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Z and alpha generation teaching methods: digitalization of learning material

Norbert Annuš[*], Ondrej Takáč[2], Iveta Štempeľová[3] and Daniel Dancsa[4]

[1]Department of Informatics, J. Selye University, Slovakia
[2]Department of Informatics, J. Selye University, Slovakia
[3]University of Veterinary Medicine and Pharmacy in Košice, Slovakia; Masaryk University, Czech Republic
[4]Department of Biology, J. Selye University, Slovakia

[*](annusn@ujs.sk) Email of the corresponding author

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Abstract – Digitalization is an emerging and inevitable part of everyday life and this also applies to education. The static learning material belongs to the multitude. Increasingly widespread artificial intelligence and other innovative technologies are facilitating the roll-out of personalized curricula and interactive learning materials. The trend in education is towards digitalisation and the appropriate use of information communication tools. Our research explores the importance, advantages and emerging disadvantages of digital learning materials. Furthermore, as a result of a quantitative survey of students, it is based on the interactive digitisation of learning materials using virtual models. Pupils, regardless of their level of education, demand digital learning materials and the use of information and communication tools in class, as Generation Z and Alpha are growing up with these tools. Educational establishments should therefore not restrict or prohibit the use of these tools, but should find ways of effectively integrating them into the classroom. Our aim is to motivate educators to increasingly complement traditional paper-based static learning materials with interactive digital learning materials. We have also worked to create interactive three-dimensional models for students to motivate and explore within the biology subject to support the teaching process. In summary, our article points out the importance of a certain degree of digitalisation of curricula and presents a model for possible future developments in contrast to static learning materials.

Keywords – Digitalization, Education, Interactive, Modelling, Innovation

I. INTRODUCTION

Digitalization is becoming more widespread in the world thanks to the development of information and communication technologies (ICT). The process of digitalization is the transformation of analogue data and processes into digital form. This makes data and processes easier, faster, more efficient and safer to manage and store. The impact of digitalization is

spreading to almost all areas of life, including business, commerce, health, transport, media and public sectors. The benefits of digital technologies include increased efficiency, speed, flexibility, the potential for automation and unlimited access to information. People can connect online, access data and processes remotely, and easily store and share data. The topic itself is the subject of a number of studies [1, 2, 3].

The digitization of educational material has been a growing trend in recent years. The spread of the internet, computers and smartphones has made it possible to make educational materials available in digital format. This allows students and learners to access materials anytime and anywhere [4, 5].

One of the most popular ways to disseminate digital learning materials is through the use of online courses and educational platforms. Such platforms allow learners to find educational materials in a single place and to complete online exercises, tests and exercises. Digital learning materials allow teachers to use both traditional teaching methods and interactive technology, which can help to better maintain and motivate students' attention. E-books and digital notebooks are also common in educational institutions. The advantage of e-books is that they are accessible to multiple students, they do not require physical carrying, and they allow students to use search functions in the materials, so they can easily and quickly find a chapter or keywords. E-books allow educational institutions to use less paper-based material, which is also a greener solution and promotes the development of a green future. In addition, educational videos and webinars are becoming more common in educational institutions and workplaces. These materials allow students to access educational materials anytime and from anywhere, and also allow teachers to use them in interaction with students.

Our study aims to highlight the opportunities and needs for developing these digital learning materials. In the first part of this article, we will describe digital learning materials, their advantages and disadvantages, and their potential from the perspective of teachers and students. We will then present the results of a survey to measure the interest of students at different levels in digital learning materials. Finally, we present a concrete example to illustrate our ideas and future developments for the production of digital learning material based on 3D models in the field of biology.

II. ADVANTAGES AND DISADVANTAGES OF DIGITAL LEARNING MATERIALS

Digital learning materials have many advantages, but they also have some disadvantages. In this section, we would like to point out some of the things that an teacher should take into account when replacing traditional teaching with digital learning materials.

Starting with the positive aspects of digital learning:

• **Accessibility:** Thanks to digital learning materials, students can access the material anytime and anywhere, as long as they have an internet connection. This can be particularly beneficial for distance learning. It can also have a significant positive impact on face-to-face teaching, e.g. in a biology class, an object (rock, mineral, plant, insect, etc.) does not need to be passed around among students one by one and there is no risk of someone not having access to it, as anyone can use their smartphone to examine a 3D model from all perspectives.

• **Interaction:** Online learning materials allow students to learn interactively and become more active participants in the learning process. Digital learning materials allow students to go at their own pace and return to certain learning materials when they feel they need to. Interactive learning materials also have the advantage over simple textbooks that the material presented is not static. It responds and changes immediately to student intervention.

• **Multiple content formats:** Digital learning materials allow teachers to make materials available in multiple formats. This can include videos, interactive quizzes, games and other online tools to help students learn in more varied ways. By taking advantage of more learning styles and more enjoyable teaching, they can make the process of consolidating knowledge more effective.

• **Environmentally friendly:** Digital learning materials offer a paperless solution for schools and educational institutions that can reduce the use of paper documents and books. Not only does this free students from unnecessary heavy school bags, it also brings us one step closer to a green future.

However, just as there are two sides to every coin, there may be negatives to consider:

• **Disadvantaged students:** The use of digital learning materials can make learning more difficult for disadvantaged students who do not have access to the internet or the appropriate technological tools. Although in the 21st century it is almost inconceivable that we will not be affected by the impact of digitalization, some families may not have the financial means to provide the technological background necessary to access digital learning materials. It would therefore be disadvantageous to use exclusively digital learning materials.

• **Too much information:** Online learning materials can contain a lot of information and it can sometimes be difficult for students to review the material. When using online learning materials, teachers need to ensure that there is appropriate teacher guidance so that students do not feel lost in the information. It can also be helpful to use artificial intelligence in teaching, which, like a virtual tutor, can guide students' progress in a personalized way. In addition, IT lessons will have an even more important role to play in equipping students with the right digital competences.

• **Technical problems:** When using online learning materials, technical problems can occur which can prevent students from progressing in the learning process. This can be a network problem or even a hardware problem, which we have to deal with in a fully digital environment. Within a school IT classroom, this would not be a major problem as an administrator may be able to deal with it immediately. In home education, however, it is a bigger problem if the students or their immediate environment do not have anyone with the right ICT competences and skills.

• **Lack of social interaction:** The use of online learning materials allows students to work at their own pace, but this can result in a lack of social interaction in class and teacher support to help students understand the material and develop social skills.

• **Health problems:** using online learning materials can lead to students being exposed to screens for longer periods of time, which can increase eye fatigue, headaches, back pain and other health problems.

Looking at the advantages and disadvantages outlined above, it can be said that we should focus on hybrid education rather than fully digital learning materials. Hybrid education is an educational model in which learning materials are available in different formats such as textbooks, paper-based learning materials and digital learning materials. This model can bring many benefits and can help students to learn more effectively and make the work of teachers and students easier and more efficient.

III. MATERIALS AND METHOD

We used a quantitative method to investigate the demand for digital learning materials among Generation Z and Generation Alpha students of different academic levels, regardless of gender and subject. The survey thus included students at primary, intermediate and higher education levels. We received a total of 338 responses to our questionnaire. After the evaluation, we focused on the creation of virtual models. Pix4D software was used to create the model. During the modelling process, we walked around the object to be modelled from different perspectives, in order to finally use the model as a digital teaching material and compare it with a static image in a printed textbook.

Virtual modelling of the learning material allows students and teachers to learn and teach interactively in a virtual environment. One of the benefits is that it becomes much easier for students to understand concepts and processes when they have a realistic virtual model in front of them. Virtual models allow students to interactively learn and explore the different elements, processes and systems discussed in the curriculum [6, 7, 8]. This can help students to better understand abstract concepts and processes and to apply them more easily in practice. A virtual model allows students to simulate different processes and systems and try them out without being physically present in a laboratory or other environment. It provides students with a safe and interactive way to practice in front of live situations, which can improve students' proficiency in different processes.

IV. RESULTS

Within the framework of this section, we would like to focus on the results of our survey. We will then present the virtual model compared to the static representations of the currently available textbooks.

A total of 338 students completed our questionnaire, of which 74 are studying at primary school, 168 at secondary school and 96 at university.
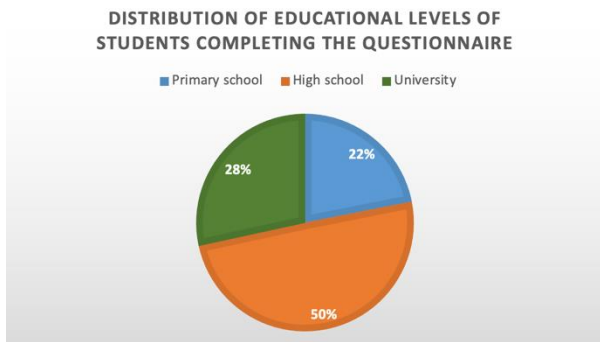

Fig. 1 Distribution of educational levels of students completing the questionnaire

55% of respondents were women and 45% were men. Our questions focused on the use of digital learning materials. Responses from respondents indicate that they have used educational software and other digital tools in the course of their studies. Except for computer science (where it is natural to work with software), language learning and mathematics were the subjects where most of the respondents had used digital teaching tools, followed by history, physics, geography, biology and chemistry. Our questionnaire also assessed students' openness to digital learning materials by asking them about their use of virtual models. Our results show that a majority of 70% of respondents would be open to learning using virtual models.
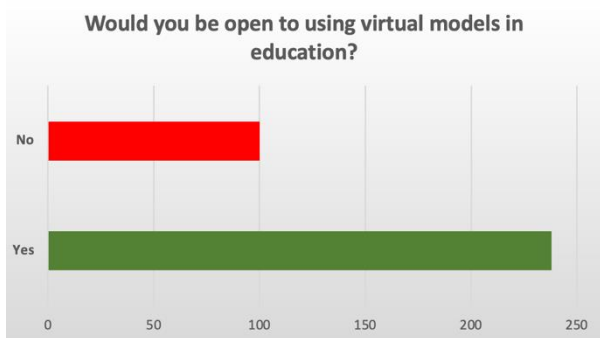

Fig. 2 Students' attitudes towards virtual models in education

With the positive feedback we received from the majority, we started on the modelling route. We conducted a literature search with a focus on biology and within that on petrology. The illustration of rocks is a difficult task, since it requires the placement of miniature illustrations of rocks or minerals with different structures and different views on a few square centimetres. In addition, the image is usually annotated, as each part of the image needs to be accompanied by an explanation.

These illustrations, as shown in Fig 3, are mostly drawn images, but in some cases they are photographs, which also serve as static diagrams.

We can see that these static figures show the minerals concerned from a single perspective. Throughout the project, we tried to walk around a lava rock from each perspective, so that the student could explore it interactively. The modelling consisted of three parts. In the first step, we created image files of the object. In modelling, images can be taken simply by using a phone, professional cameras can be used, but for larger scale models it is recommended to use drones, which are a well-established method and can be used in many other areas [10, 11, 12].
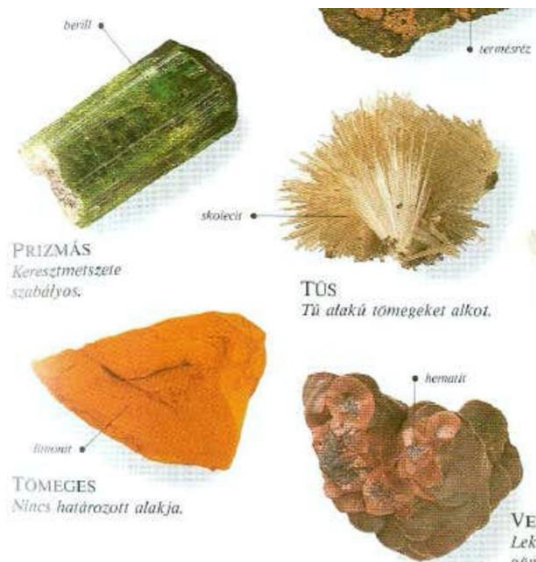

Fig. 3 Illustration of minerals: example of a book in [9]

For this project, 182 images were taken as input to the software to develop the model. The second step was for the software to create the point cloud and the three-dimensional model from the images. The process of this work is demonstrated in Fig. 4.
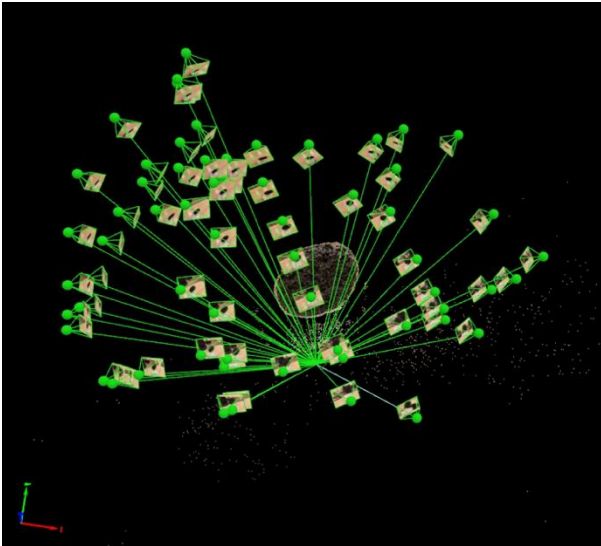
Fig. 4 The model in progress

Finally, the last step is manual post-processing, which involves correcting model errors and reducing the modelled environment.

The final result is shown in Fig. 5, where we show a montage of screenshots of the model from different perspectives.

Fig. 5 The 3D model from different perspectives

It can be seen that extending textbooks in this way can be a useful interactive and motivational tool in everyday teaching, as students can get a better look at a virtual replica of the model.

V. CONCLUSION

Digital learning materials and virtual models of education open up new opportunities for students and teachers. Our study showed that the use of digital learning materials and virtual models can help educators develop teaching methods and content that can be more effective for students. Such tools allow you to share material with learners more quickly and efficiently.

In the future, more digital teaching tools are expected to emerge, offering further opportunities for education. However, digitalization and virtual models of education will never replace the human teacher, as human interaction and emotional attachment are key elements of the educational process.

It is important to note that the use of digital learning materials and virtual models is not suitable for all students. Some students achieve better results with traditional learning methods.

Overall, digital learning materials and virtual models can make the teaching process more flexible and efficient. Using a hybrid form of education, we can take advantage of the opportunities offered by digital technology while maintaining the traditional form of education without removing the human being from the learning process.

REFERENCES

[1] Á. Sándor and Á. Gubán, *A Measuring Tool for the Digital Maturity of Small and Medium-Sized Enterprises*, Management and Production Engineering Review, 2021, vol. 12: 4 pp. 133-143. , 11 p.

[2] Á. Sándor and Á. Gubán, *A multi-dimensional model to the digital maturity life-cycle for SMEs*, International Journal of Information Systems and Project Management, 2022, vol. 10: 3 pp. 58-81. , 24 p.

[3] Á. Gubán and Z. Mezei, *Modeling Economic Processes of Hungarian Prison Service*, Asian Business Research, 2017, vol. 2: 1 pp. 31-41. , 11 p.

[4] I. Roll and R. Wylie, *Evolution and Revolution in Artificial Intelligence in Education*, Int J Artif Intell Educ, 2016, vol. 26, 582–599. https://doi.org/10.1007/s40593-016-0110-3

[5] F. Liu and P. Kromer, "Early Age Education on Artificial Intelligence: Methods and Tools," in *Kovalev, S., Tarassov, V., Snasel, V., Sukhanov, A. (eds) Proceedings of the Fourth International Scientific Conference "Intelligent Information Technologies for Industry" (IITI'19). IITI 2019*, Advances in Intelligent Systems and Computing, 2019, vol. 1156. https://doi.org/10.1007/978-3-030-50097-9_71

[6] J. Udvaros and L. Végh, "Possibilities of Creating Interactive 2D Animations for Education Using HTML5 Canvas JavaScript Libraries," *in Proceedings of the 16th International Scientific Conference "eLearning and Software for Education", Bucharest: Editura Universitara*, pp. 269–274, Apr. 2020, doi: 10.12753/2066-026X-20-119.

[7] K. Czakóová "Mathematical Model Based Interactive Simulations in Education," in *ICERI 2019 Proceedings of the 12th International Conference of Education, Research and Innovation: Enlightening Minds through Education*, *Seville: IATED Academy*, p. 10120-10125,

2019. DOI: 10.21125/iceri.2019.2479, ISBN 978-84-09-14755-7. ISSN 2340-1095.

[8] D. Paksi, M. Csóka and Sz. Svitek, "Spreadsheets Feasibility for Modeling in Education", *14th International Conference on Education and New Learning Technologies*, pp. 5855-5861, 2022. doi: 10.21125/edulearn.2022.1371

[9] Ch. Pellant, *Rocks and Minerals*, Dorling Kindersley Plc P/B, 2000, p. 256. ISBN: 9780751327410

[10] J. Udvaros, N. Forman, L. Szabó and K. Szabó, "The Importance of Teaching Drones in Logistics," *ICERI2022 Proceedings*, pp. 3286-3290, 2022. doi: 10.21125/iceri.2022.0811

[11] L. Radácsi, M. Gubán, L. Szabó and J. Udvaros, *A Path Planning Model for Stock Inventory Using a Drone*. Mathematics, 2022, vol. 10(16):2899. https://doi.org/10.3390/math10162899

[12] M. Gubán and J. Udvaros, *A Path Planning Model with a Genetic Algorithm for Stock Inventory Using a Swarm of Drones*, Drones, 2022, vol. 6(11):364. https://doi.org/10.3390/drones6110364