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STUDY ON IMPROVING THE TEACHING METHODS OF GRAPHIC DISCIPLINES AFTER THE PANDEMIC

Abstract: The work aims to analyze, determine and highlight the positive aspects of the experience gained during the 2020 pandemic in the teaching of Descriptive Geometry and Technical Drawing and Infographics at the Faculty of Mechanical Engineering and Faculty of Electrical Engineering of the Technical University "Gh. Asachi" from Iasi. We will present the premises and the statistically processed results of a survey conducted over a group of 300 students from year 1, 2, 3 and 4 regarding their opinions on the face-to-face, online and hybrid teaching. The conclusions refer to suggestions for improving the teaching methods currently chosen for the efficiency of the students' accumulation of skills.

Key words: graphic disciplines, teaching methods, after the pandemic

1. INTRODUCTION

In Romania, before 2020, there was no online teaching and education was exclusively face-to-face. The sudden transition to online, required a concentrated and sustained effort from everyone, both teachers and students, parents and staff members who provided logistical support.

The pandemic was a difficult time, but despite heightened disengagement levels due to the loss of social interactions (especially for younger children), students did learn new skills, such as time management and responsibility.

Looking back, the pandemic represented a valuable opportunity to research online learning. In other words, during that period a leap of evolution was made towards a new format of education waiting to be developed and improved.

In the post-pandemic context, the authors want to preserve and capitalize on the knowledge that was constructive during the online learning period and that meets the values of the today society

Today's students are those who in 2-3 years will be engineers, teachers, doctors and who in no time will be models and even educators for children. Therefore, the academic environment focus on them becoming responsible citizens, well trained professionally and, as far as possible, personally.

The life of students today is much more dynamic than 10 years ago. Large parts of them work part-time or full-time, commute long distances, are involved in civil society organizations and activities, etc. For them it is much easier to listen to a course/podcast on the phone and communicate in real time with the teacher through chat or e-mail than to read that course. Therefore, students can achieve more efficient time management, leading to better-trained specialists benefiting society as a whole.

2. ASPECTS OF ONLINE TEACHING IN THE WORLD AND PARTICULLARY IN ROMANIA.

In 2020, Espino-Diaz and collaborators [1] argued that it was necessary to train teachers in the use of ICT (Information and Communication Technology) resources and make learning more efficient with the help of neuroscience and, more specifically, neuroeducation. A neuroeducational approach considers the effective management of emotions and motivational processes, but also the optimization of students' academic performance (Espino-Díaz et al., 2020). Currently, 4 years later, researchers can notice major improvements in teachers' skills in the use of gags and interactive platforms, in the multitude of options for online courses and a continuous concern and development of this field.

Dhawan (2020) [2] realizes in 2020 that "Online Teaching Is No More an Option, It Is a Necessity" in the pandemic context. The same author argues that disasters stimulate our motivation to introduce highly innovative communication technologies and e-learning tools in education, and now, in the post-pandemic context, these awarenesses remain valid and even impose themselves strongly.

At the beginning of the pandemic period, as education had never faced such a situation before, most online courses continued to be configured and taught according to face-to-face learning conventions. (Wolf & Mitrea, 2020) [3].

The current landscape of education has undergone significant modifications to adapt to the demands of online platforms. With the shift towards remote learning, educators have been compelled to revise and diversify the curriculum to ensure it aligns with the digital environment.

This adaptation has led to the implementation of various teaching methods aimed at enhancing engagement and comprehension among students.

The availability of tools on the internet has played a pivotal role in transforming education. Educational platforms offer a plethora of resources, ranging from instructional materials to assessment tools, facilitating seamless lesson planning and delivery. Video and audio resources have become indispensable components of the educational toolkit, enabling educators to supplement traditional teaching methods with multimedia content that enhances comprehension and retention. Some popular tools include:
1. Video Conferencing Platforms: Such as Zoom, Microsoft Teams, Google Meet and Skype for live lectures, discussions, and presentations.

2. Learning Management Systems (LMS): Like Moodle, Canvas, Blackboard and Google Classroom for organizing course materials, assignments, quizzes and discussions.
3. Screen Sharing and Collaboration Tools: Such as Google Docs, Microsoft Office Online and Slack for real-time collaboration on documents, presentations, and projects.
4. Interactive Whiteboard Tools: Examples include Jamboard, Miro and Explain Everything for virtual whiteboarding, brainstorming, and visual presentations.
5. Video Creation and Editing Tools: Like Screencast-O-Matic, Camtasia and Adobe Premiere Rush for creating and editing instructional videos and multimedia content.
6. Online Assessment and Quiz Tools: Such as Kahoot!, Quizizz and Quizlet for creating interactive quizzes, flashcards and assessments.
7. Virtual Classroom Tools: Platforms like Edmodo, Schoology and Seesaw for creating a virtual classroom environment with features for communication, assignments and grading.

These tools offer a wide range of features to facilitate effective online teaching and learning experiences.

Therefore, at present, Romanian education has undergone a series of changes and improvements to meet the new requirements and challenges. Here are some main aspects:
1. Adapting to digital technologies: Schools and educational institutions have strengthened their digital infrastructure to enable online teaching and effective communication between students, teachers and parents. Online platforms and educational applications have been developed and implemented to support the learning process.
2. Development of online platforms: Online platforms dedicated to education have been created and improved, providing educational resources, learning materials, video lessons and other tools to facilitate learning both during and outside school.
3. Strengthening teacher's capacities for online teaching: Training sessions were organized for teachers to help them improve their skills in online teaching and the effective use of digital technologies in learning.
4. Hybrid education: Increased attention has been paid to hybrid education, which combines traditional classroom learning with online activities and resources. This approach allows flexibility in learning and can improve access to education for all students.
5. Bridging the digital divide: Efforts have been made to reduce the digital divide and ensure that all students have access to technology and resources needed for online learning. This may include distributing electronic devices, providing internet connections and supporting disadvantaged communities.

Through these measures and initiatives, Romanian education has sought to adapt to new requirements and provide quality education in a constantly changing environment.

Although the latest technologies provide interactivity to students and make a completely online education possible, teachers have no certainty regarding student involvement in a course, and students' academic performance can only be predicted with great difficulty (Bravo-Agapito et al., 2021) [4]. How does a student who is learning in the new digital formula can perceive the current situation and what elements of online learning are important to him? Unfortunately, this aspect has not been studied enough, but in the author's opinion, the development of the new way of constructing online learning must focus on adapting teachings to the perception, pace and need for learning of students, in order to take into account the elements that students consider essential in their learning process. That's why the researchers considered as a necessity to ask the students about their opinion.

3. GRAPHIC DISCIPLINES STUDENT'S GRADES BEFORE AND AFTER THE PANDEMIC. SURVEY RESULTS.

To be able to observe the influence of online and hybrid vs face-to-face learning, the authors aim to analyze from the point of view of the promovability of the results obtained by the students in the period 2012-2019, then during the pandemic, the academic years 2019-2020, 2020-2021, 2021-2022 and the post-pandemic period the academic years 2022-2023 and 2023-2024 (first semester).

The target group consists of 300 students from the "Gheorghe Asachi" Technical University of Iasi.

They study at the Faculty of Mechanical Engineering and Faculty of Electrical Engineering from "Gheorghe Asachi" Technical University of Iasi in the first, second, third and fourth year of study.

They are aged between 19-27 years, all participants in teaching activities carried out in the first and second semester of the academic year 2023-2024. Participation in the study was voluntarily. The majority of students are in the first year of study (83.33%), 5.00% are in the second, 7.33% are in the third and 4.33% are in the 4th year.

The grades considered at the end of the study year, except for those from the current year that are those from the end of the first semester.

The graphic subjects taken into consideration are Descriptive Geometry (GD), Technical Design and Infographic Semester 1 (DTI1), Technical Drawing and Infographic Semester 2 (DTI2), Computer Assisted Graphics (GAC). These disciplines studied in the first year at the Faculty of Mechanical Engineering (GD, DTI1 AND DTI2) and at the Faculty of Electrical Engineering (GAC).

The authors analyzed and graphically expressed the promovability to the GD discipline during October 2012 – January 2024 Figure 1.

For the same period, the results for DTI1 and DTI2 are presented in Figure 2 and Figure 3.

For GAC we have information for the period 2021-2023 in Figure 4.

It is important to observe that the percentages remain approximately constant before, during and after the pandemic.

Thus, if we take into account the results of the exams, the online teaching of the graphic disciplines was not different in respect with the face-to-face version of it, in terms of grades obtained by the students.
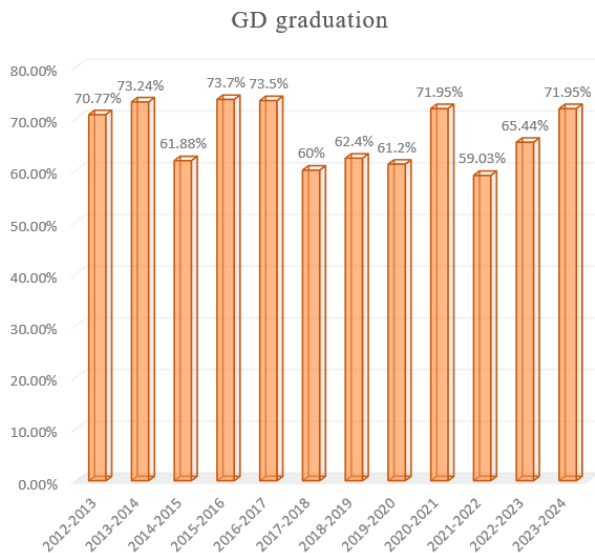
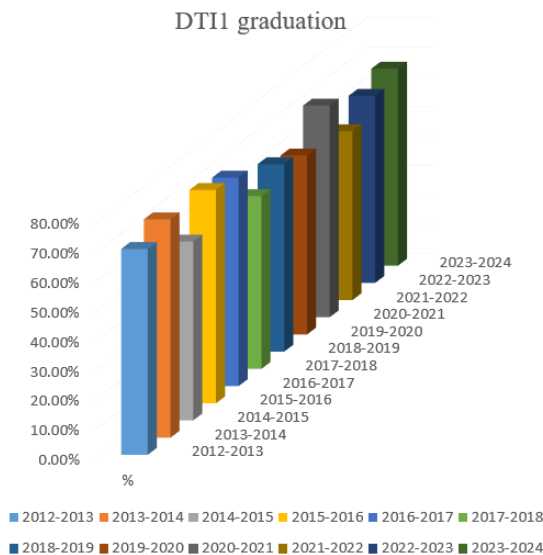**Figure 1** GD graduation grades expressed in percent since 2012 to 2024

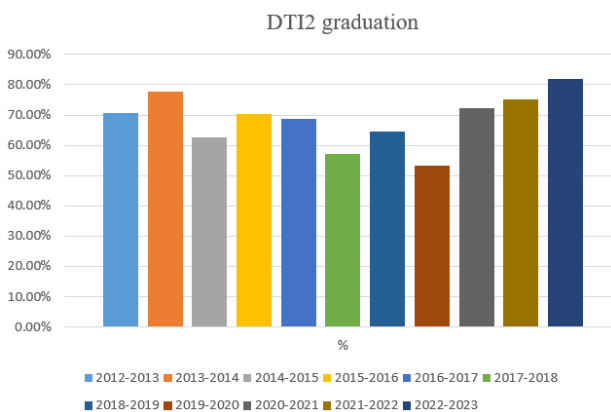**Figure 2** DTI1 graduation grades expressed in percent since 2012 to 2024

Figure 3 DTI2 graduation grades expressed in percent since 2012 to 2023
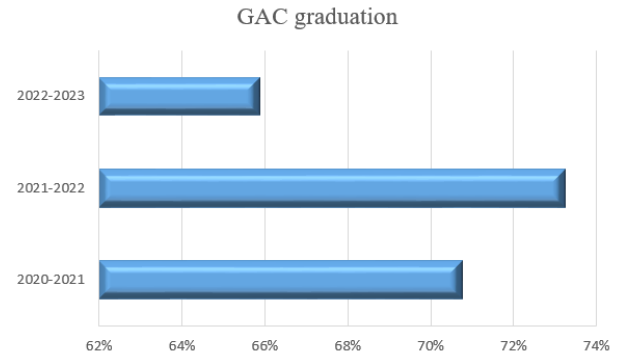

Figure 4 GAC graduation grades expressed in percent since 2021 to 2023

The success of these experiences is different however, according to the perspective:

- from the teachers' point of view, the results of learning process are the most important: "Did the students manage to obtain good grades? Do they have the required knowledge and skills?"

- from the students' point of view, the main problems are the interest, how they can put the skills learned in the Online Teaching of Graphic Courses to immediate use, therefore rapid and appropriate use of acquired knowledge, the motivation and involvement.

For a deeper and more complex understanding of the issue the authors created and applied an questionnaire containing 10 questions to 300 students from first, second, third and fourth year of study.

Thus, a clear trend against online education is evident, with almost half of respondents (48.33%) considering online experience worse than face-to-face learning. Adding those who consider it "much worse" (15.33%), we reach a majority of 63.66% who view online education as inferior to traditional education.

Only 16.67% of respondents (combining "much better" and "better") appreciate online education over traditional, more, which shows that there is a minority that adapts well or prefers this format.

There is, however, a group (19.67%) that sees no difference between the two modes of education, indicating either an adaptability to both styles, be a lack of a strong opinion in this regard Figure 5.
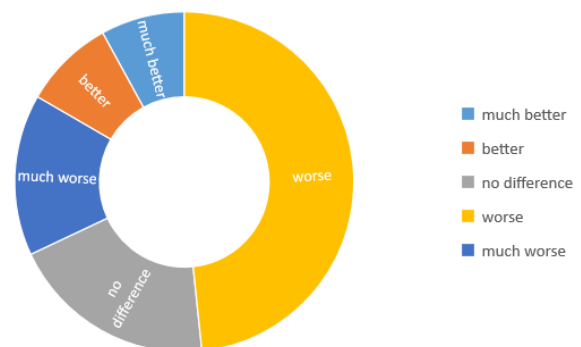

Figure 5 Percentages of appreciation of online education

These results could reflect the challenges associated with online education, such as a lack of direct interaction and technological problems, which can affect the quality of learning. They also suggest potential resistance to change or a preference for the social and structural aspects of traditional education in person.

58.67% of students surveyed believe that online education has left gaps in their knowledge. A considerable number of respondents (28.67%) are not sure whether or not online education left them gaps. This could reflect an uncertainty about the quality of their learning or the possible long-term effects that online might have on their knowledge Figure 6.

A smaller number of respondents (12.67%) feel that online education has not left them significant gaps, which could indicate a successful adaptation to this learning environment or a perception that online resources and support were sufficient for their educational needs.

This data highlights the challenges associated with online education, including its potential not to fully meet the learning needs of students. Improvements in the design and delivery of online courses may be needed to reduce these perceived gaps.

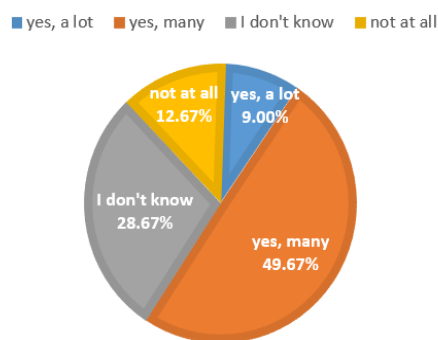## GAPS IN THE KNOWLEDGE BECAUSE ON-LINE CLASSES

Figure 6 Lack of information on student's knowledge

Asked whether they prefer on-site or online courses, most respondents (49.67%) prefer courses that are more face-to-face than online. This shows that despite the rise in online education, a significant proportion of students still value the direct experience and interaction that comes with face-to-face learning.

The hybrid, Online and Face-to-Face combination is the preferred combination of 44.33% of respondents. 52.63% of them would prefer an inclined balance towards online courses, but not exclusively this format, indicating an openness to flexibility and the benefits of distance learning. 47.37% of them have a slight preference towards face-to-face although they do not want to give up online Figure 7.

A small number of respondents (6.00%) would prefer to have exclusive online courses, while 21.00% would prefer to have only face-to-face courses. These responses reflect the extremes of the preference spectrum, with some people enjoying the benefits of each format.

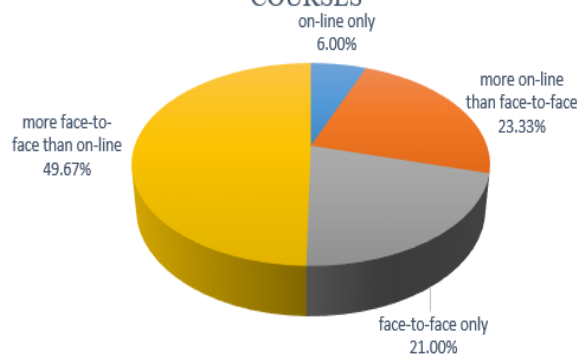## PREFERENCES ON-LINE VS FACE-TO-FACE COURSES

Figure 7 Percentages of appreciation of online courses vs face-to-face courses

The findings show a strong inclination towards traditional education or a blend that leans towards in-person learning. However, the notable acknowledgment of online education's importance points to a hybrid model possibly being the favored strategy for the future of education. This direction highlights the importance of striking a balance between technology use and face-to-face engagement to accommodate the varied requirements of learners.

On the question of the resources offered by teachers (courses, seminars and laboratories) an overwhelming majority of 94.33% of respondents (combining "yes, it would help me a lot" and "yes, it would be somewhat useful") to consider that access to didactic resources in the form of video recordings would be beneficial, either very much or somewhat. This emphasizes the perceived value of videos as educational resources, which can provide a more interactive and engaging way of learning compared to strictly written materials Figure 8.

A small percentage of 3.67% of respondents are not sure if video resources would be helpful and only 2.00% of respondents believe that video resources would not be useful, suggesting that there is a broad acceptance of the value of video in education. The skepticism of this small group could be related to personal learning preferences or concerns about the effective implementation of these resources.
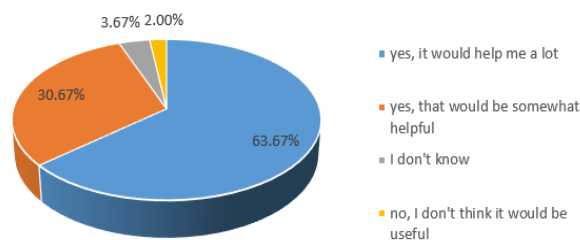
ARE VIDEO MATERIALS USEFUL?

Figure 8 Percentages of appreciation of video materials

To the question "How much would a flexible learning program help you to achieve the desired results?" almost all (91.67%, gathering "very much" and "much") responded that they understood the value of a flexible learning program in achieving academic success. It emphasizes a clear demand for adaptability in educational offerings, with the potential to allow students to personalize and optimize their learning experience Figure 9.

A small percentage (7.67%) does not feel influenced by flexibility, which could indicate a strong self-management capacity or satisfaction with current programs and a very small percentage (0.67%) prefer fixed structures or do not think that flexibility would help them, suggestive of the diversity of learning styles and individual needs.

This set of responses reflects the current trend towards the personalization of education and the need for educational institutions to adapt to the needs of students by offering flexible programs that allow a balance between study, study and education, work and personal life.
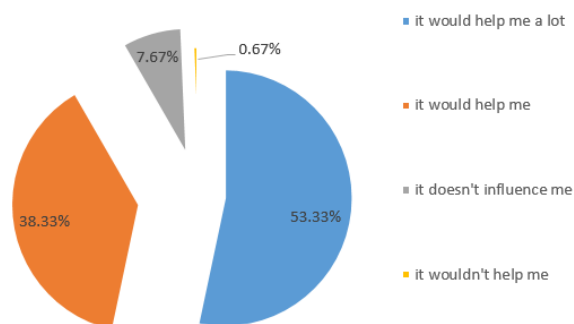
INFLUENCE OF A FLEXIBLE LEARNING PROGRAM

Figure 9 The influence of flexible learning program to achieve the desired results

Skepticism about the development of responsibility can be noted because a significant number of respondents (28.43%) do not believe that online learning would contribute to the development of their sense of responsibility Figure 10.

This could suggest that for some respondents, the structure and direct interaction provided by a traditional educational environment are essential in cultivating responsibility.

Most respondents (42.81%) do not feel influenced in any way by online learning in terms of responsibility. This indicates that their sense of responsibility could be independent of the method of delivery of education or that they are already sufficiently responsible regardless of the learning environment.

28.76% recognize that online learning could have a positive impact on the development of responsibility. This could reflect experiences where self-discipline and self-management are needed in an online environment.

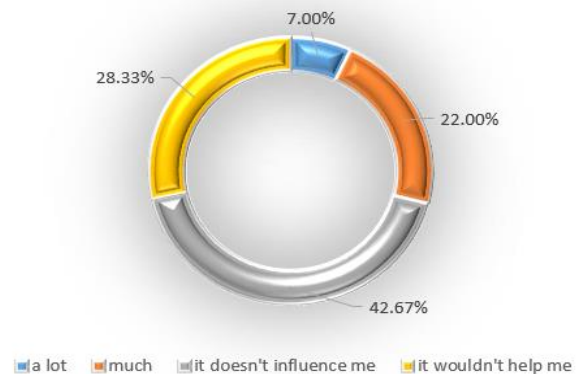ON-LINE COURSES INFLUENCE ON RESPONSABILITY SENSE

Figure 10 The impact of virtual education on sense of responsibility

Regarding the influence of online education on the relationship student – teacher, 39.33% of respondents believe that the relationship between student and teacher is negatively affected by online teaching. It suggests concerns about the limitations of communication and personal interaction in the virtual environment, which could affect educational relationships Figure 11.

A third of respondents 32.00% are not sure if online teaching negatively affects the relationship between student and teacher. This uncertainty could reflect varied experiences with online teaching or indicate the need for more data or time to assess its impact.

On the other hand, almost a third of respondents (28.67%) do not believe that the relationship is affected by online teaching. This could indicate an adaptation to digital communication or a perception that other aspects of teaching and learning are more influential on the quality of the relationship between the student and the teacher.

These results show a division in opinions about the impact of online teaching on educational relationships, with views ranging from concern to neutrality and negation. For educators, understanding these perceptions could be crucial in improving online teaching strategies and developing relationships with students in the virtual environment.
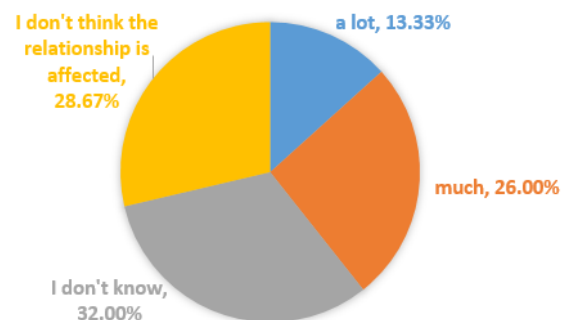
IMPACT ON STUDENT - TEACHER RELATIONSHIP

Figure 11 The effect of online courses on student – teacher relationship

These results show that opinions are still under debate about the impact of online learning on the development of personal responsibility. While some see the potential benefits of the flexibility and autonomy that online offers, others are more reluctant and may need more structure to develop this quality.

The findings presented by the authors align with those of Anghel [5]. The data from surveys and tests showcased in this article receive validation by aligning with the outcomes of comparable studies. A key finding is that while students who responded recognize the benefits of online learning, they remain uncertain about its equivalence to conventional education in terms of quality. Despite its significance, the contribution of technology acts as a supplement to pedagogy, which it cannot outperform in areas such as enhancing efficiency, stimulating creativity, boosting learning motivation, and providing emotional support.

Gonta's study [6] underscores the need for continuous teacher development. While students appreciate their well-organized, visually enhanced lessons and timely access to materials, these efforts don't fully meet expectations. Teachers' adaptation of language to student levels is highlighted as effective. However, the research points to a critical need for more engaging educational content that not only captures students' attention but also motivates learning and facilitates knowledge assimilation, suggesting an area for significant improvement in teaching strategies.

4. CONCLUSIONS

In summary, the effectiveness of teaching graphic disciplines in online learning remains uncompromised based on exam outcomes.

The methodologies implemented over the past four years have established a benchmark for exemplary practices, encompassing the following strategies:
- Provision of video materials for student access,
- Utilization of the Google Classroom platform for distributing themes and written resources,
- Adoption of the Zoom platform for enhanced workspace visibility in AutoCAD or similar software, even during in-person classes,
- Integration of whiteboards and retro projectors for dynamic teaching aids,
- Continuous accessibility via chat and email to promptly handle student queries.

Survey findings reveal a distinct preference for either traditional education or a hybrid model that leans towards direct interaction, underscoring the undeniable importance of online education.

This indicates a growing consensus that a blended approach, incorporating both online and in-person elements, might be the most effective and favored path forward in the educational landscape. Such a trend calls for a careful mix of technological tools and personal engagement to cater to the wide-ranging needs of students.

In response, there may be a need for enhancements in the structure and execution of online courses to bridge any existing divides, ensuring that all students receive a comprehensive, accessible, and high-quality education regardless of the format.

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