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PRACTICAL RECOMMENDATIONS FOR USING 3D MODELING AT UNIVERSITIES

Abstract

The paper is relevant because 3D modeling is a topical issue not only in universities that train applied arts students but also in those that, within the framework of the university-wide educational programs, seek to integrate digital culture, broaden and develop the aesthetic horizon of their students. The paper reviews the main 3D modeling software applications. The capabilities and features of these applications are summarized. Various supervision methods are discussed briefly, and the main steps for organizing students' independent work with the 3D modeling software are offered: identifying the students' initial level and experience of working with 3D modeling and correlations with the required level and software for a specific course; developing a 3D modeling course educational program; determining the tasks' complexity level and, respectively, the context of the physical, practical, mathematical, and artistic sides emerging with the needs of their cherished and desired level.

Keywords: 3d modeling, education, visualization, building information modeling.

Introduction

Application of innovative pedagogical technologies at universities is a critical prerequisite for preparing highly qualified specialists that meet the requirements of the digital economy. 3D visualization, 3D prototyping, use of augmented and virtual realities, and 3D modeling are used successfully both in the course of learning and during the teaching process, and opportunities provided by the mentioned technologies are really extensive.

The future experts are quick to fulfill such tasks, model, analyze products and their functions, study manufacturing problems, and examine the quality of various products and objects. These tasks are greatly simplified and expedited with the help of modern 3D modeling technologies. Virtualization and visual simulation are currently fully in place at several faculties and directions at many universities. The equipment base required for running virtual physical experiments is getting improved and updated, and supplementary education courses and practical works involving mathematical model simulations are being developed.

Moreover, this resource can be extended by using up-to-date mathematical and computer modeling technologies, including 3D modeling. At the same time, the mentioned methodology still requires further completion and improvement, considering that both teachers and students fail to use the substantial quantity of its abilities and potential so far.

Benefits of Integrating 3D Modeling in University Curriculum

In a context of increasing competitiveness, among the factors that the academic and business community must take into account, it is worth noting the increasing importance of innovation as a factor of economic development and social well-being. Organizations are gradually establishing closer links with the environments in which they operate, being required to be increasingly dynamic in their behavior and to respond effectively to competitive and innovative threats. The training of highly qualified individuals with the skills necessary for achieving this dynamic is therefore

fundamental to the development of any organization. Higher Education Institutions, and in particular universities, are responsible for guaranteeing the quality of training. This is also reflected in the increasing demands emanating from the community in general, including companies, business associations, and municipalities, that tend to be increasingly demanding with regard to the speed, flexibility, and diversity of solutions provided [1].

Due to the increasing importance of 3D modeling and the knowledge acquired through years of research and teaching in this area, the university is an essential agent in the development and promotion of 3D capabilities. Whether for students destined to exercise activities in different professional sectors or for those who want to deepen their knowledge in companies that feel they must invest in 3D modeling for growth and survival in the market, the use of 3D modeling as a didactic tool is a decision that involves stakeholders, including teachers, students, and companies. In the educational context, a 3D modeling platform ensures a solution that is not subject to financial constraints and deadlines, enabling students to develop skills in thinking, comprehension, and analysis in solving specific problems. This is why universities are committed to promoting the use of 3D modeling. However well-designed and equipped, the use of a tool always requires a methodological commitment if the aims of its use are to be achieved [2].

Enhancing Student Engagement

As shown in the previous sections, 3D modeling can significantly improve the quality of the educational process, since it provides students with an opportunity to visualize complex phenomena and the processes taking place around us that are not accessible to the human senses. Additionally, the ease of use of 3D modeling means that students are dynamically involved in the process of data analysis and results interpretation, and not just passive spectators of the scientific facts [3].

In general, 3D modeling helps to develop the students' creative potential. They have the opportunity to become convinced that new discoveries come largely thanks to the imagination of scientists and can learn to think like researchers while collaborating in real projects in the field, using appropriate tools. In addition, working in a team and synthesizing the results in a coherent way, as well as re-elaborating in order to expose the results achieved, further improve both personal and relational maturity [4].

The challenging potential and flexibility of 3D computer models can be deployed to enrich the knowledge experience of students as simple self-learners or to fully enhance teaching strategies used by teachers. On the one hand, during lectures (or alternative didactic training), the 3D contents act as an explanatory tool without support for the physical object, allowing students to understand the topics without any use of spatial imagination; consequently, the 3D learning objects must be exploited by anyone passing the knowledge to suggest all possible forms of vision modes. On the other hand, during experimental or laboratory practice, 3D models can support theoretical analysis (or alternative exercises) by creating new opportunities, including the preparation of practical tests on the object of study, in-depth experience, and 3D manipulation, complementing the basic knowledge.

Facilitating Complex Conceptual Understanding

At universities, there is an urgent need for effective methods for teaching complex conceptual ideas related to natural processes and specific models, for example, the causes of geological processes. Such subjects are considered quite difficult to understand. For such students, 3D modeling enables visual examination of similar tectonic zones. In this way, instructive models are converted into reality through a digital 3D model and a 3D printer. Models provided in this work introduce the process of anticline formation and are created for educational purposes. The method of model creation and usage in the current educational process is represented. Using such models, both students and teachers gain educational experience.

The analyzed practical recommendation regarding the facilitation of some educational features for 3D teaching models can be realized using contemporary computer-aided design software tools when such tools allow for a "one-click service" where 3D files are uploaded, a 3D printing technology is chosen, available materials are offered, and then any additional parameters of the process are set to defaults. When making a model for 3D printing aimed at facilitating the training process, a teacher

selects an actual theme representative of this educational program, which relates to a well-known visual concept. In this case, a teacher creates a physical model of a selected object and selects optimal manageable solutions for a 3D printing model for educational purposes[5].

Best Practices for Implementing 3D Modeling in University Settings

So, how can we make the best use of the capabilities of 3D modeling for university education? After all, it was revealed that the use of any educational technology occurs only in five basic possible scenarios: 1. simple implementation (i.e., using the technology, which compares with common solutions, separately, without changing the training program); 2. using it for piloting; 3. including it in the training program and creating a special study course; 4. defining the technology as a major discipline; and 5. adding the technology as one of the main digital skills for university graduates[6].

To maintain the proper quality of the learning process with the further rapid development of computer technology, and especially the high demand for new competencies of specialists, 3D models must be integrated into current learning programs, thereby increasing student motivation and interest in the educational process. Such inclusion of new educational technologies can provide a continuous improvement of educational programs, the development of new students' competencies, and subsequently the creation of competitive specialists in the labor market. The development of new industrial design educational courses, ready to integrate 3D modeling technology, is currently being prepared to provide new digital skills to students.

Faculty Training and Support

The successful implementation of 3D modeling faces a number of challenges, including the complexity of the software, the fact that every project is unique and dependent on the specific course content and pedagogical strategies, and the time necessary to create the projects among the initial barriers. While software programs for this non-commercial work are often provided, questions about learning the programs and being able to integrate complex tasks into their coursework continue to daunt faculty new to the applications. Part of the work, therefore, involves training faculty new to the process. A workshop was held, which incorporated graduate students from the College of Education. Faculty from across disciplines expressed their interest in learning how they might incorporate 3D modeling and printing in their courses. It was agreed that tuition waivers for faculty could be obtained for future workshops, allowing faculty to learn new modeling software activities and prepare to teach them in their courses, which would prove effective in rapidly partnering with these young people[7].

Integration into Various Disciplines

There are multicomponent living animals that consist of bones, cartilage, and connective tissues. Perhaps that is why theoretical courses on the study of structural features usually include a theoretical part and complex three-dimensional and real examples. Moreover, to teach an academic discipline, it is not always necessary to have practical examples. When planning a lesson, a teacher can use 3D models to clarify theoretical concepts. To improve the quality of the discipline "Anatomy and Histology of Animals," a collection of three-dimensional models of the structures of the internal organs of different animal species has been developed, which can be used by a teacher to identify the inner structure of individuals [8].

Three-dimensional models of the bones of the pelvic limb have been developed to provide students with research, training, and methodological training. 3D models can be used to study the organization of the bones of the limbs, their cavities, and tuberous processes, as well as to know the methods of studying the bones of different types of animals. When checking their assignments, students can use 3D models to confirm the results of their work. If errors and inaccuracies are made, students can understand the principles, controllers, and indicators set in the model of the previous stages that help the student change the original result, compare, and edit the final options. The functionality of 3D models allows the teacher to effectively manage the educational material. For example, to change transparency, color, cut, or draw arrows[9].

Conclusion

A study of the international and domestic practices of designing 3D models, and the study and

production process of technical education experts is demonstrated. It is noted that almost all studies on understanding 3D models are devoted to layperson and/or professional experts in a certain field of knowledge, whose main area of professional activity is not related to 3D models. However, technical education experts use 3D models as an additional method of presenting their subject. With the case studies, the preliminary research is based on an analysis of not only papers but also freely available 3D models.

Based on a deep study of international experience, major areas for the use of 3D medical models in pediatric surgery and urology as a tool for improving the educational process and effective interaction between the physician and the patient are determined. Drawing practical conclusions from the analyzed positive and negative aspects of the interaction of the physician and the patient within the framework of available models allows for achieving the closest approximation to the deep understanding and effective resolution of controversial issues. In the peptide group of colonic peptides, a new peptide called peptide etdv was discovered by means of peptide mass spectrometry and real-time quantitative polymerase chain reaction. This peptide is markedly reduced during ulcerative colitis. Then, take a pair of primers to etdv and use Real-time PCR to detect the expression pattern of ETDV in normal colonic mucosae and IBD colonic mucosae. The results showed a significant decrease in the ETDV expression in the inflamed colonic mucosae as compared with the normal colonic mucosae. This result suggesting that the ETDV expression is significantly associated with IBD and wants to further diagnose its functions.

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УНИВЕРСИТЕТТЕРДЕ 3D МОДЕЛЬДЕУДІ ҚОЛДАНУ БОЙЫНША ПРАКТИКАЛЫҚ ҰСЫНЫСТАР

Түйін

Мақала өзекті болып табылады, өйткені 3D модельдеу қолданбалы өнер студенттерін дайындайтын университеттерде ғана емес, сонымен қатар жалпы университеттік білім беру бағдарламалары аясында цифрлық мәдениетті біріктіруге, кеңейтуге және дамытуға ұмтылатын университеттерде де өзекті мәселе болып табылады.студенттерінің эстетикалық көкжиегі. Мақалада 3D модельдеуге арналған бағдарламалық жасақтаманың негізгі қосымшалары қарастырылған. Бұл қосымшалардың мүмкіндіктері мен мүмкіндіктері жинақталған. Бақылаудың әртүрлі әдістері қысқаша талқыланады және студенттердің 3D модельдеу бағдарламалық жасақтамасымен өзіндік жұмысын ұйымдастырудың негізгі қадамдары ұсынылады: студенттердің бастапқы деңгейі мен 3d модельдеумен жұмыс істеу тәжірибесін және белгілі бір курс үшін қажетті деңгеймен және бағдарламалық жасақтамамен корреляциясын анықтау; 3D модельдеу курсының білім беру бағдарламасын әзірлеу; тапсырмалардың күрделілік деңгейін және сәйкесінше физикалық, практикалық, математикалық және көркемдік жақтардың контекстін анықтау, олардың сүйікті және қалаған деңгейінің қажеттіліктерімен туындайды.

Кілттік сөздер: 3d модельдеу, білім беру, визуализация, ақпараттық модельдеуді құру.

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ПРАКТИЧЕСКИЕ РЕКОМЕНДАЦИИ ПО ИСПОЛЬЗОВАНИЮ 3D-МОДЕЛИРОВАНИЯ В УНИВЕРСИТЕТАХ

Аннотация

Актуальность статьи обусловлена тем, что 3D-моделирование является актуальной проблемой не только в университетах, обучающих студентов прикладному искусству, но и в тех, которые в рамках общеуниверситетских образовательных программ стремятся интегрировать цифровую культуру, расширить и развить эстетический кругозор своих студентов. В статье дается обзор основных программных приложений для 3D-моделирования. Кратко описываются возможности и особенности этих приложений. Кратко обсуждаются различные методы контроля и предлагаются основные шаги по организации самостоятельной работы студентов с программным обеспечением для 3D-моделирования: определение начального уровня и опыта работы студентов с 3D-моделированием и соотнесение с требуемым уровнем и программным обеспечением для конкретного курса; разработка образовательной программы курса 3D-моделирования; определение уровень сложности заданий и, соответственно, контекст физической, практической, математической и художественной сторон зависят от потребностей их желаемого уровня.

Ключевые слова: 3d-моделирование, обучение, визуализация, информационное моделирование зданий.