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The Digital Transformation of Higher Education: The Role of Artificial Intelligence and Chatbots

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Abstract: *The development of new digital resources and tools in education has catalyzed its transformation, aiming to achieve better outcomes for students and foster more fulfilling relationships in the educational process. Smart technologies have been, and continue to be, pivotal in the global transformation of the educational space. This paper examines the main trends related to the digital transformation of higher education, with a focus on the burgeoning role of artificial intelligence (AI) and its most popular application—chatbots. Based on a survey of students, this study explores new possibilities for knowledge acquisition and the further digitization of higher education. The increasing use of chatbots holds significant potential for enhancing university-level economics teaching. Despite certain risks associated with this technology, it is clear that chatbots can significantly contribute to the digitalization efforts within universities and make an additional impact on the sustainability of educational progress and development.*

1. INTRODUCTION

The rapid development of digital resources and tools in education has and will continue to change the landscape of higher education. Resources such as e-books, e-textbooks, online courses and massive online courses (MOOCs), educational websites and portals, as well as digital libraries and databases are part of modern education and tools that are used ubiquitously in the education and higher education system. Although somewhat slower than in business, digital tools are making their mark in schools and universities. These include learning management systems (LMS), interactive whiteboards, virtual classrooms, educational applications (Photomath, Duolingo, etc.) assessment tools (such as Kahoot, Socrative, etc.). Along with these systems and resources, in the last few years more and more smart technologies and the ones with Artificial Intelligence (AI) are rapidly entering both life and education. They are inevitably being integrated into educational structures and approaches, thereby accelerating the digital transformation in education. These transformations are fundamentally aimed at enhancing the effectiveness of student learning, as well as improving and facilitating access to learning materials. Expectations from new technologies are to strengthen student learning outcomes. The effects are widespread - teaching methods and learning approaches are changing, infrastructure is changing and so is the technological environment, new skills are being developed, research approaches are being developed and innovation is taking place. These transformations lead to a complex change and enrichment of the educational world, and its experience, and new directions for development are created - summarized it is a serious and complex digital transformation process (Alenezi, 2021; Teixeira et al., 2021). This paper examines some of the latest trends in digital transformation, namely the application of AI in higher education, with a special focus on chatbots.

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2. OBJECTIVES AND DIRECTIONS IN THE DIGITAL TRANSFORMATION IN EDUCATION

The digital transformation in education aims at major changes in the learning process through new digital technologies. Among the most important goals are: improving the learning experience and academic performance of learners; personalizing the learning process and education, improving teaching processes with improved efficiency, creating a more engaged and effective learning landscape, increasing the level of accessibility and equity, modernizing education in line with the realities and demands of the modern world, and creating more fulfilling learning experiences for learners (Acevedo, 2021; Bsecrets, n.d.; McCarthy et al., 2023; OECD, 2019, 2023; Pane et al., 2015; Tamim et al., 2011; UNESCO Institute for Statistics, 2018). In general, we can distinguish 5 major objectives:

1. **Enhance the learning experience and learning outcomes**. The use of digital tools and resources has the potential to greatly aid the educational experience and improve understanding and more effective retention of material. This inevitably leads to better academic outcomes (UNESCO, n.d.; UNESCO, 2020).
2. **Personalized learning and education**. New digital technologies, which include self-tuning programs and those that can provide feedback depending on the progress or lack thereof of the learners (most often artificial intelligence tools) have the potential to adapt the educational content to the individual needs of each learner, to the respective learning style of the material, and also to the optimal pace of learning the curriculum. This creates real opportunities for effective personalized learning. To this goal can be added the improvement of teaching processes with improved efficiency as a consequence of the personalization of learning and the creation of a more engaged and effective learning side. Overall, digital tools provide more interactive and engaging learning, which in many cases leads to more active participation from learners.
3. **Increasing access and equity**. Digital resources make education more accessible and efficient by removing geographical barriers (travel) that in many cases have been difficult to overcome for the vast majority of people who want to get a good, quality education, while also removing the need for learning to take place within precise time frames (as in traditional education), thus enabling learners to follow their flexible learning schedules.
4. **Modernizing education in line with the digital world** and creating more fulfilling learning experiences for learners. This process includes integrating technology, adapting teaching methods and preparing students for the rapidly evolving digital environment. This can also be the use of blended and hybrid learning, which successfully combines online and face-to-face learning and enables the application of best practices from digital and traditional methods of teaching knowledge.
5. **Digital Age competencies and skills**. The use of digital technology enables learners to perceive, learn and build important digital literacy skills to be able to solve both existing traditional problems and new ones that are typical of today's workforce that is in a digital work environment. Some studies indicate that companies and enterprises lack workers with advanced knowledge and skills to use new digital technologies, and education systems need to further update their training programs to be able to respond to the dynamically emerging needs of the labor market (Spada et al., 2022). It is also important to adopt new methods to change student mindsets, increase critical thinking and motivation and align with the real world (Kopackova et al., 2024).

Digital transformation should not be limited to the installation, adoption and use of new programs, tools, and resources, but to a serious, even in some cases - fundamental rethinking of the learning process and its methodology. In some cases, this could involve a new perspective and even approach to creating educational content to improve both learning and teaching outcomes.

Chatbots and Chatbots in Education. Advances in artificial intelligence have led to the development of powerful techniques capable of solving problems ranging from gaming to medical diagnostics. Today, artificial intelligence is deeply embedded in our everyday lives, both visible and invisible. Technologies like fingerprint and facial recognition in smartphones, voice assistants like Siri and Alexa, personalized movie and shopping recommendations, and social media algorithms are all powered by AI. In recent years, the use of chatbots (abbreviation of the words **chat** and ro**bot**) - tools built and working on the basis of AI and in particular Generative AI - has become extremely popular. Chatbots have been around since 1966 when ELIZA (Ireland, 2012) was created, but since 2016 and especially since 2022, sophisticated chatbots using advanced machine learning techniques including deep learning and natural language processing have rapidly developed. These chatbots have vastly improved communication skills and provide answers to users that in their vast majority seem to be by humans with serious levels of knowledge. It is for these reasons that the ChatGPT chatbot (an OpenAI product) reached 100 million active users just two months after being released for mass use (November 2022)! Such unprecedented rapid growth was identified in a UBS study as the fastest-growing consumer app to date. The data is taken from Similarweb and shows an average of 13 million unique visitors per day in January 2023 (Gadgets 360., 2023). Today, we know that chatbots mimic conversations with a human in natural language, provide answers to questions or perform "tasks". They can be used to retrieve information, schedule meetings, create content and get answers to questions in all sorts of areas, including financial services, customer service and marketing, planning trips, booking flights, hotels or car rentals, providing information on travel destinations and real-time updates on travel-related issues, automating the process of gathering user feedback, conducting surveys and collecting opinions on products or services, for entertainment, storytelling, etc. In recent years, chatbots have also entered the field of education. They are proving to be a serious help in the learning process for both students and their teachers. Along with this, chatbots have improved communications used for administrative tasks. Apart from the popular general-purpose chatbots such as ChatGPT, Gemini, Copilot, Claude, You.com, today we are seeing the use of many chatbots that have been created for use in the field of education.

Math chatbots can provide step-by-step explanations, practice problems, and instant feedback to help students master math concepts (ALEKS, n.d.; Mathway, n.d.; Thinkster Math, n.d.). Developing artificial intelligence is becoming a major focus for universities around the world. Many prestigious institutions such as Georgia Tech, Stanford, MIT, Oxford University and many others are actively pursuing AI-related projects, not only as research topics but also as initiatives to help make learning more efficient and easy (Georgia Institute of Technology, 2023; MIT Media Lab, n.d.; Stanford Artificial Intelligence Laboratory, n.d.; University of Oxford, 2024). Additionally, technology solutions like conversational AI tools are being deployed across so many platforms on the internet, whether it's social media or business websites and apps. Tech-literate students, parents, and teachers experience the privilege of interacting with chatbots, and institutions in turn see happy students and staff.

AI chatbots can significantly contribute to the sustainability of higher education by enhancing operational efficiency, reducing costs, and promoting environmentally conscious practices. Key areas include automating administrative tasks, creating digital learning resources, optimizing energy and resource consumption through smart campus technologies, and personalizing learning experiences to reduce dropout rates and the need for physical infrastructure. This can lead to significant financial savings for universities, enabling them to operate more sustainably. Furthermore, AI chatbots can support at-risk students, and facilitate global collaboration and knowledge sharing among students and institutions (Dempere et al., 2023).

Although chatbots have been around for a relatively short time, there are already many studies that raise questions about how they or similar tools can be used in education, including higher education (Baidoo-Anu & Owusu Ansah, 2023; Fitzpatrick et al., 2023; Ilieva et al., 2023; Labadze et al., 2023; Lo, 2023; Michel-Villarreal et al., 2023). The most frequently discussed topics are whether it is acceptable to use these tools during work (and even exams) or not, what are the best and correct ways to use them, should students and teachers develop skills to use them, what are the benefits and harms of them, etc. From these and similar perspectives, we conducted a survey at the UNWE to see what the current state of thinking of students at that university is on these issues.

3. METHODS AND DATA

This study aims to uncover the potential of chatbots in education, focusing on their applications and benefits, as well as identifying the associated challenges and issues. This understanding will contribute to better regulation of these tools, ultimately leading to more effective digitalization of the learning process.

The main research hypothesis is that in the last two years, a large proportion of students have had a small but some experience with using chatbots for a variety of purposes. At the same time, a number of them are using it for their university studies, and the use has rather been sporadic for solving a specific task and there is no regulated technology for incorporating chatbots into the learning process.

In order to accomplish the aim of the study, an author's instrument (questionnaire) was developed and disseminated via email to 200 undergraduate and graduate students at the UNWE in May 2024. 106 responses were received. Although the sample is with 53% response rate and is not completely balanced by key characteristics, the results have the potential to highlight an under-studied issue and reveal the main, attitudes of students at UNWE towards the use of chatbots in their studies. The distribution of students by key characteristics is presented in Table 1. The results reveal interesting trends among students regarding their general use of chatbots, their application in education, and the challenges associated with them, and their perspectives on the potential opportunities they offer in their studies.

Table 1. Distribution of the Respondents in the Sample by Variables of Interest

Variables of Interest	Share %
Gender	
Female	60.0
Male	39.0
Age	
up to 22	76.2
23 and more	21.9
Specialty	
Business Informatics or Data Analytics	40.0
Economics, Business and Management	60.0
Level and Year of Study	
Bachelors first and second year	57.1
Bachelors third and fourth year	31.4
Master	11.4

Source: Own calculations

Non-parametric hypothesis testing methods - Chi-Square Test, Independent-Samples Mann-Whitney U Test and Independent-Samples Kruskal-Wallis Test - were used to explore the presence of statistically significant relationships between variables and the presence of statistically significant differences between relative proportions in subgroups formed by the categories of variables of interest.

4. RESULTS

According to respondents' answers to the question "Since when do you know about the possibility of using chatbots for any reason?" the largest share (about 40%) is "From about one year". Approximately one in five indicated that they had known about this possibility "For about two years" and another 20% indicated "Since a few months". Around 14% have known about the possibility of using chatbots for more than two years and just under 7% have not heard of this possibility. Meanwhile, 72% use chatbots for any purpose and 28% do not (Table 2). Differences in usage by categories of variables of interest stand out, with a higher proportion of men and students under 23 using chatbots. As expected, the proportion of student users from "Business Informatics or Data Analytics" majors is higher compared to those from "Economics, Business and Management" majors. By testing hypotheses for a relationship between the listed characteristics and chatbot usage Chi-Square Test results confirm a statistically significant relationship between Specialty and Chatbot usage ($p=0.003$).

Of those using chatbots, 70% indicated that they use them to find information related to their studies. Between 30 and 45% indicated using chatbots for problem-solving, finding information related to their hobbies and entertainment, finding information related to daily activities, translating texts, writing homework, finding information related to their job and getting help with their job duties.

Table 2. Usage of Chatbots for any Purposes - Total and by Subgroups

Variables of Interest	Users	Non-users
Gender		
Female	68.3%	31.7%
Male	78.0%	22.0%
Age		
up to 22	73.8%	26.3%
23 and more	65.2%	34.8%
Specialty		
Business Informatics or Data Analytics	88.1%	11.9%
Economics, Business and Management	61.9%	38.1%
Level and Year of Study		
Bachelors first and second year	65.0%	35.0%
Bachelors third and fourth year	84.8%	15.2%
Master	75.0%	25.0%
Total sample	72.4%	27.6%

Source: Own calculations

Chatbot users were asked if they use this tool for their studies. Interestingly, just over ¼ declared that they use chatbots frequently for their learning purposes, while over half use them rarely (55%) and 17% do not use them. This fact may suggest that there is a need for a broad discussion about the possibilities of chatbots for the educational process at the UNWE, as well as the definition of rules

and procedures for their use in specific activities within the training. Moreover, of the 76 students who used chatbots at all, only 18 indicated that lecturers/professors had recommended them to use chatbots concerning their studies. Chi-Square Test results confirm a statistically significant relationship between the frequency of usage and Gender ($p < 0.001$), Specialty ($p < 0.001$), and Level and Year of Study ($p < 0.001$). The trends observed in line with the general usage of chatbots.

Figure 1 presents the specific training-related activities for which respondents indicated they use chatbots. The most common use is for obtaining additional information related to their study material. Students also use chatbots extensively for writing homework, preparing for exams, and developing course assignments or projects. About one in three students indicate that they use chatbots to solve assignments during class, suggesting that in some form or other lecturers have started to encourage students to use this tool in class. Interestingly, less than 10% indicated that they use chatbots during exams, suggesting that such use is not yet popular and is not regulated for assessing student knowledge.

Sixty-three students responded to the question of how satisfied they were with using chatbots for their learning purposes. More than half (36 students) stated "Partly help to complete the tasks", 14 answered "Yes, it helped me a lot to complete the tasks" and 13 - "It helped me very little to complete the tasks". The variety in responses is likely due to the different skills of the students in using chatbots as well as the variety in the tasks they used them for. Of those using chatbots in their studies, 21 students indicated that they had also experienced problems. Twenty students experienced inaccurate answers, 13 –could not find the information they were looking for and the same number had the wrong answer to the problem. In addition, among the problems mentioned were "Could not solve the problem" (9 answers), "Communication was difficult and could not understand what I wanted" (6 answers) and "Lack of security" (6 answers). These problems also outline potential challenges that will seek solutions as chatbots become more prevalent in the learning process - how to find the right information and check for its correctness, how to ask clear, precise and unambiguous questions so that we get unambiguous answers, and how to be sure of the accuracy of the information received.

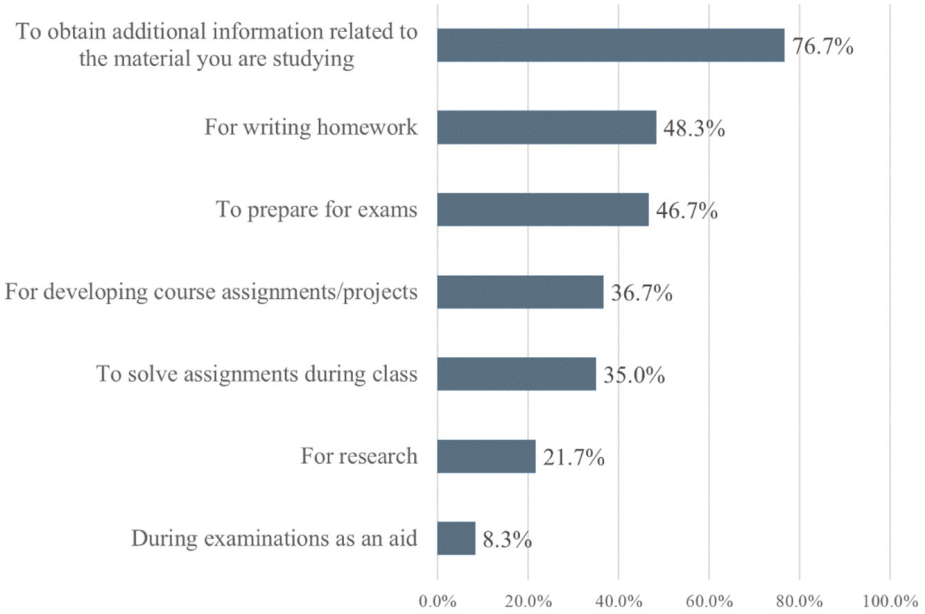

Figure 1. Chatbots Usage in Training-Related Activities for University Studies

Source: Own calculations

All survey participants were asked, "Would you like to have specialized training on working with chatbots in connection with your studies at the university?" (Table 3). About ¼ of the respondents claimed that they did not need such training. Interestingly, students who do not use chatbots in their studies are more likely to declare a lack of need for training (38%). At the same time, only 14% of those who frequently use chatbots in their training do not need specialized training and about 50% of them think it would be very useful. This leads to the conclusion that those who already have experience realize the need for targeted instruction and comprehensive training on the use of chatbots in training.

Table 3. Interest in Specialized Chatbots Training Related to University Studies: Usefulness and Learning Potential vs. Current Usage in University Studies

Do you use chatbots in your studies at UNWE	Would you like to have specialised training on working with chatbots in connection with your studies at the university?		
	Yes, it would be very useful	Rather yes, I can learn something new	No, I don't see what more I can learn
Yes, often	47.6%	38.1%	14.3%
Yes, rarely	30.0%	45.0%	25.0%
No, I do not use	15.4%	46.2%	38.5%
Total sample	32.4%	43.2%	24.3%

Source: Own calculations

To the question "Would you like to have a regulated possibility to use chatbots in your studies at the university" only six participants answered negatively. Table 4 presents the relative proportions of respondents (overall and by subgroup) who responded positively to the need for regulated use of chatbots for study activities. The highest proportion of those who wanted a regulated opportunity to use chatbots during class (53%) and the lowest proportion of those who indicated during exams (20%). The latter result may be due to students associating exams mainly with the reproduction of material rather than creative tasks. Another reason for this low proportion could be the lack of confidence in the facts and information received.

Table 4. Proportion of Respondents Supporting Regulated Use of Chatbots for Various Study Purposes by Subgroup

Variables of Interest	For homework help	For help with coursework/ projects	During class to solve assignments, case studies, etc.	During exams
Gender				
Female	34.9%*	36.5%*	50.8%	20.6%
Male	53.7%*	53.7%*	56.1%	19.5%
Age				
up to 22	45.0%	42.5%	52.5%	23.8%
23 and more	30.4%	43.5%	52.2%	8.7%
Specialty				
Business Informatics or Data Analytics	50.0%	57.1%**	54.8%	16.7%
Economics, Business and Management	36.5%	33.3%**	50.8%	22.2%
Level and Year of Study				
Bachelors first and second year	36.7%*	35.0%	50.0%	23.3%
Bachelors third and forth year	57.6%*	57.6%	63.6%	18.2%
Master	25%*	41.7%	33.3%	8.3%
Total sample	41.9%	43.3%	52.9%	20.2%

* $p<0.10$, ** $p<0.05$

Source: Own calculations

The Independent-Samples Mann-Whitney U Test and Independent-Samples Kruskal-Wallis Test were used to test hypotheses about differences in proportions of positive responses by subgroups. Men indicated "For help with coursework/projects" and "For homework help" at significantly higher rates. The proportion of students in "Business Informatics or Data Analytics" who wanted to regulate use of chatbots in coursework/projects was significantly higher than that of students in "Economics, Business and Management". This may be due to both the greater experience of using chatbots and the greater number of coursework/projects they prepare during their studies. Undergraduates, especially those in their third and fourth years, are more likely to want regulated use of chatbots for homework. This is probably also related to the larger number of homework assigned in this period of study.

5. CONCLUSION

As a relatively new technology, chatbots are still an important topic for consideration in their use in Higher education. In line with this, we surveyed students at UNWE. There is a need for a broader discussion on the potential educational applications of chatbots and the establishment of guidelines for their use in specific training activities. The fact that only about 1/4th of students declared that they use chatbots frequently for their learning purposes may suggest that there is a need to look closely at the possibilities of chatbots for the purposes of the educational process. There is also a need for the definition of rules and procedures for chatbot use in specific activities within the training. Another interesting fact is the low percentage of lecturers/professors who have recommended the use of chatbots by students concerning their studies. This can be considered as an indicator that educators must also be educated in the use of chatbots and how and when they can help (or not) students.

Universities can use chatbots to personalize the educational process by recommending appropriate courses, learning materials, and extracurricular activities based on individual preferences and achievements. This technology can be used to collect feedback, and assessing the quality of teaching, course content, and overall satisfaction of both students and faculty. The implementation and integration of AI chatbots will boost the efficiency of delivering learning material and enhance the overall educational experience by making it more personalized, accessible, and interactive. This points to the sustainability of the process and is supported by other research as well (Mekić et al., 2024).

Chatbots are not yet able to replace lecturers in higher education institutions. However, they offer many advantages and opportunities to improve and enhance the learning process, the student experience and their attitude. The implementation of chatbots in higher education has the potential to foster the development of more sustainable knowledge, aligning educational outcomes with the ever-evolving demands of the job market and present and emerging industry trends.

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