metaverse-specific courses, stating that while traditional animation and modelling are covered, VR and AR are not sufficiently addressed (Participant 022). Another student requested more internships or real-world projects to apply their knowledge (Participant 028).

This aligns with broader research suggesting that educational institutions need to adapt curricula to meet the needs of emerging industries like the Metaverse, where new technologies and skills are constantly evolving (Şılbır et al., 2020). Both managers and students agree that staying up-to-date with technological advancements and offering industry-standard courses are essential. Managers expect schools to integrate Metaverse technologies into their curricula, while students seek more hands-on experiences. One student argued that schools should drive industry breakthroughs, stating that they need to learn the skills companies demand, not just the basics (Participant 030). Current research further supports that educational programmes must align with industry developments to adequately prepare students for rapidly changing fields like the Metaverse (Kato et al., 2022).

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## Discussion

The study focused on the integration of technical skills in Metaverse animation students, particularly in the context of project management. It explored the significance of key skills, their impact on both animation and Metaverse development, as well as the strengths and limitations of the study, and compared the results to existing research. The study emphasised the critical role of hard skills in advancing the Metaverse, particularly in the creation of realistic virtual worlds. 3D modelling and model mapping were identified as essential components for producing immersive and visually captivating virtual experiences. Stakeholders highlighted that model mapping adds texture to 3D models, enhancing authenticity, while 3D modelling is crucial for designing landscapes and characters that populate virtual worlds. These technical skills are foundational for creating engaging and lifelike virtual outputs, reinforcing the idea that high-quality animated characters and environments play a pivotal role in captivating viewers (Yan et al., 2024). Additionally, the study underscored the importance of animation scriptwriting and video editing in Metaverse projects, particularly for effective storytelling and marketing. Animation scriptwriting is vital for creating compelling narratives that draw viewers into virtual experiences, while video editing is essential for crafting visually appealing promotional content. Ji (2021) emphasised that both marketing and storytelling contribute to the appeal of virtual objects and experiences, which aligns with the study's findings. The research concluded that Metaverse projects should incorporate these skills to enhance customer satisfaction and improve product marketing, aligning with previous studies that stress the importance of narrative-driven engagement and visually impactful advertising.

Aptitudes critical for the Metaverse's growth are ranked based on their perceived impact on development. Research highlights that 3D modelling, animation character and scene design, and virtual reality VR software proficiency are paramount. 3D modelling plays a central role in creating realistic virtual environments, which are essential for building interactive and immersive experiences within the Metaverse. As noted by Picciotto (2020) high-quality 3D modelling is indispensable for crafting immersive virtual worlds. In addition, the design of animation characters and scenes is integral to enriching the virtual experience. Yanto et al. (2022) emphasized that well-designed characters and environments enhance the overall immersion and engagement of users within the virtual space. Furthermore, expertise in virtual reality software is vital for producing the immersive effects that define the Metaverse. Proficiency in VR technologies, such as Unity3D and Unreal Engine, is crucial for creating engaging virtual worlds that captivate and involve viewers, as outlined by Oliveira and Cruz (2023).

Animation scriptwriting, special effects, and model mapping are less important for

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Metaverse development. Model mapping enhances visual fidelity by adding textures, improving virtual object realism and depth (Kato et al., 2022). Special effects, such as smoke and fire, increase immersion (Şılbır et al., 2020), while animation scripts make Metaverse apps more engaging (Kellems et al., 2020). However, VR software, character and scene design, and 3D modelling require more advanced skills. Video editing, while useful for marketing and content creation, is less crucial for virtual world development (Stadlinger et al., 2021). This study suggests that animation educators should focus on 3D modelling, character and scene design, and VR software training to better prepare students for Metaverse roles. Real-world experience is essential for mastering these skills, while scriptwriting, special effects, and model mapping should be less emphasised due to their lower technical significance.

This strategy enhances students' technical and creative skills. The findings suggest that industry specialists and companies should hire professionals skilled in 3D modelling, animation character and scene design, and virtual reality software for Metaverse projects. These skills are essential to meet user expectations. While model mapping, animation special effects, and scriptwriting improve virtual world quality and appeal, companies should also prioritise these in their project teams. Understanding the value of these skills can enhance team and recruitment decisions. Comparing the findings with previous studies reveals both agreement and disagreement. VR software, character and scene design, 3D modelling, and animation are critical for creating immersive virtual worlds (Kellems et al., 2020). The literature supports the modest importance of model mapping, animation special effects, and scriptwriting in enhancing virtual reality and storytelling. However, the reduced value of video editing contrasts with studies highlighting its importance in marketing virtual products (Zhao et al., 2022), suggesting a shift towards technical and creative skills over marketing roles. The study's strengths include its comprehensive approach, incorporating perspectives from Metaverse management, animation educators, and students, which provides valuable insights into the skills needed for Metaverse development. Qualitative methods and grounded theory offer an in-depth analysis of these skills. However, the study has limitations, such as a small sample size of 30 participants and potential underrepresentation of Metaverse professionals and students. Self-reported data may also introduce bias. Future research could address these limitations by using quantitative methods and a larger, more diverse sample. Despite these constraints, the study contributes to understanding the hard skills required by Metaverse animation students and their implications for both education and industry.

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## Implication

### Practical Implications

The findings are crucial for Metaverse development project managers, industry experts, and educational institutions, suggesting that educational institutions should prioritise hard skills in animation and Metaverse curricula. By focusing on 3D modelling, animation character and scene design, and virtual reality software, students will be well-prepared for the industry. These subjects should be taught in depth, along with hands-on experience with essential software like Unity3D, Unreal Engine, and MAYA. Creating immersive Metaverse experiences requires these hard skills, with animation scriptwriting, special effects, and model mapping as supplementary skills. A well-rounded education combining these competencies will enhance students' abilities. Instructors should foster industry partnerships and internships to enhance students' practical experience. Recruitment efforts should focus on VR software, animation design, and 3D modelling, as these are critical for high-quality virtual worlds. While model mapping, animation special effects, and scriptwriting are valuable, they are not core competencies. Companies should prioritise these attributes for virtual world authenticity, visual appeal, and narrative when forming project teams. The study highlights the importance of effective project management in Metaverse development, emphasising the need to coordinate model mapping and special effects while prioritising technical expertise. Project managers should allocate tasks based on critical skills, ensuring adequate focus on 3D modelling and animation design. Supporting interdisciplinary collaboration can enhance Metaverse projects by facilitating seamless integration. Future research should investigate how emerging technologies influence Metaverse skill development, with longitudinal studies on skill demand providing useful insights. The findings offer guidance to project managers, industry specialists, and educational institutions, recommending a focus on hard skills and cross-disciplinary collaboration to improve project quality and efficiency.

## Limitations and Future Direction

Future Metaverse research should focus on how emerging technologies like blockchain, AI, and VR influence the skills needed for development. Longitudinal studies could track the evolution of hard skills as the Metaverse and related technologies progress, helping educational institutions and employers adjust their training and hiring practices. Research should also examine how machine learning and AI-driven content production impact animation and traditional skills. Additionally, exploring project-based learning, apprenticeships, and industry collaborations can better prepare students for the workforce. Investigating transdisciplinary collaboration and how various businesses contribute to the Metaverse will further enhance understanding. User research on how 3D modelling, animation, and VR software affect engagement can align skill development with user needs, improving training and project outcomes.

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## Conclusion

The study explored how animation students apply core hard skills in the Metaverse, focusing on project management and outcomes. Qualitative research highlighted the importance of specific abilities for Metaverse project success. 3D modelling, animation character and scene design, and virtual reality software are essential for creating realistic and engaging virtual worlds. Previous research supports the need for 3D modelling in visual appeal, while character and scene design enhances user engagement and immersion. VR software competency is also crucial for dynamic virtual environments. Animation scriptwriting, special effects, and model mapping are of moderate importance. Model mapping improves object realism, and special effects enhance immersion. Scriptwriting supports interactive storytelling in the Metaverse. Video editing, while helpful in promotion, plays a lesser role in virtual environments and complements, rather than drives, Metaverse creation.

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