# Online Education Management: A Multivariate Analysis of Students’ Perspectives and Challenges during Online Classes

# 在线教育管理：在线课程中学生观点和挑战的多元分析

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（本文属于2019冠状病毒后时代高等学校的特殊问题创新与挑战）

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## Abstract

## 摘要

The aim of the present study is to find solutions for better management of online education, starting from students’ perspectives regarding the challenges they encountered in the last two years when online courses were imposed during the COVID-19 pandemic. The research methodology we used was partial least squares structural equation modelling based on data collected by applying a survey among students in Romanian universities. The novelty of our study consists in the proposed model, which has five variables: communication problems specific to online education, professors’ skill in conducting online classes, the quality of online education, the stress felt by students during online education, and the technical requirements of online education. The results revealed that despite challenges during online classes students benefited from a high-quality education because they had the support of their professors, all the educational resources that they needed, a device to connect from, and a very good internet connection. These findings are helpful for managers in the higher education system to create better educational strategies meant to satisfy the educational needs of students in the digital age.

本研究的目的是从学生的角度出发，寻找更好地管理在线教育的解决方案，了解他们在过去两年中遇到的挑战，当时在2019冠状病毒病大流行病期间实施了在线课程。我们使用的研究方法是基于在罗马尼亚大学学生中应用调查收集的数据的偏最小二乘结构方程建模。本研究的新颖性在于所提出的模型，该模型有五个变量：在线教育特有的沟通问题、教授进行在线课程的技能、在线教育的质量、学生在在线教育期间感受到的压力以及在线教育的技术要求。研究结果显示，尽管在在线课堂上遇到了挑战，学生还是从高质量的教育中获益，因为他们得到了教授、他们所需的所有教育资源、连接设备和非常好的互联网连接。这些发现有助于高等教育系统中的管理者制定更好的教育策略，以满足数字时代学生的教育需求。

Keywords:

关键词：

[online education management ; online classes ; online education ; face-to-face education ; higher education management ; internet speed ; non-verbal communication ; digital age](https://www.mdpi.com/search?q=online+education+management)

在线教育管理；在线课程；在线教育；面对面教育；高等教育管理；互联网速度；非语言沟通；数字时代

## 1. Introduction

## 简介

The topic of online education has gained much attention especially in the last two years (2020–2022) because educational institutions have had to move their courses online due to the COVID-19 pandemic. Professors, students, and managers in these institutions were not asked whether they want to do it; they were required in order to prevent the spread of the virus within the community. Online education offered the opportunity of flexibility in a time when professors and students could not meet face to face [ 1]. Black et al. [ 2] considered “online education as an opportunity equalizer”, offering access even to those in less-developed regions, of course, with the condition of having the necessary technical infrastructure (internet connection, devices for connecting online). Other recent studies have presented both challenges and opportunities provided by online education [ 3, 4]. Watermeyer et al. [ 4] mention a “digital disruption” in UK universities determined by moving traditional education abruptly to an online format. As Adedoyin and Soykan [ 3] state, challenges should be “transformed to opportunities” for increased quality and efficiency. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B1-electronics-12-00454" \o ""

在线教育的主题在过去两年（2020–2022年）得到了广泛关注，因为由于2019新冠疫情大流行病，教育机构不得不在线迁移课程。这些机构的教授、学生和管理者没有被问及他们是否愿意这样做；他们是为了防止病毒在社区内传播而被要求的。在线教育在教授和学生无法面对面相遇的情况下提供了灵活性的机会 [1] 。Black等人认为在线教育是机会均衡器，为欠发达地区的人提供接入，当然，条件是具备必要的技术基础设施（互联网连接、在线连接设备）。其他最近的研究也提出了在线教育提供的挑战和机遇。Watermeyer等人 [4] 提到英国大学中的“数字化颠覆”，这是通过将传统教育突然转变为在线形式决定的。正如Adedoyin和Soykan [3] 所述，挑战应“转变为机遇”，以提高质量和效率。

As Nikdel Teymori and Fardin [ 5] put it, “education can be divided into before and after the COVID-19 outbreak”, emphasizing the important role of online education during a very challenging time. Our research was not intended to reflect the challenges of the pandemic, which definitely affected education, professors and students, and was instead focused on online education more generally. Online education in Romania during the COVID-19 pandemic was possible because the country declared a state of emergency. Thus, between March 2020 and March 2022, online education was implemented in all higher education institutions. Nonetheless, after the sudden end of the state of emergency in March 2022, many universities faced a lack of legislation that did not allow them to continue with online classes. This was difficult, especially because students were not provided with sufficient time before these changes were announced. With the start of the new academic year in October 2022, the country introduced the possibility of a hybrid form, though with a prevalence of traditional formats, especially for seminars and labs. There are no statistics regarding the number of universities that used the hybrid form, though many important universities implemented this form, especially during the winter months. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B5-electronics-12-00454" \o ""

正如NikdelTeymori和Fardin所说，“教育可以分为2019冠状病毒病疫情（COVID-19爆发）前后”，强调了在线教育在一个极具挑战性的时期的重要作用。我们的研究不是为了反映大流行病的挑战，它肯定会影响教育、教授和学生，而是更广泛地关注在线教育。由于罗马尼亚宣布进入紧急状态，2019新冠疫情大流行病期间，罗马尼亚的在线教育是可能的。因此，在2020年3月至2022年3月期间，所有高等教育机构都实施了在线教育。尽管如此，在2022年3月紧急状态突然结束后，许多大学面临立法不允许他们继续上在线课程的问题。这是很困难的，特别是因为在宣布这些变化之前没有给学生足够的时间。随着2022年10月新学年的开始，该国引入了混合形式的可能性，尽管传统形式非常普遍，尤其是对于研讨会和实验室。没有关于使用混合形式的大学数量的统计数据，尽管许多重要的大学实施了这种形式，尤其是在冬季。

Even as many countries report fewer and fewer COVID-19 cases, the energy crisis may put pressure on many organisations, educational institutions included, to reduce expenses due to heating and electrical bills. In this context, online education might be one solution for educational managers to consider, as can be seen in other countries such as Poland [ 6]. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B6-electronics-12-00454" \o ""

尽管许多国家报告的2019冠状病毒感染病例越来越少，但能源危机可能会对许多组织（包括教育机构）施加压力，以减少因取暖和电费而产生的费用。在这种情况下，在线教育可能是教育管理者需要考虑的一个解决方案，在波兰等其他国家也是如此。

There are many studies emphasizing the numerous benefits of online education, which include comfort and accessibility [ 7], reaching a higher number of students [ 8], and flexibility [ 9]. However, there are disadvantages or challenges as well, which should be tackled by managers in order to ensure that they provide high quality education to everyone. Firmansyah et al. [ 10] mention as disadvantages poor internet connections, the lack of direct interaction, excessive assignments given by professors to their students, and important restrictions for certain subjects that are more practical and not as theoretical, for example, the need to be in a lab to conduct experiments. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B7-electronics-12-00454" \o ""

有许多研究强调了在线教育的诸多好处，包括舒适性和可及性，达到更高的学生人数和灵活性。然而，也存在一些缺点或挑战，管理者应加以解决，以确保他们为每个人提供高质量的教育。Firmansyah等人 [10] 指出网络连接不好、缺乏直接互动、教授给学生的任务过多，以及对某些更实用而不是理论上的学科的重要限制，例如，需要在实验室进行实验。

The present research focuses on the higher education system in Romania and students’ perspectives regarding the challenges and advantages offered by an online class format. The benefits and disadvantages of online education [ 7, 8, 9, 10] are influenced by many factors. For instance, if the internet connection is good, online education may be seen as an advantage, while if the broadband coverage is a problem, then online education is seen as a disadvantage, or at least a challenge to work on. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B7-electronics-12-00454" \o ""

本研究的重点是罗马尼亚的高等教育体系以及学生对在线课堂形式所带来的挑战和优势的看法。在线教育的优点和缺点受到许多因素的影响。例如，如果因特网连接良好，则在线教育可以被视为优点，而如果宽带覆盖是问题，则在线教育被视为缺点，或者至少是工作的挑战。

According to World Population Review [ 11], the speed of internet connections in Romania is one of the fastest in the world, which constitutes an important foundation for online education. As previously mentioned, the evolution of online education after the state of emergency ended in March 2022 meant that Romanian universities could not continue online classes because of a gap in legislation, which was corrected only for the start of the academic year in October 2022. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B11-electronics-12-00454" \o ""

根据《世界人口评论》，罗马尼亚的互联网连接速度是世界上最快的，这是在线教育的重要基础。如前所述，在紧急状态于2022年3月结束后，在线教育的发展意味着罗马尼亚大学不能继续在线课程，因为立法上存在差距，仅在2022年10月学年开始时进行了纠正。

Potra et al. [ 12] conducted research on students in the first year of their studies, and among the problems revealed were: “information overload, limited interaction, teacher-related hindrances and presence and concentration hurdles”. Another report [ 13] reveals the conclusions of students from the most import important universities in Romania: digital competencies were not a problem, technical difficulties were not significant, access to the internet was not limited, computer performance was good enough, digital resources were available in high proportion, and time was not a problem. Lack of motivation was a problem for half of the students. The same study mentions the perception of professors that students with good academic results performed well during online classes, while for students with low academic results their problems with learning increased, as did the gap between students. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B12-electronics-12-00454" \o ""

Potra等人 [12] 对学业第一年的学生进行了研究，发现的问题包括：信息过载、互动有限、教师相关障碍以及存在和集中障碍。另一份报告 [13] 显示了罗马尼亚最重要的进口大学学生的结论：数字能力不是问题，技术困难不是重大问题，互联网接入不是限制，计算机性能足够好，数字资源可用率高，时间不是问题。缺乏动力是一半学生的问题。同一项研究提到了教授的看法，即学业成绩良好的学生在在线课堂上表现良好，而学业成绩低的学生的学习问题增加，学生之间的差距也增加。

Our main objectives are reflected by the variables we analysed: the communication problems that might arise in an online class, the stress felt by students due to the lack of direct connection with their colleagues and professors, the role played by teachers in offering quality online lectures, the technical requirements inherent in being able to connect to online classes, and the quality of online education as a dependent variable. It is important to highlight that Romania, the country we focused on, occupies the fourth position in the ranking of countries with the fastest broadband speed, after Monaco, Singapore, and Hong Kong [ 11]. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B11-electronics-12-00454" \o ""

我们分析的变量反映了我们的主要目标：在线课堂中可能出现的沟通问题、学生由于与同事和教授缺乏直接联系而感到的压力、教师在提供高质量在线讲座中所起的作用、能够连接在线课堂所固有的技术要求以及在线教育作为因变量的质量。重要的是要强调，罗马尼亚是我们关注的国家，在宽带速度最快的国家排名中排名第四，仅次于摩纳哥、新加坡和香港 [11] 。

## 2. Literature Review

## 文献综述

As mentioned in the introduction, we wanted to analyse the student perspective regarding the challenges brought about by online education in order for the results to be used by educational managers. There are many studies focusing on student perspectives [ 10, 12, 14, 15, 16, 17]; however, the novelty of our research consists in creating a model with variables that are considered the most challenging (communication problems, technical requirements, stress, professors’ skills) for the quality of online education based on students’ reported experience of online education [ 13]. Thus, starting from the opinions and needs of the students, higher education managers can develop strategies that best fit the reality. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B10-electronics-12-00454" \o ""

如前所述，我们希望分析学生对在线教育带来的挑战的看法，以便教育管理者使用结果。有许多关注学生观点的研究 [10、12、14、15、16、17]；然而，我们研究的新奇之处在于根据学生报告的在线教育经验创建一个变量模型，这些变量被认为是在线教育质量最具挑战性（沟通问题、技术要求、压力、教授技能）的变量。因此，从学生的意见和需求出发，高等教育管理者可以制定最符合实际的策略。

#### 2.1. Communication Problems Specific to Online Education

#### 网络教育特有的沟通问题

Many studies [ 18, 19, 20] have pointed out the communication problems encountered during online classes. Because there is no face-to-face contact between professors and students, this aspect is frequently mentioned as the main disadvantage. This problem should be analysed in the context of culture. Each country has its own culture, and the way people interact with each other and the need for interaction is emphasized more in certain countries than in others. Coman et al. [ 20] mentioned that the lack of communication between professors and students in Romania was least important during online classes. The most important problems were technical issues and lack of technical skills [ 20]. These results are normal for the time of the study (second semester, the beginning of online classes in Romania), taking into account that neither professors, nor students were prepared to move to a completely online format. In this context, students saw technical problems as having higher importance than interaction with their professors. For research focusing on online classes during the COVID-19 pandemic, it is important to understand that certain problems (stress, psychological issues) might be in part generated by the specifics of a crisis situation such as the pandemic, a time marked by uncertainty, fear, and decreased socialization. These issues have been addressed in studies about students’ perspectives [ 4, 8, 9, 12, 13]. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B18-electronics-12-00454" \o ""

许多研究 [18,19,20] 指出了在线课程中遇到的沟通问题。由于教授和学生之间没有面对面接触，这方面经常被称为主要缺点。应该在文化背景下分析这个问题。每个国家都有自己的文化，某些国家比其他国家更强调人与人之间的互动方式和互动需求。Coman等人 [20] 提到在罗马尼亚，教授和学生之间缺乏沟通是在线课程中最不重要的。最重要的问题是技术问题和缺乏技术技能 [20] 。研究期间（第二学期，罗马尼亚在线课程的开始），这些结果是正常的，考虑到教授和学生都没有准备好进入完全在线模式。在这种情况下，学生认为技术问题比与教授互动更重要。对于关注2019冠状病毒病疫情（大流行病）期间在线课程的研究，重要的是了解某些问题（压力、心理问题）可能部分由危机情境（如大流行病）的具体情况产生，该危机情境以不确定性、恐惧和社会化程度下降为特征。这些问题已在关于学生观点的研究中得到解决 [4,8, 9,12,13] 。

As with any other problem, the solution is not to give up online classes, because, as has been shown, there are important benefits for this type of leaning; rather, it is to take measures to raise the quality of online education by better preparing students and professors. Thus, Sharma and Vyas [ 21] point to the importance of training for teachers in order to help them decipher non-verbal signs exhibited by students during online classes. For this to happen, it is important to have internal regulations requiring the students to turn on their cameras. Other studies [ 19] have shown that students in Bahrain do not consider visual contact during online classes to be important for teaching and learning. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B21-electronics-12-00454" \o ""

与任何其他问题一样，解决方案不是放弃在线课程，因为，正如已经表明的，这种学习有重要的好处；而是采取措施，通过更好的培养学生和教授来提高在线教育的质量。因此，Sharma和Vyas [21] 指出了对教师进行培训的重要性，以帮助他们破译学生在网上课堂上展示的非语言符号。要想做到这一点，必须制定内部规章，要求学生打开相机。其他研究 [19] 表明，巴林的学生不认为在线课堂期间的视觉接触对教学和学习很重要。

#### 2.2. Professors’ Skills in Conducting Online Classes

#### 教授在线授课技能

Professors’ skills teaching in an online format can refer to many aspects, from their capacity to use verbal and non-verbal communication to the way they provide the course content to their students (e.g., offering online resources, adapting their lectures and supplementary materials to an online format, creating attractive and interactive courses). This is not only about the digital skills, it is about the way the message changes. Even if there are studies according to which students do not perceive the visual contact in the educational process as important [ 19], it cannot be denied that non-verbal communication can offer important cues for professors, helping them to adjust their teaching style in accordance with what happens in the class, whether virtual or not. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B19-electronics-12-00454" \o ""

教授以在线形式进行技能教学可以涉及许多方面，从他们使用口头和非口头沟通的能力到他们向学生提供课程内容的方式（例如，提供在线资源、将其演讲和补充材料改编为在线形式、创建有吸引力的交互式课程）。这不仅关系到数字技能，也关系到信息的变化方式。即使有学生认为教育过程中的视觉接触不重要的研究 [19]，也不能否认，非语言沟通可以为教授提供重要线索，帮助他们根据课堂上发生的事情调整教学风格，无论是否虚拟。

According to Bambaeeroo and Shokrpour [ 22] (p. 51), “the more the teachers used verbal and non-verbal communication, the more efficacious their education and the students’ academic progress were”. Similarly, Dragomir et al. [ 23] conclude that both verbal and non-verbal communication are important, and provide solutions to compensate for the situation in which professors and students had traditional classes with face masks on during the COVID-19 pandemic. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B22-electronics-12-00454" \o ""

根据Bambaeeroo和Shokrprint [22] （第51）、“教师越多的使用口头和非口头交流，他们的教育和学生的学术进步就越有效”。同样，Dragomir等人得出的结论是，口头和非口头交流都是重要的，并提供了解决方案，以补偿教授和学生在2019冠状病毒病疫情（COVID-19大流行病）期间进行传统面具班的情况。

As for the digital skills of professors and their readiness to conduct online classes, if this is a problem, it should be followed by important strategies at a national level to better prepare teachers at all educational levels to teach online, because the reality is that we live in a digital age and education should keep up with changes. Mirķe et al. [ 24] showed that the strategies taken by the Latvian government in the field of education are focused on preparing teachers to offer online classes by developing their digital skills. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B24-electronics-12-00454" \o ""

至于教授的数字技能及其在线课堂的准备情况，如果这是一个问题，应该在国家一级制定重要的战略，以便更好地为各级教师在线教学做好准备，因为现实是我们生活在数字时代，教育应该跟上变化。Miríe等人 [24] 表明拉脱维亚政府在教育领域采取的策略集中于培养教师通过发展其数字技能来提供在线课程。

#### 2.3. The Quality of Online Education

#### 网络教育质量

This variable is influenced by many factors, among which communication is vital, because it is the way education is provided regardless of whether it is in a traditional or an online format. Young and Norgard [ 25] (p. 107) analysed the factors with the most impact on the quality of online education, and found that these were “interaction among students, quality and timely interaction between student and professor, consistent course design across courses, technical support availability, and flexibility”. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B25-electronics-12-00454" \o ""

这个变量受到许多因素的影响，其中沟通是至关重要的，因为不管是传统还是在线形式，它都是提供教育的方式。Young和Norgard [25] （第107）分析了对在线教育质量影响最大的因素，发现这些因素是“学生之间的互动、学生和教授之间的质量和及时的互动、跨课程的一致课程设计、技术保障单元可用性和灵活性”。

As we have seen [ 9], flexibility is a characteristic of online classes that brings important benefits for students in the teaching–learning process. Sun and Chen [ 26] appreciate that online education quality depends on course design, the success in creating the feeling among participants that they are part of a community, and technological progress. Palvia et al. [ 27] (p. 233) mention the role of “country-level factors” such as regulations and laws in the educational area, policies focused on developing digital skills in the entire system, and internet coverage among various regions in the country. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B9-electronics-12-00454" \o ""

正如我们所见 [9]，灵活性是在线课程的一个特点，它为学生在教学过程中带来了重要的好处。孙和陈认识到，在线教育质量取决于课程设计、在参与者中创造他们是社区成员的感觉的成功以及技术进步。Palvia等人 [27] （第233）提到“国家层面因素”的作用，例如教育领域的法规和法律、注重在整个系统中发展数字技能的政策以及国家各地区的互联网覆盖。

#### 2.4. The Stress Felt by Students during Online Education

#### 学生在网络教育中感受到的压力

The stress factor has been extensively studied in the literature, especially in works related to online learning during the pandemic. In our opinion, it is important to take into account that part of the stress felt by the students was determined by the pandemic and the uncertainty that came with it in many areas of life. Certainly, the stress generated by the pandemic and the isolation felt by many people influenced many students in terms of the way they were able to cope with the requirements of online education and all the changes that came after. Nonetheless, online education is not specific only to times of crisis, and is a modern tool that is widely used nowadays.

压力因素在文献中得到了广泛研究，尤其是在大流行病期间与在线学习相关的作品中。在我们看来，重要的是要考虑到学生感受到的部分压力是由大流行病决定的，以及在许多生活领域伴随而来的不确定性。当然，大流行病产生的压力和许多人感受到的孤独感影响了许多学生如何处理在线教育的要求和随后的所有变化。尽管如此，在线教育并不仅仅局限于危机时期，它是一种当今广泛使用的现代工具。

Chandra [ 28] emphasized the stress felt by students along with the fact that online learning can be used to learn coping strategies and develop emotional intelligence, especially in conditions where face-to-face contact is not possible. Bruggerman et al. [ 29] highlighted both the positive implications (the flexibility and the opportunities provided) and negative stressors (feeling overwhelmed and pressured to accomplish more tasks, having technical problems, and not being able to extract the essential information from the courses provided online) encountered by students during online classes. The relationship between stress during online learning and the quality of education was highlighted by Altaf et al. [ 30], who concluded that for medical students the online experience was less stressful than face-to-face learning, which might be explained by the inherent stress specific to this profession. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B28-electronics-12-00454" \o ""

Chandra [28] 强调了学生感受到的压力以及在线学习可用于学习应对策略和发展情商的事实，尤其是在无法面对面接触的情况下。Bruggerman等人 [29] 强调了学生在在线课程中遇到的积极影响（灵活性和提供的机会）和消极压力源（感到不堪重负，不能从在线提供的课程中提取基本信息）。Altaf等人 [30]，他得出的结论是，对于医学生而言，在线体验比面对面学习的压力要小，这可能是由这一职业特有的内在压力来解释的。

Mheidly et al. [ 31] mostly highlighted the mental problems determined by spending more time online, mentioning stress, anxiety, and even burnout. Benila Pearl and Arunfred [ 32] conducted research before the pandemic, comparing the concentration capacity of students in online vs. traditional formats. The authors noticed that students familiar with online classes were able to focus more due to the technological opportunities that were used by professors to maintain their focus. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B31-electronics-12-00454" \o ""

Mheidly等人 [31] 主要强调了通过在网上花费更多的时间、提及压力、焦虑甚至倦怠来确定的心理问题。BenilaPearl和Arunfred在大流行病之前进行了研究，比较了在线与传统格式学生的集中能力。作者注意到，由于教授利用技术机会来保持注意力，熟悉在线课程的学生能够更加集中注意力。

According to O’Brien et al. [ 33], the use of the internet is important for the development of a good education. However, they state that university managers should take into account “the balance between education… and distraction”. Other works mention the risk of online distractions (students using their smartphones to connect on social media or playing mobile games), even for traditional classrooms [ 33, 34]. Thus, the stress determined by multitasking (listening to a lecture, online or not, while engaging in an unrelated activity) and the lack of concentration due to digital technologies can be attributed to the age we live in, and not only to online education. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B33-electronics-12-00454" \o ""

根据O'Brien等人 [33] 、互联网的使用是发展良好教育的重要环节。然而，他们指出，大学管理者应该考虑“教育……和分心之间的平衡”。其他作品提到了网络干扰的风险（学生使用智能手机连接社交媒体或玩移动游戏），甚至对于传统教室也是如此 [33,34] 。因此，由多任务（在线听讲座或不听讲座，同时参与不相关的活动）确定的压力和由于数字技术导致的注意力不集中可以归因于我们生活的年龄，而不仅仅是在线教育。

#### 2.5. The Technical Requirements for Online Education

#### 网络教育技术要求

The minimum technical requirements for a student to be able to attend online classes are mostly related to internet coverage and speed and the device used for connection, preferably one with a larger screen and software packages meant to help students in the learning process and their assignments. Meeting these requirements depends on the area students are living in (urban or rural), and the economic status of their family (families may not be able to afford to buy a computer, a laptop, or a performant smartphone for their children).

学生能够参加在线课程的最低技术要求主要与互联网覆盖和速度以及用于连接的设备有关，优选具有更大屏幕的设备和旨在帮助学生学习过程及其作业的软件包。满足这些要求取决于学生居住的地区（城市或农村）及其家庭的经济状况（家庭可能无法为其子女购买电脑、笔记本电脑或高性能智能手机）。

Muthuprasad et al. [ 35] showed that internet connection problems in terms of coverage, speed, and limited data were the three most important problems faced by students in India during online classes. Not having a device was only in the sixth position. Sifat [ 36] conducted research on students in Bangladesh, highlighting technical problems (poor internet speeds, high associated costs) and the stress caused by online classes. Cullinan et al. [ 37] addressed the problem of disparities between students with access to the internet and students from regions with less coverage, as well as the way these problems affect the quality of education if universities do not provide support for this latter group of students. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B35-electronics-12-00454" \o ""

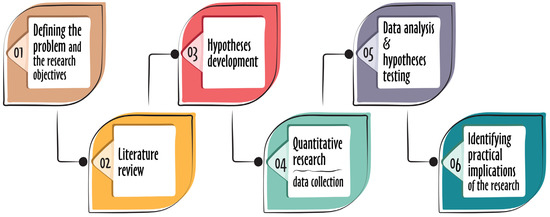
穆特普拉萨德等人 [35] 显示，网络连接在覆盖率、速度和有限数据方面的问题是印度学生在网上课程中面临的三个最重要的问题。没有装置仅处于第六位置。西法特 [36] 对孟加拉国的学生进行了研究，强调了技术问题（互联网速度差、相关成本高）和在线课程带来的压力。Cullinan等人 [37] 解决了拥有互联网的学生与来自覆盖率较低地区的学生之间的差距问题，以及如果大学不为后一组学生提供支持，这些问题将如何影响教育质量。

## 3. Research Methodology and Hypothesis Development

## 研究方法和假设发展

[Figure 1 illustrates the flowchart of the methodological process we used for the present research.](https://www.mdpi.com/2079-9292/12/2/454" \l "fig_body_display_electronics-12-00454-f001)

图1说明了我们用于本研究的方法过程的流程图。



**Figure 1.** The methodological process. Source: own work.

**图1.**方法过程。来源：自己的工作。

As our research methodology, we used partial least squares structural equation modelling (PLS-SEM) and SmartPLS software, version 4 [ 38]. The most important research question we wanted to answer refers to the measures that higher education managers might take in order to ensure a high-quality education for students. With this question at the core of our research, we conducted our analysis starting from the following nine hypotheses: HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B38-electronics-12-00454" \o ""

作为我们的研究方法，我们使用偏最小二乘结构方程模型（PLS-SEM）和SmartPLS软件，版本4[38] 。我们想回答的最重要的研究问题是高等教育管理者为确保学生的高质量教育而可能采取的措施。以这个问题为研究核心，我们从以下九个假设出发进行分析：

**Hypothesis  1 (H1).**

**假设一（H1）。**

There is a direct and negative influence from the communication problems specific to online education to the quality of online education .

在线教育特有的通信问题对在线教育的质量有直接的负面影响。

**Hypothesis  2 (H2).**

**假设二（H2）。**

There is a direct and positive influence from communication problems specific to online education to the stress felt by students during online education .

在线教育特有的沟通问题对学生在在线教育期间感受到的压力有直接和积极的影响。

**Hypothesis  3 (H3).**

**假设三（H3）。**

There is a direct and negative influence from professors’ skills in conducting online classes to the communication problems specific to online education .

教授开展在线课程的技能对在线教育特有的沟通问题产生直接和负面影响。

**Hypothesis  4 (H4).**

**假设四（H4）。**

There is a direct and positive influence from professors’ skills in conducting online classes to the quality of online education .

教授开展在线课程的技能对在线教育的质量有直接和积极的影响。

**Hypothesis  5 (H5).**

**假设5（H5）。**

There is a direct and negative influence from professors’ skills in conducting online classes to the stress felt by students during online education .

教授开展在线课程的技能对学生在在线教育期间感受到的压力有直接的负面影响。

**Hypothesis  6 (H6).**

**假设六（H6）。**

There is a direct and negative influence from the stress felt by students during online education to the quality of online education .

学生在在线教育期间感受到的压力对在线教育的质量有直接的负面影响。

**Hypothesis  7 (H7).**

**假设七（H7）。**

There is a direct and negative influence from the technical requirements for online education to the communication problems specific to online education .

在线教育的技术要求对在线教育特有的通信问题有直接的负面影响。

**Hypothesis  8 (H8).**

**假设八（H8）。**

There is a direct and positive influence from the technical requirements for online education to the quality of online education .

在线教育的技术要求对在线教育的质量有直接和积极的影响。

**Hypothesis  9 (H9).**

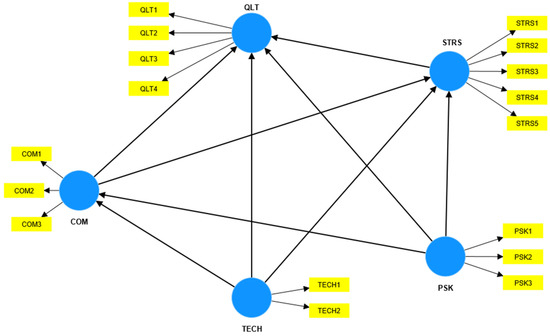
**假设9（H9）。**

There is a direct and negative influence from the technical requirements for online education to the stress felt by students during online education .

在线教育的技术要求对学生在在线教育期间感受到的压力有直接的负面影响。

[Figure 2 illustrates the model we proposed for the present research (H1: COM -> QLT; H2: COM -> STRS; H3: PSK -> COM; H4: PSK -> QLT; H5: PSK -> STRS; H6: STRS -> QLT; H7: TECH -> COM; H8: TECH -> QLT; H9: TECH -> STRS), and Table 1 details the model’s constructs, items, and codes. The model includes five constructs, each with its own items: communication problems specific to online education (three items); professors’ skills in conducting online classes (three items); the quality of online education (four items); the stress felt by students during online education (five items); and the technical requirements for online education (two items).](https://www.mdpi.com/2079-9292/12/2/454" \l "fig_body_display_electronics-12-00454-f002)

图2显示了我们为本研究提出的模型（H1：COM - > QLT；H2：COM - > STRS；H3：PSK - > COM；H4：PSK - > QLT；H5：PSK - > STRS；H6：STR - > QLT；H7：技术- > COM；H8：技术- > QLT；H9：技术- > STRS），表1详细说明了模型的构造、项和代码。该模型包括五个结构，每个结构都有自己的项目：在线教育特有的通信问题（三个项目）；教授在线授课技能（三项）；在线教育的质量（四项）；学生在在线教育期间感受到的压力（五项）；在线教育的技术要求（两项）。



**Figure 2.** The proposed research model. Source: Designed by authors with SmartPLS version 4.

**图2.**所提出的研究模型。来源：由作者使用SmartPLS第四版设计。

**Table 1.** The constructs, items, and codes used in the research model.

**表1.**研究模型中使用的构造、项和代码。



For applying PLS-SEM, we used a questionnaire which was sent out during September and October 2022 to students in Romanian universities. After eliminating incomplete surveys, we had 200 valid questionnaires remaining, a number which is in accordance with the minimum sample required by this method [ 39]. We used 5-point Likert scales (from 1, corresponding to total disagreement, to 5, corresponding to total agreement) for the questions addressing the variables in the model. The survey was created using Google Forms and shared online on Facebook groups dedicated to students in the main university centres in Romania. No personal data were collected; it was hoped that the anonymity would make students feel safer in expressing their opinions regarding online education. Most respondents were students between 18 and 25 years old (77.5%), and preferred to connect to online classes using a laptop (70%). HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B39-electronics-12-00454" \o ""

为了应用PLS-SEM，我们使用了2022年9月和10月向罗马尼亚大学学生发出的问卷。剔除不完整的调查后，我们有200份有效问卷，这一数字符合本方法要求的最小样本。我们使用5分Likert量表（从1分，对应总不一致，到5分，对应总一致）来回答模型中的变量问题。这项调查是使用谷歌表格创建的，并在Facebook网站上分享，专门面向罗马尼亚主要大学中心的学生。未收集个人数据；希望匿名能让学生更安全地表达他们对在线教育的看法。大多数受访者年龄在18岁至25岁之间（77.5%），更喜欢使用笔记本电脑连接到在线课堂（70%）。

## 4. Results

## 结果

For the results shown in Table 2 , we determined the outer loadings and variance inflation factors (VIF) in order to check whether the convergent validity of the model and the items we proposed was ensured. We eliminated the items with an outer loading below 0.6, as this level indicates an acceptable convergent validity [ 40, 41]. The VIF for each of the model’s items was lower than 5, showing a low collinearity of the items, as is desired [ 42]. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "table\_body\_display\_electronics-12-00454-t002"

对于表2所示的结果，我们确定了外载荷和方差膨胀因子 (VIF)，以检查模型和我们提出的项目的收敛有效性是否得到保证。我们消除了外部负荷低于0.6的项目，因为该水平表示可接受的收敛有效性 [40,41] 。每个模型项目的VIF低于5，显示项目的低共线性，如所期望的 [42] 。

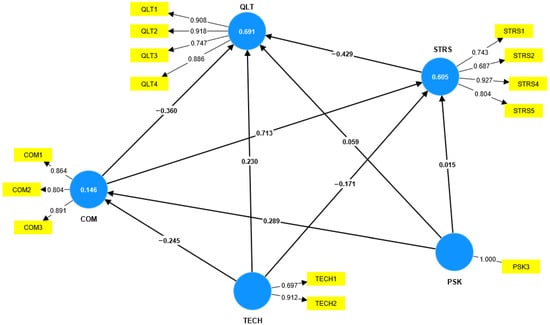
**Table 2.** The outer loadings and VIF values for the items in the model.

**表2.**模型中项目的外部负载和VIF值。



Thus, we eliminated the items PSK1, PSK2, and STRS3 from the initial proposed model, changing it to the one illustrated in Figure 3 . The strongest influence was registered from COM to STRS (0.713), followed by the negative relations (the minus sign) from STRS to QLT (−0.429) and from COM to QLT (−0.360); 69.1% of the QLT variance was determined by the influence of STRS, COM, TECH, and PSK, in this order, while 60.5% of the STRS variance was determined by COM, TECH, and PSK. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "fig\_body\_display\_electronics-12-00454-f003"

因此，我们从最初提出的模型中删除了PSK1、PSK2和STRS3项，将其改为图3所示的模型。最强的影响是从COM到STRS（0.713），其次是从STRS到QLT（-0.429）和从COM到QLT（-0.360）的负关系（负号）；69.1%的QLT方差由STRS、COM、TECH和PSK的影响按该顺序确定，而60.5%的STRS方差由COM、TECH和PSK确定。



**Figure 3.** PLS-SEM algorithm applied to the changed model. Source: Own work using SmartPLS, version 4.

**图3.**PLS-SEM算法应用于改变模型。来源：使用SmartPLS第四版进行自己的工作。

In Table 3 , we include the descriptive statistics for each of the model’s items after removing the ones with outer loadings below 0.6. TECH 1 and TECH 2 have the highest means (4.095 and 4.485, respectively), showing the importance of meeting the minimal technical requirements in online education. The lowest means (less than 3, corresponding to disagreement) were registered by STRS1, STRS2, STRS4, and STRS5, which show the low level of stress felt by the students during online classes. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "table\_body\_display\_electronics-12-00454-t003"

在表3中，我们包括在移除外部负载低于0.6的模型项之后的每个模型项的描述性统计。TECH 1和TECH2具有最高的手段（分别为4.095和4.485），表明满足在线教育中最低技术要求的重要性。STRS1、STRS2、STRS4和STRS5记录了最低的平均值（小于3，对应于不一致），这表明学生在在线课程中感受到的压力水平较低。

**Table 3.** The descriptive statistics of the items kept in the model.

**表3.**模型中项目的描述性统计。



The constructs’ reliability and validity are presented in Table 4 . Cronbach’s Alpha measures the consistency and the reliability, and the average variance extracted (AVE) measures the variance of the constructs in the model. The values for Cronbach’s Alpha are higher than 0.8 for COM, QLT, PSK, and STRS, indicating very good reliability, and the value for TECH is higher than 0.5, corresponding to acceptable reliability [ 43]. The values for AVE are higher than 0.6, and for Composite Reliability they are higher than 0.7, indicating good reliability and the validity of the variables. In addition, we determined the value for the standardized root mean square residual (SRMR), which was 0.077, showing that the proposed model has a good fit [ 44]. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "table\_body\_display\_electronics-12-00454-t004"

结构的可靠性和有效性如表4所示。Cronbach's Alpha测量一致性和可靠性，平均方差提取 (AVE) 测量模型中构造的方差。对于COM、QLT、PSK和STRS，Cronbach's Alpha的值高于0.8，表明非常好的可靠性，而TECH的值高于0.5，对应于可接受的可靠性 [43] 。AVE的值高于0.6，复合可靠性的值高于0.7，表明良好的可靠性和变量的有效性。此外，我们确定标准均方根残差（SRMR）的值为0.077，表明所提出的模型具有良好的拟合 [44] 。

**Table 4.** The reliability and validity of the model constructs.

**表4.**模型构造的信度和效度。



The Fornell–Larcker criterion in Table 5 shows the model’s discriminant validity; the square roots of the AVE values (shown in the main diagonal) for the five constructs of the model are higher than the other values due to the relationship of each construct with the others. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "table\_body\_display\_electronics-12-00454-t005"

表5中的Fornell–Larcker标准显示了模型的判别有效性；由于每个构造与其他构造的关系，模型的五个构造的AVE值（在主对角线中显示）的平方根高于其他值。

**Table 5.** The Fornell–Larcker criterion.

**表5.**Fornell–Larcker标准。



To check the discriminant validity of the model, we calculated heterotrait–monotrait ratio (HTMT) with the confidence intervals bias corrected, as suggested by Ringle [ 45]. The confidence intervals in Table 6 show good discriminant validity between the constructs, even if the correlation between STRS and COM has a borderline value for HTMT (0.909). As Ringle [ 45] and Henseler et al. [ 46] state, if the confidence intervals for HTMT do not include a value of 1, discriminant validity is met. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B45-electronics-12-00454" \o ""

为了检验模型的判别有效性，我们计算了异质-单质比（HTMT），并校正了置信区间偏差，如Ringle [45] 所建议。即使STRS和COM之间的相关性具有HTMT的边界线值 (0.909)，表6中的置信区间也显示构造之间的良好判别有效性。As Ringle [45] 和Henseler等人 [46] 状态，如果HTMT的置信区间不包括值1，则满足判别有效性。

**Table 6.** HTMT with corrected confidence interval bias.

**表6.**校正置信区间偏差的HTMT。



The bootstrapping test was applied to analyse the significance of the proposed model, with the results shown in Table 7 . For a 5% significance level, there are two relations between the variables in the model for which the t-statistics are below 1.96 and the p-value is above 0.05 (the relation from PSK to QLT and from PSK to STRS). These relations are characterised by corrected confidence interval biases that include a value of zero, invalidating hypotheses H4 and H5. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "table\_body\_display\_electronics-12-00454-t007"

应用自举试验分析所提出模型的意义，结果如表7所示。对于5%显著性水平，t统计量低于1.96且p值高于0.05的模型中的变量之间存在两个关系(从PSK到QLT和从PSK到STRS的关系)。这些关系的特征在于包含零值的校正置信区间偏差，使假设H4和H5无效。

**Table 7.** Bootstrapping test and validation of hypotheses.

**表7.**自举测试和假设验证。



2In order to determine whether the model in our research has predictive relevance, we calculated Q predict, with the results shown in Table 8 . 2Because the Q predict values for the dependent constructs (COM, QLT, and STRS) are higher than 0, we can state that the proposed model has high predictive relevance. 2Q predict is determined by applying PLSpredict in SmartPLS.

2为了确定本研究中的模型是否具有预测相关性，我们计算了Q预测，结果如表8所示。2由于相关结构（COM、QLT和STRS）的Q预测值高于0，我们可以声明所提出的模型具有高度的预测相关性。2通过在SmartPLS中应用PLS预测来确定Q预测。

**Table 8.** Cross-validated redundancy.

**表8.**交叉验证冗余。



## 5. Discussion

## 讨论

Of the nine hypotheses we formulated at the beginning of our research, two were not validated (H4 and H5). In this section, we discuss each of the findings in comparison with other studies which reached similar or opposite results.

在我们研究开始时提出的九个假设中，有两个没有得到验证（H4和H5）。在本节中，我们将讨论每项研究结果与其他研究结果相似或相反的结果进行比较。

H1: There is a direct and negative influence from the communication problems specific to online education to the quality of online education. This hypothesis was validated, showing that communication problems affect the quality of online education if they exist. We notice from Table 3 that the three items considered as communication problems (the connection with the professor, non-verbal communication, and the depth of debates) registered low means, with students mostly disagreeing with the fact that there are important communication problems. This result is in accordance with other studies that emphasize the importance of communication for the success of online learning [ 47, 48, 49]. Ahmed [ 49] considered that students sometimes disregard these problems because of the advantages and accessibility offered by online classes. A similar conclusion was noticed for students in Bahrain [ 19], who did not consider visual contact important, even though it is essential for good non-verbal communication. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "table\_body\_display\_electronics-12-00454-t003"

H1：在线教育特有的通信问题对在线教育的质量有直接的负面影响。这一假设得到了验证，表明如果存在通信问题，则会影响在线教育的质量。我们从表3中注意到，被认为是沟通问题的三个项目（与教授的联系、非语言沟通和辩论的深度）的手段较低，学生大多不同意存在重要沟通问题的事实。该结果与强调沟通对于在线学习成功的重要性的其他研究一致 [47，48，49] 。Ahmed [49] 认为，由于在线课程提供的优势和可访问性，学生有时会忽略这些问题。巴林的学生也注意到了类似的结论 [19]，他们认为视觉接触并不重要，尽管视觉接触对于良好的非语言沟通是必不可少的。

H2: There is a direct and positive influence from communication problems specific to online education to the stress felt by students during online education. This hypothesis was validated, and is the relation with the strongest impact (0.713). If there are communication problems, they increase the level of stress felt by the students. This is in accordance with other studies [ 28]; however, there are authors who emphasize the fact that stress can be reduced with proper techniques and when there is a balance [ 28, 32, 33]. Our study revealed that Romanian students registered a low level of stress (i.e., the mean in Table 3 for the items related to stress registered values corresponding to disagreement) for all stressors (general, time needed for learning, concentration, and distractions). HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B28-electronics-12-00454" \o ""

H2：在线教育特有的沟通问题对学生在在线教育期间感受到的压力有直接和积极的影响。这一假设得到了验证，并且是与最强影响的关系（0.713）。如果存在沟通问题，则会增加学生的压力。这与其他研究 [28] 一致；然而，有些作者强调了这样一个事实，即压力可以通过适当的技术来降低，并且当存在平衡时 [28、32、33] 。我们的研究表明，罗马尼亚学生对所有压力源（一般、学习所需的时间、注意力和分心）的压力水平都很低（即，表3中与不一致对应的压力登记值相关的项目的平均值）。

H3: There is a direct and negative influence from professors’ skills in conducting online classes to the communication problems specific to online education. This hypothesis is validated, highlighting the important role played by professors in tackling communication problems encountered during online classes. It is a professional and moral responsibility of professors to diminish as much as possible any communication barriers that might appear during online courses. This is in accordance with other studies [ 22, 23, 24] that show the importance of developing the digital and communication skills of professors and helping them to be better prepared to teach online. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B22-electronics-12-00454" \o ""

H3：教授开展在线课程的技能对在线教育特有的沟通问题产生直接和负面影响。这一假设得到了验证，突出了教授在解决在线课程中遇到的沟通问题方面发挥的重要作用。尽可能减少在线课程期间可能出现的任何沟通障碍是教授的职业和道德责任。这与其他研究 [22、23、24] 一致，这些研究表明了培养教授的数字和沟通技能并帮助他们更好地做好在线教学准备的重要性。

H4: There is a direct and positive influence from professors’ skills in conducting online classes to the quality of online education. This hypothesis was not validated; at least, Romanian students did not consider that the quality of online education was influenced by their professors’ skills. To explain this result, it is useful to place it in the context of the other factors appreciated by students that affected quality to a higher extent, namely, stress (−0.429), followed by communication problems (−0.360), technical requirements (0.230), and only in the last position their professors’ skills (0.059). Other authors [ 24] mention the role of professors in creating interactive courses and in helping students feel that they are part of a community, thereby increasing the quality of education. Coman et al. [ 20] conducted a study of Romanian students and noticed that the lack of communication with their teachers was the least important. Ahmed [ 46] noticed that sometimes students disregard problems if they find the advantages to be more important. These factors can partially explain the results in our research. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B24-electronics-12-00454" \o ""

H4：教授开展在线课程的技能对在线教育的质量有直接和积极的影响。该假设未得到验证；至少，罗马尼亚学生不认为在线教育的质量受到教授技能的影响。为了解释这一结果，将其放在学生所认识到的对质量有较大影响的其他因素（即压力（-0.429）、随后的沟通问题（-0.360）、技术要求（0.230）以及仅在最后位置的教授技能（0.059））的背景下是有用的。其他作者 [24] 提到教授在创建互动课程和帮助学生感觉自己是社区的一部分，从而提高教育质量方面的作用。Coman等人 [20] 对罗马尼亚学生进行了一项研究，发现缺乏与教师的沟通是最不重要的。Ahmed [46] 注意到，如果学生发现优势更为重要，他们有时会忽略问题。这些因素可以部分解释我们研究的结果。

H5: There is a direct and negative influence from professors’ skills in conducting online classes to the stress felt by students during online education. This hypothesis was not validated, and a connection showing that professors can help students to diminish their stress level was not proven. Other authors [ 32] have shown that professors with the right skills can help students to focus better during classes and to be more relaxed, and provide examples such as brainstorming, games, and quizzes that can be used to this end. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B32-electronics-12-00454" \o ""

H5：教授开展在线课程的技能对学生在在线教育期间感受到的压力有直接的负面影响。这一假设没有得到验证，表明教授可以帮助学生降低压力水平的联系也没有得到证明。其他作者 [32] 表明，具备适当技能的教授可以帮助学生在课堂上更好地集中注意力，更加放松，并提供诸如头脑风暴、游戏和测验等可用于此目的的示例。

H6: There is a direct and negative influence from the stress felt by students during online education to the quality of online education. This hypothesis was validated, stress being the factor with the strongest influence on online education quality (−0.429). Benila Pearl and Arunfred [ 32] found that stress can have a stimulating effect, noticing that students following online classes can concentrate better. Romanian students mentioned low levels of their stressors (general stress, concentration problems, distractions, being overwhelmed by assignments and tasks). HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B32-electronics-12-00454" \o ""

H6：学生在在线教育期间感受到的压力对在线教育的质量有直接的负面影响。验证了这一假设，应力是对在线教育质量影响最强的因素（-0.429）。Benila Pearl和Arunfred [32] 发现，压力可以产生一种刺激效果，注意到在线课程之后的学生可以更好地集中注意力。罗马尼亚学生提到他们的压力源水平很低（一般压力、集中注意力问题、分心、被作业和任务压垮）。

H7: There is a direct and negative influence from the technical requirements for online education to the communication problems specific to online education. This hypothesis was validated, showing that students who have a device and a good internet speed for connecting to online classes have fewer communication problems. The mean registered by both items related to technology (TECH1 and TECH2) was above 4, corresponding to the agreement of most students that they have everything they need for online learning. As previously mentioned, Romania has very good internet speeds, occupying the fourth position in the world [ 11], which explains the role played by meeting the minimum technical requirements in reducing communication problems during online classes. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B11-electronics-12-00454" \o ""

H7：在线教育的技术要求对在线教育特有的通信问题有直接的负面影响。这一假设得到了验证，表明拥有连接到在线课程的设备和良好互联网速度的学生具有较少的通信问题。与技术（TECH1和TECH2）相关的两个项目注册的平均值均在4以上，这与大多数学生同意他们拥有在线学习所需的一切相一致。如前所述，罗马尼亚拥有非常好的互联网速度，占据世界第四位 [11]，这解释了满足最低技术要求在减少在线课程期间的通信问题方面所起的作用。

H8: There is a direct and positive influence from the technical requirements for online education to the quality of online education. This hypothesis was validated, showing the role played by technology and the need for minimal requirements in order to benefit from online education. Sun and Chen [ 26] considered that technological developments positively influence the quality of online education. The high speed of the internet in Romania [ 11], a developing country which is among the countries with the fastest broadband connection speeds, creates important opportunities for Romanian students and offers a good foundation for offering high quality online classes. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B26-electronics-12-00454" \o ""

H8：在线教育的技术要求对在线教育的质量有直接和积极的影响。这一假设得到了验证，表明了技术所起的作用以及从在线教育中获益所需的最低要求。孙和陈认为，技术的发展对在线教育的质量产生了积极的影响。罗马尼亚的互联网高速发展 [11]，是宽带连接速度最快的发展中国家之一，为罗马尼亚学生创造了重要的机会，为提供高质量的在线课程奠定了良好的基础。

H9: There is a direct and negative influence from the technical requirements for online education to the stress felt by students during online education. This hypothesis was validated, with the results being in accordance with other studies [29,36]. Bruggerman et al. [29] mentioned that technical problems can raise the level of stress felt by students, and Sifat [36] highlighted both technical problems and mental problems (stress, anxiety) generated by online classes during the COVID-19 pandemic. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B29-electronics-12-00454" \o ""

H9：在线教育的技术要求对学生在在线教育期间感受到的压力有直接的负面影响。验证了该假设，结果与其他研究一致 [29,36] 。Bruggerman等人提到技术问题可以提高学生感受到的压力水平，西法特强调了COVID-19大流行病期间在线课堂产生的技术问题和心理问题（压力、焦虑）。

Figure 3 shows the coefficients of determination measured by R squared in SmartPLS. 2The high R for QLT (0.691) shows the important influence of STRS, COM. TECH, and PSK, with the highest impact from STRS and COM (expressed by H1 and H6). This is relevant because decision-makers such as managers in the higher education system could use these results to raise the quality level of online education in higher education institutions. The second most important coefficient of determination is STRS (0.605), which is mostly influenced by COM. Because communication problems increase the level of stress felt by students, managers should develop training programs for professors in order to reduce the communication gap between students and their professors.

图3显示由SmartPLS中的R平方测量的确定系数。2QLT的高R (0.691) 显示STRS、COM的重要影响。科技类和PSK，受STRS和COM影响最大（由H1和H6表示）。这是相关的，因为高等教育系统中的决策者（如管理者）可以利用这些结果来提高高等教育机构中在线教育的质量水平。第二重要的确定系数是STRS (0.605)，其主要受COM影响。由于沟通问题增加了学生的压力，管理者应制定教授培训计划，以缩小学生与教授之间的沟通差距。

## 6. Conclusions

## 结论

The present study analyses online education management, starting from students’ perspective regarding the challenges they encountered during this type of education. The results show that the quality of education is influenced mostly by stress and communication problems, and less by the minimum technical requirements and professors’ skills. These findings can be explained by the excellent position occupied by Romania at the top of the countries with the highest fixed broadband speeds, this being the reason why Romanian students are not preoccupied by lack of connection or low internet speeds. Regarding professors’ skills in communicating and disseminating information in a way adapted for online classes, students did not consider these aspects to affect the quality of their online education in a significant way.

本研究从学生的角度分析了在线教育管理在这类教育中遇到的挑战。结果表明，教育质量受压力和沟通问题的影响较大，受最低技术要求和教授技能的影响较小。这些发现可以通过罗马尼亚在固定宽带速度最高的国家中占据的优越地位来解释，这就是罗马尼亚学生不专注于缺乏连接或低互联网速度的原因。关于教授以适合在线课程的方式交流和传播信息的技能，学生没有考虑到这些方面会显著影响其在线教育的质量。

#### 6.1. Theoretical and Practical Implications

#### 理论和实践意义

The results of our research are useful for higher education managers and strategists in public administration for developing strategies and policies meant to raise the quality of online learning, enhance its benefits, and diminish any risks and challenges that might appear. In practice, our findings are helpful to professors who are dealing with their own stress and sometimes burnout [50] when teaching online. They should understand the role played by verbal and non-verbal communication in helping students have a successful learning experience. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B50-electronics-12-00454" \o ""

我们的研究结果对公共行政部门的高等教育管理者和策略师很有用，他们可以制定策略和政策，以提高在线学习的质量，提高其效益，并减少可能出现的任何风险和挑战。在实践中，我们的发现对那些在网上教学时处理自己的压力和有时疲惫的教授是有帮助的 [50] 。他们应该了解口头和非口头交流在帮助学生获得成功学习经验方面所起的作用。

Thus, in accordance with the results of our research, higher education managers should tailor their strategies to better fit the needs of both students and professors. As our findings show, communication problems and stress are the factors that most influence the quality of education. In conclusion, we recommend strategies focusing on improving communication between students and professors and finding solutions to reduce the stress that comes with online education. For better communication, managers should invest in training programs for professors to better prepare them for providing interesting content to their students.

因此，根据我们的研究结果，高等教育管理者应该调整他们的策略，以更好地满足学生和教授的需求。正如我们的研究发现，沟通问题和压力是影响教育质量的主要因素。总之，我们建议采用注重改善学生和教授之间沟通的策略，并找到解决方案来减轻在线教育带来的压力。为了更好地沟通，管理者应该投资教授培训项目，以便更好地为向学生提供有趣的内容做好准备。

#### 6.2. Limitations and Future Research Directions

#### 局限性和未来研究方向

The limitations of our research refer to the fact that we conducted the quantitative analysis online, not face-to-face, which might have affected the dimension of the sample. This was due to geographical restrictions and reduced financial resources. Furthermore, we developed a model with only five variables; in future research studies, we intend to add other constructs which might change the results, such as the influence of social groups, family support [51], personality traits, or physical and mental health. Another research direction we wish to follow in the future is to analyse all the countries with the highest broadband speeds and examine their similarities and differences, as well as the impact of culture [52], gross domestic product [53], and public expenditures; similar methods were used by Florea et al. [54] and Vatavu et al. [55] to study the impact of investment in the educational sector [56] on the quality of online education. HYPERLINK "https://www.mdpi.com/2079-9292/12/2/454" \l "B51-electronics-12-00454" \o ""

我们研究的局限性在于我们在线进行了定量分析，而不是面对面，这可能会影响样本的尺寸。这是由于地理限制和财政资源减少。此外，我们还开发了一个只有五个变量的模型；在未来的研究中，我们打算添加可能改变结果的其他结构，例如社会群体、家庭支持 [51] 、人格特质或身心健康的影响。我们希望今后遵循的另一个研究方向是分析宽带速度最快的所有国家，并研究它们的异同，以及文化 [52] 、国内生产总值 [53] 和公共支出的影响；Floret等人使用了类似的方法。[54] 和Vatavu等人研究教育部门投资对在线教育质量的影响。

## Author Contributions

## 作者贡献

Conceptualization, S.P., R.M.B. and S.O.I.; methodology, S.P. and G.-M.M.-T.; validation, S.P., G.-M.M.-T. and N.M.D.; formal analysis, S.P. and A.G.M.; investigation, S.O.I. and R.M.B.; writing—original draft preparation, A.G.M. and N.M.D.; writing—review and editing, S.P. and S.O.I.; visualization, S.P.; supervision, S.P. and R.M.B.; project administration, S.P., A.G.M. and G.-M.M.-T. All authors have read and agreed to the published version of the manuscript.

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## Conflicts of Interest

## 利益冲突

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## References

## 参考文献

1. Stone, C.; Freeman, E.; Dyment, J.E.; Muir, T.; Milthorpe, N. Equal or equitable?: The role of flexibility within online education. Aust. Int. J. Rural. Educ. [Google Scholar] [CrossRef]
2. 石头，C.；弗里曼，E.；Dyment, J.E.；Muir, T.；密尔索普，N。平等还是公平？:灵活性在在线教育中的作用。奥斯特内部J.农村。教育2019, 29, 26–40. 【谷歌学者】【CrossRef】
3. Black, D.; Bissessar, C.; Boolaky, M. Online Education as an Opportunity Equalizer: The Changing Canvas of Online Education. Interchange 2019, 50, 423–443. [Google Scholar] [CrossRef]
4. 黑色，D.；Bisesar, C.；Boolaky, M.在线教育作为机会均衡器：网络教育的变化。2019，50，423-443互通式立交。【谷歌学者】【CrossRef】
5. Adedoyin, O.B.; Soykan, E. COVID-19 pandemic and online learning: The challenges and opportunities. Interact. Learn. Environ. [Google Scholar] [CrossRef]
6. Adedoyin, O.B.；Soykan, E.COVID-19大流行病和在线学习：挑战和机遇。互动。学习。环境。2020, 1–13. 【谷歌学者】【CrossRef】
7. Watermeyer, R.; Crick, T.; Knight, C.; Goodall, J. COVID-19 and digital disruption in UK universities: Afflictions and affordances of emergency online migration. High. Educ. [Google Scholar] [CrossRef]
8. 沃特迈耶，R.；克里克，T.；奈特，C.；Goodall, J.COVID-19和英国大学的数字化颠覆：紧急在线迁移的痛苦和负担。高。教育2021, 81, 623–641. 【谷歌学者】【CrossRef】
9. Teymori, A.N.; Fardin, M.A. COVID-19 and educational challenges: A review of the benefits of online education. Ann. Mil. Health Sci. Res. 2020, 18(3), e105778. [Google Scholar] [CrossRef]
10. A.N.Teymori；Fardin, M.A.2019冠状病毒病和教育挑战：审查在线教育的好处。安。MIL。健康科学决议20 20、18（3）、e105778。【谷歌学者】【CrossRef】
11. University World News. Available online: https://www.universityworldnews.com/post.php?story=20221010103915479 (accessed on 7 November 2022). HYPERLINK "https://www.universityworldnews.com/post.php?story=20221010103915479" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
12. 大学世界新闻。在线访问：https://www.universityworldnews.com/post.php?story=20221010103915479（2022年11月7日访问）。
13. Mukhtar, K.; Javed, K.; Arooj, M.; Sethi, A. Advantages, Limitations and Recommendations for online learning during COVID-19 pandemic era. Pak. J. Med. Sci. [Google Scholar] [CrossRef]
14. Mukhtar, K.；Javed, K.；Arooj, M.；Sethi, A. 2019冠状病毒大流行病时代在线学习的优势、局限性和建议。巴基斯坦J.医学SCI。2020, 36, 27–31. 【谷歌学者】【CrossRef】
15. Dumford, A.D.; Miller, A.L. Online learning in higher education: Exploring advantages and disadvantages for engagement. J. Comput. High Educ. [Google Scholar] [CrossRef]
16. 公元前杜姆福德；米勒，A.L.高等教育在线学习：探索参与的优缺点。J.输入。高等教育2018, 30, 452–465. 【谷歌学者】【CrossRef】
17. O’Donoghue, J.; Singh, G.; Green, C. A comparison of the advantages and disadvantages of IT based education and the implication upon students. Digit. Educ. Rev. [Google Scholar]
18. O'Donoghue, J.；Singh, G.；绿色，C。基于IT的教育的优缺点比较及其对学生的启示。数字。教育版本2004, 9, 63–76. [Google学者]
19. Firmansyah, R.; Putri, D.M.; Wicaksono, M.G.S.; Putri, S.F.; Widianto, A.A. The University students’ perspectives on the advantages and disadvantages of online learning due to COVID-19. In Proceedings of the 2nd Annual Management, Business and Economic Conference (AMBEC 2020), Virtual, 5 September 2020; pp. [Google Scholar] [CrossRef] HYPERLINK "https://scholar.google.com/scholar\_lookup?title=The+University+students%E2%80%99+perspectives+on+the+advantages+and+disadvantages+of+online+learning+due+to+COVID-19&conference=Proceedings+of+the+2nd+Annual+Management,+Business+and+Economic+Conference+(AMBEC+2020)&author=Firmansyah,+R.&author=Putri,+D.M.&author=Wicaksono,+M.G.S.&author=Putri,+S.F.&author=Widianto,+A.A.&publication\_year=2020&pages=120%E2%80%93124&doi=10.2991/aebmr.k.210717.025" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
20. Firmansyah, R.；Putri, D.M.；Wicaksono, M.G.S.；Putri, S.F.；A.A.维迪安托大学生对2019冠状病毒病在线学习优势和劣势的看法。在第二届年度管理、商业和经济会议（AMBEC 2020）的会议记录中，虚拟，2020年9月5日；PP.120–124. 【谷歌学者】【CrossRef】
21. World Population Review. Available online: https://worldpopulationreview.com/country-rankings/internet-speeds-by-country (accessed on 7 November 2022). HYPERLINK "https://worldpopulationreview.com/country-rankings/internet-speeds-by-country" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
22. 世界人口回顾。在线访问：https://worldpopulationreview.com/country-rankings/internet-speeds-by-country（2022年11月7日访问）。
23. Potra, S.; Pugna, A.; Pop, M.-D.; Negrea, R.; Dungan, L. Facing COVID-19 Challenges: 1st-Year Students’ Experience with the Romanian Hybrid Higher Educational System. Int. J. Environ. Res. Public Health 2021, 18, 3058. [Google Scholar] [CrossRef]
24. Potra, S.；普尼亚，A.；POP，M. - D.；Negrea, R.；Dungan, L.面临2019冠状病毒病挑战：一年级学生在罗马尼亚混合高等教育体系中的经验。内部J.环境。决议公共卫生20 21，18，3058。【谷歌学者】【CrossRef】
25. ANOSR. Invatamantul Online Prin Ochii Studentilor. Available online: https://anosr.ro/wp-content/uploads/2021/04/2020-Invatamantul-online-prin-ochii-studentilor.-Recomandarile-ANOSR.-Raport-octombrie.pdf (accessed on 10 January 2023). HYPERLINK "https://anosr.ro/wp-content/uploads/2021/04/2020-Invatamantul-online-prin-ochii-studentilor.-Recomandarile-ANOSR.-Raport-octombrie.pdf" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
26. ANOSR。Invatamantul在线打印Ochii Studenlor。在线：https://anosr.ro/wp-content/uploads/2021/04/2020-Invatamantul-online-prin-ochii-studentilor。-重组- ANOSR。- Raport - octombrie.pdf（2023年1月10日访问）。
27. Sujarwo, S.; Sukmawati, S.; Akhiruddin, A.; Ridwan, R.; Siradjuddin, S.S.S. An analysis of university students’ perspective on online learning in the midst of COVID-19 pandemic. J. Pendidik. Dan Pengajaran 2020, 53, 125–137. [Google Scholar] [CrossRef]
28. Sujarwo, S.；Sukmawati, S.；Akhiruddin, A.；Ridwan, R.；Siradjuddin, S.S.S.2019大流行病新冠疫情期间大学生网络学习视角分析J.Pendidik。Dan Pengajaran 20 20,53,125-137.【谷歌学者】【CrossRef】
29. Coldwell, J.; Wells, J. Students’ perspective of online learning. In Quality Education @ a Distance; IFIP—The International Federation for Information Processing; Davies, G., Stacey, E., Eds.; Springer: Boston, MA, USA, 2003; Volume 131, pp. [Google Scholar] [CrossRef] HYPERLINK "https://scholar.google.com/scholar\_lookup?title=Students%E2%80%99+perspective+of+online+learning&author=Coldwell,+J.&author=Wells,+J.&publication\_year=2003&pages=101%E2%80%93108" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
30. Coldwell, J.；韦尔斯，J。学生的在线学习视角。在素质教育中@一段距离；IFIP -国际信息处理联合会；Davies, G.、Stacey, E.、EDS；施普林格：美国马萨诸塞州波士顿，2003年；第131卷，第页101–108. 【谷歌学者】【CrossRef】
31. Van Wart, M.; Ni, A.; Medina, P.; Canelon, J.; Kordrostami, M.; Zhang, J.; Liu, Y. Integrating students’ perspectives about online learning: A hierarchy of factors. Int. J. Educ. Technol. High. Educ. [Google Scholar] [CrossRef] [PubMed]
32. 范沃特，M.；Ni, A.；麦地那，P.；Canelon, J.；科德罗马蒂，M.；张，J.；Liu, Y.整合学生的在线学习观点：要素层次。内部J.教育技术高。教育2020, 17, 1–22. 【谷歌学者】【CrossRef】【PubMed】
33. Sit, J.W.; Chung, J.W.; Chow, M.C.; Wong, T.K. Experiences of online learning: Students’ perspective. Nurse Educ. Today 2005, 25, 140–147. [Google Scholar] [CrossRef] [PubMed]
34. Sit，J.W.；Chung, J.W.；Chow, M.C.；黄，T.K.网上学习经历：学生的观点。护士教育今天，2005年，25日，140-147。【谷歌学者】【CrossRef】【PubMed】
35. Shrivastava, G.; Ovais, D.; Arora, N. Measuring the walls of communication barriers of students in higher education during online classes. J. Content Community Commun. [Google Scholar]
36. Shrivastava, G.；Ovais, D.；Arora, N.在线课程中测量高等教育学生沟通障碍的墙。J.内容社区通信。2021, 13, 263–272. [Google学者]
37. Al Mahadin, L.; Hallak, L. The Lack of Visual Interaction in Online Classes and its Effect on the Learning Experience of Students during the COVID-19 Pandemic: A Survey of a Bahraini Private University Students. In Proceedings of the AUBH E-Learning Conference 2021: Innovative Learning & Teaching—Lessons from COVID-19, Manama, Bahrain, 24–26 May 2021. [Google Scholar] [CrossRef] HYPERLINK "https://scholar.google.com/scholar\_lookup?title=The+Lack+of+Visual+Interaction+in+Online+Classes+and+its+Effect+on+the+Learning+Experience+of+Students+during+the+COVID-19+Pandemic:+A+Survey+of+a+Bahraini+Private+University+Students&conference=Proceedings+of+the+AUBH+E-Learning+Conference+2021:+Innovative+Learning+&+Teaching%E2%80%94Lessons+from+COVID-19&author=Al+Mahadin,+L.&author=Hallak,+L.&publication\_year=2021&doi=10.2139/ssrn.3874420" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
38. Al Mahadin, L.；Hallak, L.在线课堂缺乏视觉互动及其对2019冠状病毒疫情期间学生学习体验的影响：对巴林私立大学学生的调查。在2021年AUBH电子学习会议上：创新性学习与教学- 2021年5月24日至26日，巴林麦纳麦2019冠状病毒病疫情报告。【谷歌学者】【CrossRef】
39. Coman, C.; Țîru, L.G.; Meseșan-Schmitz, L.; Stanciu, C.; Bularca, M.C. Online Teaching and Learning in Higher Education during the Coronavirus Pandemic: Students’ Perspective. Sustainability 2020, 12, 10367. [Google Scholar] [CrossRef]
40. Coman, C.；ru, L.G.；Meseían - Schmitz, L.；Stanciu, C.；Bularca, M.C.冠状病毒大流行期间高等教育的在线教学：学生视角。可持续发展20 20,12,10367。【谷歌学者】【CrossRef】
41. Sharma, S.; Vyas, P. Enhancing non-verbal communication in online classes: A conceptual framework. J. Educ. Teach. [Google Scholar] [CrossRef]
42. Sharma, S.；Vyas, P.加强在线课堂中的非语言沟通：概念框架。J.教育教学。2022, 48, 135–137. 【谷歌学者】【CrossRef】
43. Bambaeeroo, F.; Shokrpour, N. The impact of the teachers’ non-verbal communication on success in teaching. J. Adv. Med. Educ. Prof. [Google Scholar]
44. Bambaeeroo, F.；教师的非语言交流对教学成功的影响。J.高级医学教育教授2017, 5, 51–59. [Google学者]
45. Dragomir, G.-M.; Fărcașiu, M.A.; Șimon, S. Students’ Perceptions of Verbal and Non-Verbal Communication Behaviors during and after the COVID-19 Pandemic. Appl. Sci. [Google Scholar] [CrossRef]
46. Dragomir，G.-M.；F<unk> rca<unk> iu, M.A.；① 191年冠状病毒疫情期间和之后，学生对口头和非口头交流行为的认知。申请SCI。2021, 11, 8282. 【谷歌学者】【CrossRef】
47. Mirķe, E.; Cakula, S.; Tzivian, L. Measuring teachers-as-learners’ digital skills and readiness to study online for successful e-learning experience. J. Teach. Educ. Sustain. [Google Scholar] [CrossRef]
48. Miríe, E.；卡库拉，S.；Tzivian, L.测量教师作为学习者的数字技能和在线学习的准备情况，以获得成功的电子学习体验。J.教学。教育维持。2019, 21, 5–16. 【谷歌学者】【CrossRef】
49. Young, A.; Norgard, C. Assessing the quality of online courses from the students’ perspective. Internet High. Educ. [Google Scholar] [CrossRef]
50. 杨，A.；Norgard, C.从学生的角度评估在线课程的质量。互联网高。教育2006, 9, 107–115. 【谷歌学者】【CrossRef】
51. Sun, A.; Chen, X. Online education and its effective practice: A research review. J. Inf. Technol. Educ. [Google Scholar] [CrossRef]
52. Sun, A.；陈十，网络教育及其有效实践：研究回顾。J.信息技术教育2016, 15, 157–190. 【谷歌学者】【CrossRef】
53. Palvia, S.; Aeron, P.; Gupta, P.; Mahapatra, D.; Parida, R.; Rosner, R.; Sindhi, S. Online education: Worldwide status, challenges, trends, and implications. J. Glob. Inf. Technol. Manag. [Google Scholar] [CrossRef]
54. 帕尔维亚，S.；Aeron, P.；古普塔，P.；Mahapatra, D.；Parida, R.；Rosner, R.；Sindhi, S.在线教育：全球现状、挑战、趋势和影响。J.全球。INF.技术管理2018, 21, 233–241. 【谷歌学者】【CrossRef】
55. Chandra, Y. Online education during COVID-19: Perception of academic stress and emotional intelligence coping strategies among college students. Asian Educ. Dev. Stud. [Google Scholar] [CrossRef]
56. Chandra, Y. 2019冠状病毒病在线教育：大学生学习压力感知与情绪智力应对策略亚洲教育开发螺柱。2021, 10, 229–238. 【谷歌学者】【CrossRef】
57. Bruggeman, B.; Garone, A.; Struyven, K.; Pynoo, B.; Tondeur, J. Exploring university teachers’ online education during COVID-19: Tensions between enthusiasm and stress. Comput. Educ. Open 2022, 3, 100095. [Google Scholar] [CrossRef]
58. 布鲁格曼，B.；Garone, A.；Struyven, K.；Pynoo, B.；Tondeur, J.在2019冠状病毒病疫情期间探索大学教师的在线教育：热情和压力之间的紧张关系。计算。教育打开20 22，3，100095。【谷歌学者】【CrossRef】
59. Altaf, R.; Kling, M.; Hough, A.; Baig, J.; Ball, A.; Goldstein, J.; Brunworth, J.; Chau, C.; Dybas, M.; Jacobs, R.J.; et al. The Association between Distance Learning, Stress Level, and Perceived Quality of Education in Medical Students after Transitioning to a Fully Online Platform. Cureus 2022, 14, e24071. [Google Scholar] [CrossRef]
60. Altaf, R.；Kling, M.；霍夫，A.；Baig, J.；A.球；Goldstein, J.；Brunworth, J.；周，C.；Dybas, M.；Jacobs, R.J.；等人医学生在过渡到完全在线平台后，远程学习、压力水平和感知教育质量之间的关联。铜20 22，14，e24071。【谷歌学者】【CrossRef】
61. Mheidly, N.; Fares, M.Y.; Fares, J. Coping with stress and burnout associated with telecommunication and online learning. Front. Public Health 2020, 8, 574969. [Google Scholar] [CrossRef] [PubMed]
62. M，N；票价，M. Y.；Fares, J.应对与电信和在线学习相关的压力和倦怠。前面。公共卫生20 20,8, 574969。【谷歌学者】【CrossRef】【PubMed】
63. Benila Pearl, J.; Arunfred, N. A Comparative Study on the Concentration Skill between E-Learning Methods and Traditional Learning Methods among Higher Education Students. Asia Pac. J. Multidiscip. Res. [Google Scholar]
64. Benila Pearl, J.；Arunfred, N.高等教育学生电子学习方法与传统学习方法集中技巧的比较研究。亚洲公司J.多碟。决议2019, 7, 67–73. [Google学者]
65. O’Brien, O.; Sumich, A.; Kanjo, E.; Kuss, D. WiFi at University: A Better Balance between Education Activity and Distraction Activity Needed. Comput. Educ. Open 2022, 3, 100071. [Google Scholar] [CrossRef]
66. O’Brien, O.Sumich, A.；Kanjo, E.；Kuss, D. WiFi，大学：更好地平衡所需的教育活动和分心活动。计算。教育打开20 22，3，100071。【谷歌学者】【CrossRef】
67. Goundar, S. The distraction of technology in the classroom. J. Educ. Hum. Dev. [Google Scholar]
68. Goundar，S。课堂上技术的分散。J.教育嗡嗡声。开发2014, 3, 211–229. [Google学者]
69. Muthuprasad, T.; Aiswarya, S.; Aditya, K.S.; Jha, G.K. Students’ perception and preference for online education in India during COVID-19 pandemic. Soc. Sci. Humanit. Open 2021, 3, 100101. [Google Scholar] [CrossRef]
70. 穆特普拉萨德，T.；Aiswarya, S.；Aditya, K.S.；Jha, G.K.COVID-19大流行病期间印度学生对在线教育的认知和偏好。SOC。SCI。人性化。打开20 21，3，100101。【谷歌学者】【CrossRef】
71. Sifat, R.I. COVID-19 pandemic: Mental stress, depression, anxiety among the university students in Bangladesh. Int. J. Soc. Psychiatry 2021, 67, 609–610. [Google Scholar] [CrossRef]
72. 西法特，R.I.COVID-19大流行病：孟加拉大学生的心理压力、抑郁、焦虑。内部J.Soc.精神病学20 21，67，609-610。【谷歌学者】【CrossRef】
73. Cullinan, J.; Flannery, D.; Harold, J.; Lyons, S.; Palcic, D. The disconnected: COVID-19 and disparities in access to quality broadband for higher education students. Int. J. Educ. Technol. High. Educ. [Google Scholar] [CrossRef] [PubMed]
74. Cullinan, J.；弗兰纳利，D.；Harold, J.；里昂，S.；Palcic, D.断开连接：2019冠状病毒和高等教育学生获得优质宽带的差距。内部J.教育技术高。教育2021, 18, 1–21. 【谷歌学者】【CrossRef】【PubMed】
75. Ringle, C.M.; Wende, S.; Becker, J.M. SmartPLS 4. Boenningstedt: SmartPLS GmbH. Available online: http://www.smartpls.com (accessed on 6 November 2022). HYPERLINK "http://www.smartpls.com" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
76. Ringle, C.M.；文德，S.；贝克尔，J.M.SmartPLS 4..Boenningstedt：SmartPLS GmbH。2015. 在线访问：http://www.smartpls.com（2022年11月6日访问）。
77. Kock, N.; Hadaya, P. Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods. Inf. Syst. J. 2018, 28, 227–261. [Google Scholar] [CrossRef]
78. Kock, N.；Hadaya, P. PLS-SEM中的最小样本量估算：反平方根和伽马指数方法。INF.系统J. 20 18,28,227 – 261.【谷歌学者】【CrossRef】
79. Yana, A.G.A.; Rusdhi, H.A.; Wibowo, M.A. Analysis of factors affecting design changes in construction project with Partial Least Square (PLS). Procedia Eng. [Google Scholar] [CrossRef]
80. 雅娜，A.G.A.；Rusdhi，H.A.；Wibowo, M.A.采用偏最小二乘法 (PLS) 分析影响建设项目设计变更的因素。程序工程师2015, 125, 40–45. 【谷歌学者】【CrossRef】
81. Hulland, J. Use of partial least squares (PLS) in strategic management research: A review of four recent studies. Strateg. Manag. J. 1999, 20, 195–204. [Google Scholar] [CrossRef]
82. Hulland, J.在战略管理研究中使用偏最小二乘法（PLS）：回顾最近的四项研究。战略。管理J.1999，20,195-204.【谷歌学者】【CrossRef】
83. Hair, J.F., Jr.; Hult, G.T.M.; Ringle, C.M.; Sarstedt, M. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM), 3rd ed.; Sage: Thousand Oaks, CA, USA, 2021. [Google Scholar] HYPERLINK "https://scholar.google.com/scholar\_lookup?title=A+Primer+on+Partial+Least+Squares+Structural+Equation+Modeling+(PLS-SEM)&author=Hair,+J.F.,+Jr.&author=Hult,+G.T.M.&author=Ringle,+C.M.&author=Sarstedt,+M.&publication\_year=2021" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
84. 头发，J.F.，小；Hult, G.T.M.；Ringle, C.M.；Sarstedt, M.关于偏最小二乘结构方程模型 (PLS-SEM) 的底漆，第3版；鼠尾草：美国加利福尼亚州千橡，2021年。 [Google学者]
85. Hinton, P.; McMurray, I.; Brownlow, C. SPSS Explained, 2nd ed.; Routledge: London, UK, 2014. [Google Scholar] [CrossRef] HYPERLINK "https://scholar.google.com/scholar\_lookup?title=SPSS+Explained&author=Hinton,+P.&author=McMurray,+I.&author=Brownlow,+C.&publication\_year=2014" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
86. 辛顿，P.；McMurray, I.；Brownlow, C.SPSS解释，第2版；路由：英国伦敦，2014年。【谷歌学者】【CrossRef】
87. Hu, L.T.; Bentler, P.M. Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. Psychol. Methods 1998, 3, 424–453. [Google Scholar] [CrossRef]
88. Hu, L.T.；宾特勒，下午协方差结构建模中的拟合指数：对参数化不足的模型错误规范的敏感性。精神病。方法1998,3, 424-453。【谷歌学者】【CrossRef】
89. Ringle, M. HTMT Discriminant Validity. Forum SmartPLS. Available online: https://forum.smartpls.com/viewtopic.php?t=3616 (accessed on 9 January 2023). HYPERLINK "https://forum.smartpls.com/viewtopic.php?t=3616" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
90. Ringle, M. HTMT判别有效性。论坛SmartPLS。在线访问：https://forum.smartpls.com/viewtopic.php?t=3616（2023年1月9日访问）。
91. Henseler, J.; Ringle, C.M.; Sarstedt, M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J. Acad. Mark. Sci. [Google Scholar] [CrossRef]
92. Henseler, J.；Ringle, C.M.；Sarstedt, M.基于方差的结构方程建模中评估判别有效性的新准则。J.Acad.标记。SCI。2015, 43, 115–135. 【谷歌学者】【CrossRef】
93. Betts, K. Lost in translation: Importance of effective communication in online education. Online J. Distance Learn. Adm. [Google Scholar]
94. Betts, K.译文丢失：在线教育中有效沟通的重要性。在线J.远程学习。行政2009, 12, 1–14. [Google学者]
95. Bhatti, M.T.; Teevno, R.A. Nonverbal Communication (NVC) and teacher presence in collaborative online learning. J. Contemp. Issues Bus. Gov. [Google Scholar]
96. 巴蒂，M.T.；Teevno, R.A.非语言沟通（NVC）和教师参与协作在线学习。J.当代问题总线。政府2021, 27, 308–316. [Google学者]
97. Ahmed, R. Effects of Online Education on Encoding and Decoding Process of Students and Teachers. In Proceedings of the International Association for Development of the Information Society, International Conference on e-Learning, Madrid, Spain, 17–19 July 2018. [Google Scholar] HYPERLINK "https://scholar.google.com/scholar\_lookup?title=Effects+of+Online+Education+on+Encoding+and+Decoding+Process+of+Students+and+Teachers&conference=Proceedings+of+the+International+Association+for+Development+of+the+Information+Society,+International+Conference+on+e-Learning&author=Ahmed,+R.&publication\_year=2018" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
98. 在线教育对学生和教师的编码和解码过程的影响。在国际信息社会发展协会会议记录中，国际电子学习会议，西班牙马德里，2018年7月17日至19日。 [Google学者]
99. Mosleh, S.M.; Kasasbeha, M.A.; Aljawarneh, Y.M.; Alrimawi, I.; Saifan, A.R. The impact of online teaching on stress and burnout of academics during the transition to remote teaching from home. BMC Med. Educ. [Google Scholar] [CrossRef]
100. Mosleh, S.M.；Kasasbeha, M.A.；Aljawarneh, Y.M.；Alrimawi, I.；赛凡，A.R.从家庭向远程教学过渡期间，在线教学对学术界压力和倦怠的影响。BMC医学教育2022, 22, 475. 【谷歌学者】【CrossRef】
101. Hart, C. Factors associated with student persistence in an online program of study: A review of the literature. J. Interact. Online Learn. [Google Scholar]
102. HART, C.在线学习计划中与学生坚持相关的因素：文献回顾。J.互动。在线学习。2012, 11, 19–42. [Google学者]
103. Wang, C.-M.; Reeves, T.C. The Meaning of Culture in Online Education: Implications for Teaching, Learning and Design. In Globalized E-Learning Cultural Challenges; Edmundson, A., Ed.; IGI Global: Hershey, PA, USA, 2007; pp. [Google Scholar] [CrossRef] HYPERLINK "https://scholar.google.com/scholar\_lookup?title=The+Meaning+of+Culture+in+Online+Education:+Implications+for+Teaching,+Learning+and+Design&author=Wang,+C.-M.&author=Reeves,+T.C.&publication\_year=2007&pages=1%E2%80%9317" \t "https://www.mdpi.com/2079-9292/12/2/\_blank"
104. Wang, C.-M.；Reves, T.C.文化在网络教育中的意义：对教学、学习和设计的影响。全球化的电子学习文化挑战；艾德蒙森，A.，编辑；IGI全球：美国宾夕法尼亚州赫尔希，2007年；页码1–17. 【谷歌学者】【CrossRef】
105. Pastor, J.M.; Peraita, C.; Serrano, L.; Soler, Á. Higher education institutions, economic growth and GDP per capita in European Union countries. Eur. Plan. Stud. [Google Scholar] [CrossRef]
106. 牧师，J.M.；Peraita, C.；Serrano, L.；Soler，□。欧盟国家的高等教育机构、经济增长和人均GDP。欧元计划。螺柱。2018, 26, 1616–1637. 【谷歌学者】【CrossRef】
107. Florea, N.M.; Bădîrcea, R.M.; Meghisan-Toma, G.-M.; Puiu, S.; Manta, A.G.; Berceanu, D. Linking Public Finances’ Performance to Renewable-Energy Consumption in Emerging Economies of the European Union. Sustainability 2021, 13, 6344. [Google Scholar] [CrossRef]
108. 浮游生物，N.m；B<unk> d<unk> rcea, R.M.；Meghisan-Toma，G.-M.；Puiu, S.；A.G.曼塔；Berceanu, D.将公共财政表现与欧盟新兴经济体的可再生能源消耗联系起来。可持续发展20 21，13，6344。【谷歌学者】【CrossRef】
109. Vatavu, S.; Lobont, O.-R.; Stefea, P.; Brindescu-Olariu, D. How Taxes Relate to Potential Welfare Gain and Appreciable Economic Growth. Sustainability 2019, 11, 4094. [Google Scholar] [CrossRef]
110. Vatavu, S.；洛邦特，O-R；Stefea, P.；Brindescu-Olariu, D.税收如何与潜在的福利收益和可观的经济增长相关。可持续发展2019，11，4094。【谷歌学者】【CrossRef】
111. Morawczynski, O.; Ngwenyama, O. Unraveling the impact of investments in ICT, education and health on development: An analysis of archival data of five West African countries using regression splines. Electron. J. Inf. Syst. Dev. Ctries. [Google Scholar] [CrossRef]
112. Morawczynski, O.；Ngwenyama, O.揭开ICT、教育和卫生投资对发展的影响：使用回归样条分析五个西非国家的档案数据。电子。J.信息系统开发文化。2007, 29, 1–15. 【谷歌学者】【CrossRef】