Integrating Virtual Production and MetaHuman Creator Into University Curriculum

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Abstract

This paper presents an overview of a specialised segment of the course Engineering Animation and Other Media, we teach at the Faculty of Technical Sciences. Our focus is on integrating multimedia techniques through the Unreal Engine workflow and the MetaHuman Character Creator. The primary aim of this study is to evaluate student proficiency in digital cinematography using these tools. In the curriculum, Unreal Engine serves as a central platform for developing skills in virtual cinematography and mixed-media production. Students are tasked with recreating reference-based compositions, which are assessed based on specific technical criteria: focal length accuracy, framing, depth of field, lighting consistency, and character posing. By replicating still-image references in a game-engine environment, they learn to apply visual communication principles to virtual marketing and cinematography. Learning about synthetic human applications in marketing and creative industries prepares our students for future trends in digitalisation and virtual production. We provide an interactive and creative educational environment by combining classical principles with digital tools. The final results are validated through a structured assessment methodology; the resulting industry-level projects are presented alongside a student progress comparison chart included in this paper.

Keywords: metahumans, university curriculum, virtual cinematography, multimedia

Introduction

Virtual production has become one of the most significant developments in contemporary audiovisual and multimedia production, reshaping the relationship between filmmaking, computer graphics, real-time rendering, and interactive media. By combining game-engine technologies, computer-generated imagery, motion capture, virtual environments, and real-time visualisation, virtual production enables creative and technical decisions to be made earlier and more interactively within the production process. Unlike traditional production pipelines, where many visual elements are developed in later stages of post-production, virtual production allows directors, cinematographers, artists, and technical teams to preview and adjust scenes in real time, creating a closer connection between artistic intention and technical execution (Kadner, 2019; Priadko & Sirenko, 2021).

The increasing use of real-time engines, particularly Unreal Engine, has further expanded the role of virtual production beyond traditional film production. Real-time workflows enable artists and filmmakers to work with lighting, camera movement, art direction, scene composition, and visual effects in a more immediate and interactive way. As described in The Virtual Production Field Guide, Unreal Engine not only supports previs or mechanical planning but also provides a cinematographic perspective on the scene, allowing creative decisions related to lighting, art direction, and camera work to be tested earlier in the production process (Kadner, 2019). This shift has made virtual production relevant not only for film but also for advertising, game development, cinematic visualisation, simulation, virtual reality, augmented reality, and interactive multimedia.

As virtual production workflows become more accessible, the required skill set for students and future digital media professionals is also changing. Contemporary production increasingly demands hybrid knowledge that connects animation, cinematography, lighting, camera parameters, digital character staging, real-time rendering, and interactive 3D environments. Similar concerns have been discussed in recent higher education contexts, where virtual production is examined not only as an industry technology but also as a teaching and curriculum development challenge (Sills-Jones & Bennett, 2026). Recent publications on virtual production education note that while academic programs and training initiatives in this area are expanding rapidly, research on their effectiveness remains limited, particularly regarding long-term learning outcomes, graduate competencies, and comparative pedagogical evaluation (Anes Silveira et al., 2026).

A systematic multivocal review by Anes Silveira, São Mamede, and Santos provides a broader overview of how virtual production is currently taught internationally. The authors analysed 115 English-language sources and 55 curricula from 49 higher education institutions, showing that virtual production education commonly emphasises real-time workflows, three-dimensional content creation, immersive technologies, motion capture, digital storytelling, and game-engine-based production. The review also identifies gaps in the systematic assessment of curricular effectiveness and points to the need for stronger evidence on pedagogical approaches and learning outcomes (Anes Silveira et al., 2026).

Goals and Methodology

The aim of this research is to present the Engineering Animation and Other Media Course in the Engineering Animation study programme at the Faculty of Technical Sciences in Novi Sad, Serbia. For the first time in this course, students of Animation and Engineering encounter digital humans, MetaHumans. The course has been part of the curriculum since 2020 and is constantly evolving to keep up to date with industry requirements and trends in multimedia and animation. Within this broader context, this paper presents the integration of virtual production workflows and MetaHuman Creator into the course Engineering Animation and Other Media, which is part of the Animation in Engineering study programme at the University of Novi Sad. According to the official course description, the course aims to train students to recognise the possibilities of connecting computer animation with related media, including sound, video/film, multimedia, the internet, and virtual reality (Faculty of Technical Sciences, n.d.). Since contemporary production pipelines are continuously evolving, the course assignments have been regularly updated in order to remain aligned with current technological developments and industry standards.

Unreal Engine was introduced as a core component of the course in 2020 and incorporated into student projects and production workflows. In response to the rapid development of virtual production technologies and evolving industry demands, the course was further adapted two years ago to include MetaHuman Creator, digital human creation, and character-driven real-time production workflows. The central objective of these adaptations is to introduce students to emerging professional practices in the creative industries and support the development of relevant technical and artistic competencies.

Virtual Production and Digital Humans in Education

The task is structured so that students apply the knowledge gained in exercises and lectures on practical examples. The main task is to position the MetaHuman character into an appropriate pose and recreate the overall composition of the original reference. Using virtual production tools in Unreal Engine and MetaHumans, students recreate three still picture references.

Assignment Design and Virtual Production Workflow

The practical assignment was designed to introduce students to the fundamentals of virtual production by recreating reference images in Unreal Engine using MetaHuman characters. Each student was tasked with recreating three different reference scenes, requiring careful observation and analysis of the original images before translating them into a real-time digital environment.

To achieve a convincing recreation, students had to address multiple aspects of scene construction, including character posing, spatial positioning, camera setup, framing, focal length, focus distance, depth of field, and lighting characteristics such as direction, intensity, colour, and overall atmosphere. The assignment encouraged students to examine how these elements interact to create a specific visual impression.

By combining visual analysis with practical implementation, the task served as a bridge between artistic interpretation and technical execution. Students were required not only to reproduce the appearance of the reference images, but also to understand the underlying cinematic and compositional principles that shaped them and apply this knowledge within a real-time production workflow.

Assignment Overview

The workflow began with the selection and analysis of reference images. Students examined the visual structure of each reference, including the position of the human figure, camera angle, framing, lighting direction, contrast, shadows, and overall atmosphere. This initial analysis served as the foundation for recreating the scene inside Unreal Engine.

After analysing the reference, students developed the scene through three main stages: MetaHuman character staging, camera setup, and lighting setup. Although these stages are presented separately, they were closely interconnected during the production process. Changes in character pose influenced framing, camera parameters affected perceived body proportions, and lighting adjustments altered the readability and atmosphere of the final composition.

MetaHuman Character Staging

The entire project was developed in Unreal Engine using MetaHuman Creator and MetaHuman characters. One of the main reasons for selecting MetaHumans for this assignment was their fully prepared rigging and skinning system, which allowed students to focus on scene reconstruction, character posing, and visual analysis rather than spending time creating and rigging a character from scratch. Students used the MetaHuman Control Rig and Animation mode within Unreal Engine to position the character according to the reference image. The task required careful adjustment of body posture, limb placement, and overall character orientation while maintaining anatomically plausible poses. Particular attention was given to avoiding mesh intersections, geometry penetration, unnatural deformations, and unstable body positions that could reduce the realism of the final result. This approach is consistent with contemporary MetaHuman-based production workflows, in which ready-to-use digital humans, rigging systems, and animation tools support character-driven real-time production (Rossney, 2022; Venter & Ogterop, 2022). This part of the assignment developed spatial awareness and an understanding of digital human staging. Students learned how subtle changes in body position, gesture, silhouette, and character orientation can significantly influence the visual accuracy and overall composition of a scene. After the MetaHuman character had been positioned, students proceeded with camera setup.

Camera and Lighting Setup

After the initial MetaHuman character staging had been established, a cinematic camera was introduced into the scene. From that point onward, camera setup and character adjustments were developed in parallel, as both processes directly influenced the final visual appearance of the reconstruction. Students worked with Unreal Engine’s cinematic camera system, which simulates parameters of real-world film cameras. This camera and lighting workflow followed contemporary Unreal Engine cinematic production practices, in which cinematic cameras, real-time lighting, and scene composition are adjusted interactively to achieve the desired visual result (Venter & Ogterop, 2022). While refining the character’s pose and position, they simultaneously analysed and adjusted sensor size, focal length, aperture, focus distance, depth of field, camera angle, and framing in order to recreate the reference image as accurately as possible. This part of the assignment helped students understand the engineering and visual logic behind cinematic camera parameters. Rather than treating the camera as a simple viewport, they learned how camera settings influence perspective, composition, scale, focus, and the overall visual impression of a scene. At the same time, they observed how changes in character positioning affected framing and how camera adjustments altered the perceived proportions and spatial relationships within the scene.

Once the character staging and camera setup had been established, students proceeded to the lighting stage. They analysed the reference image in terms of light direction, intensity, colour, contrast, shadows, and atmosphere, and then attempted to recreate these lighting conditions inside Unreal Engine.

Lighting represented the final major stage of the workflow because it connected the technical setup with visual interpretation. Students had to understand not only where to place lights, but also how light affects mood, composition, readability of the character, and similarity to the original reference. Compared to camera setup and character staging, lighting required a more complex interpretation of visual information, since several technical parameters had to be adjusted simultaneously in order to achieve a convincing result.

Evaluation Methodology

This section describes the methodology used to evaluate student work and determine the level of understanding achieved through the assignment. A total of 66 students participated in the project over a two-year period, with each student recreating three reference scenes using MetaHuman characters and Unreal Engine. Student performance was assessed using a four-level grading scale ranging from 0 to 3 points, where 3 points indicated excellent understanding and mastery of the material, 2 points indicated solid understanding, 1 point reflected familiarity with the concepts and partial achievement of the learning outcomes, and 0 points indicated that the material had not been successfully mastered.

The evaluation was based on several technical criteria that reflected the core learning objectives of the assignment: MetaHuman pose accuracy, camera framing and composition, focal length adjustment, focus setup, and lighting recreation. Although these categories are closely interconnected within the virtual cinematography workflow, they were assessed separately in order to distinguish specific technical competencies.

MetaHuman pose accuracy evaluated how closely the digital character matched the posture and spatial positioning visible in the reference image. In addition to visual similarity, particular attention was given to the technical correctness of the pose. Characters were expected to maintain anatomically plausible body positions without appearing unnaturally bent or broken, while mesh intersections and geometry penetrations between body parts or clothing elements were considered indicators of incorrect character staging.

Camera framing and composition focused on the student's ability to reproduce the original shot structure. This criterion included the correct placement of the virtual camera, appropriate camera angle, and accurate framing of the character within the image. Students were also required to select a suitable camera sensor configuration, as sensor size directly influences the resulting composition and perspective. A successful recreation required the character to occupy a position within the frame that closely corresponded to the reference image.

Focal length adjustment was evaluated independently from framing because perspective distortion can significantly alter the perceived proportions of the character. To determine whether the focal length had been correctly selected, evaluators compared the relative proportions of body parts that should maintain consistent visual relationships, such as the size of the hand relative to the head or the foot relative to the forearm. Significant deviations from these expected proportions indicated that the focal length was either too short or too long. Since pose accuracy, framing, and focal length strongly influence one another, clear assessment boundaries were established to ensure that each criterion measured a distinct aspect of the reconstruction process.

The focus setup assessed the student's understanding of aperture and focus settings within Unreal Engine's cinematic camera system. A successful result required the primary subject to be clearly in focus while maintaining an appropriate depth-of-field effect consistent with the reference image. Images in which the character was not properly focused, or where the entire scene remained uniformly sharp despite the visual characteristics of the reference, received lower scores.

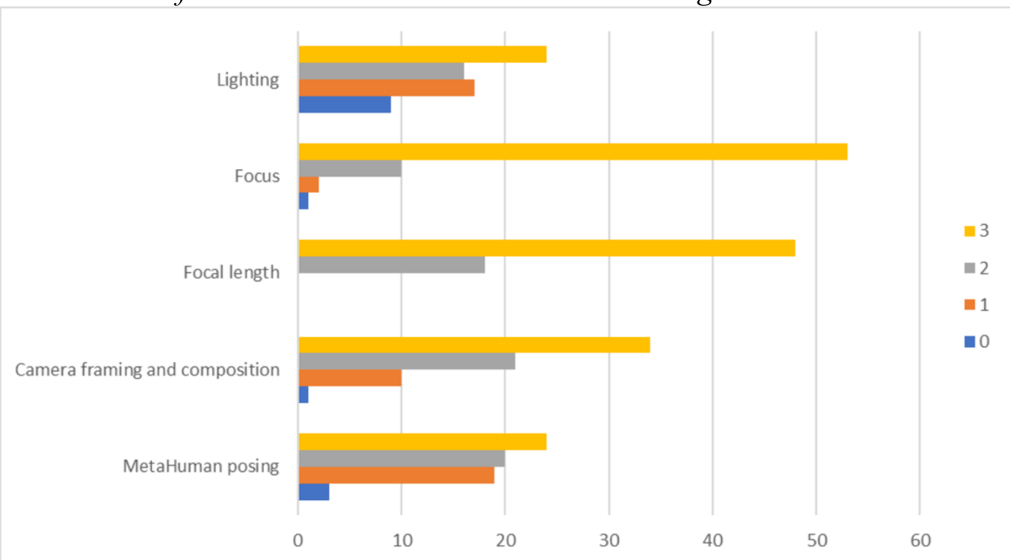
Lighting recreation represented a single evaluation category but incorporated several technical components. Students were required to accurately reproduce the spatial placement of light sources, their colour characteristics, and their intensity. Assessment, therefore, focused on whether the lighting setup recreated the direction of illumination, the colour temperature and visual appearance of the light, and the overall brightness levels observed in the reference image. Although lighting contributes significantly to the final visual impression, the evaluation emphasised the technical accuracy of the lighting configuration rather than subjective artistic interpretation.

Results and Discussion

The evaluation results indicate that students achieved the strongest performance in focus setup and focal length adjustment. As shown in Figure 1 and Table 1, these two categories contain the highest number of students who achieved the maximum score of 3 points, with only a small number of lower scores. This suggests that students adapted well to the technical aspects of virtual cinematography once camera parameters were explained and applied through practical examples.

Figure 1

Distribution of Student Scores Across Evaluation Categories



Note. Scores range from 0 to 3, where 0 indicates that the material was not successfully mastered and 3 indicates excellent understanding and mastery of the material. Values represent the number of students in each score category.

Table 1
Distribution of Student Scores by Evaluation Category

Score	MetaHuman Posing	Camera Framing and Composition	Focal Length	Focus	Lighting
3 - Excellent understanding and mastery	24	34	48	53	24
2 - Solid understanding	20	21	18	10	16
1 - Basic familiarity	19	10	0	2	17
0 - Not successfully mastered	3	1	0	1	9

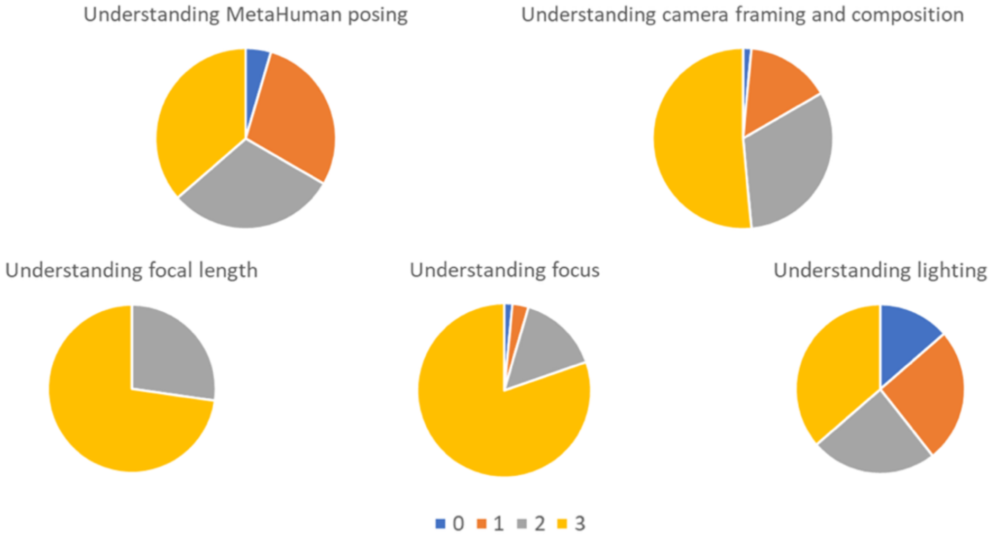
Strong results were also achieved in camera framing and composition, as well as in MetaHuman posing. Although these categories showed a slightly wider distribution of scores than focus and focal length, the majority of students still achieved high results. This indicates that most students were able to understand the relationship between character placement, spatial composition, shot construction, and the position of the digital human within the virtual scene.

Lighting reconstruction showed the greatest variation in student performance. In contrast to the camera-related categories, the lighting results were more evenly distributed across all score levels, including a noticeably higher number of lower scores. This suggests that lighting was the most challenging aspect of the assignment for beginner students. Unlike focus or focal length, which can be adjusted through relatively direct technical parameters, lighting requires a simultaneous understanding of light direction, intensity, colour, shadow, contrast, atmosphere, and visual interpretation.

The individual score distributions presented in Figure 2 further support this observation. While focus and focal length are dominated by the highest score category, lighting shows a more balanced distribution between scores 0, 1, 2, and 3. This indicates that students were generally more successful in mastering camera-related technical parameters than in reconstructing complex lighting conditions. Therefore, future iterations of the assignment should place additional emphasis on lighting analysis, including practical exercises focused on identifying light sources, recreating shadow direction, adjusting colour temperature, and balancing light intensity within the scene.

Figure 2

Individual Score Distributions by Evaluation Category



Note. Each pie chart shows the percentage distribution of student scores within one evaluation category. Scores range from 0 to 3, where higher scores indicate a higher level of mastery.

Student Work Examples

In addition to the quantitative evaluation, selected examples of student work are presented in Figures 3–5. Each figure includes the original reference image alongside the corresponding student recreation created in Unreal Engine using MetaHuman characters. These examples demonstrate the students' ability to analyse visual references and reproduce key elements such as camera perspective, focal length, depth of field, character pose, composition, and lighting conditions. The showcased works illustrate different levels of achievement, providing insight into both successful solutions and common challenges encountered during the assignment.

Figure 3

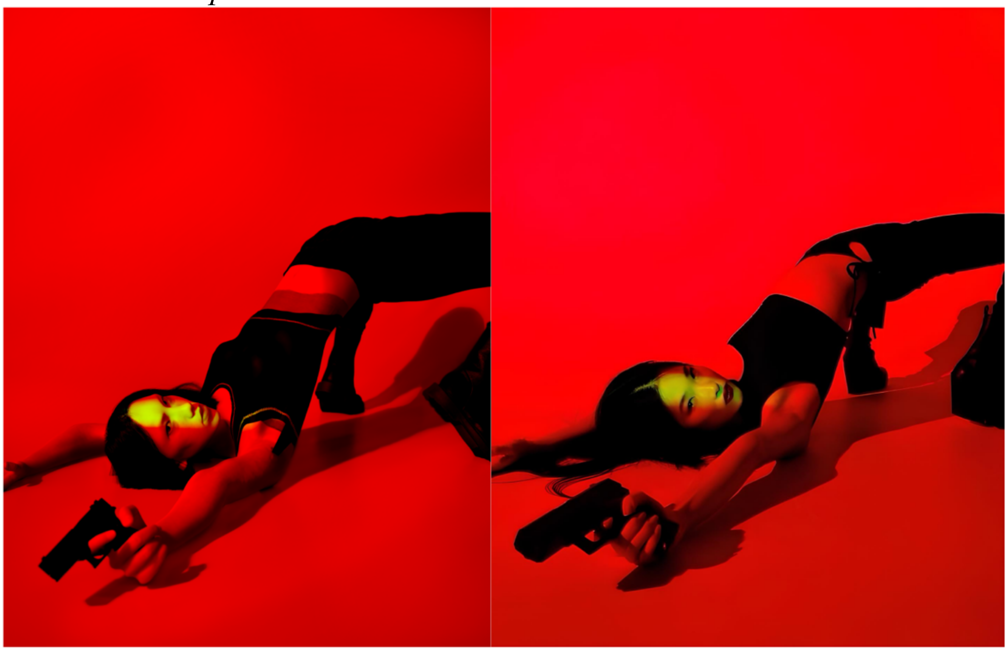
Selected Examples of Student Recreations and Reference Images After the Course, Student Anja Bojić

Source: Left: student recreation created in Unreal Engine using a MetaHuman character, by student Anja Bojić. Right: original reference image retrieved from Pinterest, https://in.pinterest.com/pin/674484481730595756/

Figure 4
Selected Examples of Student Recreations and Reference Images After the Course, Student Lazar Pejak

Source: Left: student recreation created in Unreal Engine using a MetaHuman character, by student Lazar Pejak. Right: original reference image retrieved from Pinterest, https://fr.pinterest.com/pin/464222674113813986/

Figure 5
Selected Examples of Student Recreations and Reference Images After the Course, Student Nina Popović



Source: Left: student recreation created in Unreal Engine using a MetaHuman character, by student Nina Popović. Right: original reference image retrieved from Pinterest, https://www.pinterest.com/pin/798263102751552804/

The presented examples complement the statistical analysis by providing a visual representation of student performance. While numerical results indicate overall achievement across evaluation categories, the recreated scenes reveal how students applied theoretical knowledge and technical skills in practice. The comparison between reference images and student recreations highlights the extent to which students were able to interpret visual information, make informed production decisions, and translate their observations into a real-time virtual environment.

Taken together, the quantitative results and visual examples suggest that the assignment successfully connected technical and artistic learning outcomes. Students were not only introduced to Unreal Engine and MetaHuman Creator as software tools, but also to a production-oriented way of thinking that involves analysing references, reconstructing visual systems, solving technical challenges, and making creative decisions within a real-time workflow. As such, the assignment demonstrates how virtual production exercises can support the development of both technical competencies and visual literacy in computer graphics education.

Conclusion

This paper presented the integration of virtual production workflows and MetaHuman Creator into the course Engineering Animation and Other Media at the University of Novi Sad. The main objective was to examine how industry-relevant tools, such as Unreal Engine and MetaHuman characters, can be used in higher education to support the development of students' technical and artistic competencies in computer graphics, engineering animation, and virtual cinematography.

The assignment was designed around the recreation of reference images in a real-time production environment. Through this process, students were required to analyse visual references and translate them into Unreal Engine scenes by adjusting character pose, spatial positioning, camera framing, focal length, focus, depth of field, and lighting. In this way, the assignment connected theoretical knowledge with practical implementation and encouraged students to understand the relationship between visual analysis, technical parameters, and cinematic composition.

The evaluation results showed that students achieved the strongest performance in focus setup and focal length adjustment, suggesting that they were able to understand and apply camera-related parameters successfully after practical instruction. Strong outcomes were also observed in camera framing, composition, and MetaHuman posing, indicating that most students developed a solid understanding of spatial placement, digital human staging, and shot construction. Lighting reconstruction, however, showed the greatest variation in results and proved to be the most challenging aspect of the assignment. This indicates that lighting requires additional pedagogical attention, as it involves the simultaneous interpretation of direction, intensity, colour, contrast, shadows, atmosphere, and visual meaning.

Overall, the results suggest that the integration of MetaHuman Creator and virtual production workflows into the curriculum can support the development of both technical competencies and visual literacy. Students were not only introduced to contemporary software tools, but also to a production-oriented way of thinking that includes reference analysis, scene reconstruction, problem solving, and creative decision-making within a real-time digital environment.

The study also points to several directions for future development. Future iterations of the course may include more focused lighting exercises, animation-based assignments, facial animation, motion capture, and more advanced virtual production workflows. Expanding the assignment in these directions would allow students to engage more deeply with contemporary production practices and further strengthen the connection between academic education and the professional demands of the multimedia, film, gaming, and creative industries.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors acknowledge the use of Grammarly for proofreading and minor language refinement. The tool was used only to improve grammar, clarity, and readability. All content, structure, methodology, analysis, results, and conclusions were developed, reviewed, and verified by the authors.

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