

ASSESSING THE IMPACT OF THE COVID-19 PANDEMIC ON THE TRANSITION FROM BACCALAUREATE TO HIGHER EDUCATION: A CASE STUDY

*Evaluación del impacto de la pandemia de COVID-19 en la transición del
bachillerato a la enseñanza superior: Un estudio de caso*

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Resumen

Este estudio de caso evalúa la transición de los estudiantes que han completado su bachillerato en modalidad virtual a un modelo de educación superior presencial en la era post-pandémica. La hipótesis propuesta sugiere que la rápida transformación a la educación virtual debido a la pandemia COVID-19 ha perjudicado el aprendizaje y el rendimiento académico de los estudiantes, lo que ha provocado una disminución de la calidad educativa. Se empleó una metodología mixta que combinaba técnicas cuantitativas y cualitativas de recolección de datos. Para ello, se aplicó un cuestionario en línea para recabar los datos cuantitativos y se complementó con una técnica de grupo de discusión para obtener datos cualitativos más detallados. Los

resultados apoyaron la hipótesis, y se concluyó que la falta de habilidades sociales y emocionales y la baja calidad de la educación recibida en la enseñanza virtual pueden haber dejado a los estudiantes en una situación difícil para adaptarse a la educación presencial en la enseñanza superior.

Abstract

This case study assesses the transition of students who have completed their baccalaureate in virtual mode to a face-to-face higher education model in the post-pandemic era. The proposed hypothesis suggests that the rapid transformation to virtual education due to the COVID-19 pandemic has harmed students' learning and academic performance, resulting in a decline in educational quality. A mixed methodology combining quantitative and qualitative data collection techniques was employed. For this purpose, an online questionnaire was applied to collect quantitative data and was complemented by a focus group technique to obtain more detailed qualitative data. The results supported the hypothesis, and it was concluded that the lack of social and emotional skills and the low quality of education received in virtual education may have left students in a difficult situation to adapt to face-to-face education in higher education.

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Palabras Clave: Rendimiento Académico, Pandemia COVID-19, Transición Educativa, Educación Superior, Educación Virtual.

Keywords: Academic Performance, COVID-19 Pandemic, Educational Transition, Higher Education, Virtual Education.

Introduction

The COVID-19 pandemic has significantly impacted education globally, directly affecting the transition of baccalaureate into higher education, which is a critical juncture in itself (Lanphier & Carini, 2022). The rapid and profound transformation in education due to the pandemic has harmed students' learning

and academic performance (Lytras et al., 2022), reflecting the problem that current teaching methods are not keeping up with the demands of a modern society that demands new approaches (Engelbrecht et al., 2023; Rivadeneira & Inga, 2023), which may ultimately result in a decline in educational quality. In addition, there are concerns about the adverse effects on students' ability to reach their full academic potential after two years of receiving a virtual education (UNESCO, 2022).

1.1 Difference between face-to-face, online, and virtual education

Face-to-face education is where teaching is carried out traditionally, i.e. the student physically attends a learning space (such as a school, university, or institute, among others) where they interact directly with the teacher and other students. Classes and activities are carried out at a pre-established timetable and in a specific physical location (Segovia-García et al., 2022).

On the other hand, virtual and online education are distance learning modalities that use digital technologies (Lytras et al., 2022). The main difference between them is that virtual education takes place in real-time, with synchronous classes that require the active participation of the student and the teacher through videoconferencing tools and chats (García-de-Paz & Santana Bonilla, 2021). In contrast, online education is based on asynchronous learning. The student accesses the content of classes and activities autonomously through virtual learning platforms, without the need to connect to a specific timetable or direct interaction with the teacher in real-time (García-de-Paz & Santana Bonilla, 2021).

It is important to note that student learning differs in each study mode. In virtual education, for example, the student can interact in real-time with the teacher and peers, encouraging participation and exchanging ideas. In online education, students have more flexibility in organising their study time and carrying out activities at their own pace. However, it may require greater discipline and autonomy in their learning. In face-to-face education, the student has direct contact with the teacher and peers, which can foster collaboration and teamwork. Each mode has its advantages and disadvantages, and it is

essential to select the most appropriate one according to the needs and learning objectives of each student (Stecula & Wolniak, 2022).

This research focused on a case study in which the transition of a group of students who completed their baccalaureate in virtual mode and started their higher education in face-to-face mode was evaluated, considering that the transition from one way of schooling to another can present significant challenges in terms of adaptation and academic performance. In addition, it was considered essential to analyse how a lack of understanding of the basic principles may have affected the learning experience of these students in face-to-face higher education. *Basic principles* are understood as those that are essential for understanding any discipline. At an initial university level, students must gain a deep understanding of these principles, as this will enable them to build a solid foundation for their subsequent academic training.

1.2 What impact has the pandemic had on the quality of education?

One of the most significant impacts of the pandemic on education has been the abrupt transition to distance education, which has created significant challenges for students, teachers, and educational administrators (Ferrer et al., 2023; UNESCO, 2022). The lack of technological resources, adequate training for the use of virtual platforms, and the emotional and social disconnection of students are some of the difficulties that have arisen in virtual education (Atweh et al., 2023; Bonal & González, 2020; González-Moreira et al., 2023; Mahajan et al., 2023; Villa-Ochoa et al., 2023). All this has negatively affected the quality of education, as many students could not receive the individualised attention and academic support they need to achieve their learning achievements (Ayoo, 2023; UNESCO, 2022).

In addition, the pandemic exposed some of the structural and policy deficiencies in education present in many countries (Dilemmas, 2021). For example, lack of investment in educational infrastructure and technology, unequal access to educational and technological resources, and lack of adequate teacher training are just some of the problems contributing to the decline in academic quality (Ayoo, 2023; UNESCO, 2022). Therefore, efforts must be made to address

these problems and strengthen the quality of education in a post-pandemic context.

1.3 Challenges of the transition from virtual to face-to-face education

The transition from virtual to face-to-face education has posed significant challenges in the wake of the COVID-19 pandemic (Bonal & González, 2020; Jandrić et al., 2022). Students who have completed their bachelor's degree virtually may face difficulties adapting to higher education's demands in a face-to-face environment. These challenges can range from difficulties in socialising and time management to academic problems stemming from a lack of knowledge of the basic principles that were not previously acquired and may have been overlooked or inadequately addressed in virtual learning environments (Daniel, 2020; Liebendörfer et al., 2023; Stecula & Wolniak, 2022). These gaps may become evident in face-to-face classes where students are expected to understand and be familiar with key concepts.

The pandemic has significantly impacted many students' routines and habits. The transition to a new learning environment can be overwhelming, especially for those who have suffered academic setbacks during this period (Noori, 2021). Returning to face-to-face education presents a complex set of challenges that require careful consideration and planning by all parties involved.

In addition to students' challenges during this transition, educators and institutions must also address unique challenges. The pandemic has highlighted the need for flexible and adaptive pedagogical approaches and the importance of technology to enhance the learning experience (Lytras et al., 2022). Educators need to address potential academic gaps and learning loss that may have arisen during the pandemic, as well as support their student's social and emotional well-being (Wang et al., 2022). Close collaboration between educators, students and families is crucial to ensure a triumphant and supportive return to face-to-face education. In summary, the return to face-to-face education after the pandemic presents complex and multifaceted challenges that require careful planning and consideration by all parties involved.

It is important to note that the transition from virtual to face-to-face education can also impact students' mental and emotional health (Wang et al., 2022). The pandemic has generated stress, anxiety, and depression in many people, including students, and adapting to a new learning environment can exacerbate these problems. In addition, academic and social pressures in face-to-face higher education may be greater than in virtual education, leading to increased stress for students (López-Aguilar et al., 2022). Therefore, it is necessary to consider students' emotional and psychological aspects during the transition and provide them with the support needed to ensure a successful learning experience.

1.4 About this case study

The general objective of this research was to evaluate the transition of students who have completed their baccalaureate in virtual mode to a face-to-face higher education model in the post-pandemic period. To this end, two specific objectives were set out. First, we identified the challenges a group of students faced during the pandemic in completing their baccalaureate to analyse how this situation might have influenced their academic performance in a face-to-face higher education environment. Secondly, it was examined how students' need for more understanding of the basic principles might have impacted their learning experience during a face-to-face mode of study. Both objectives focus on assessing how students' transition from virtual to face-to-face education has affected their academic performance and learning experience at university. For that purpose, a questionnaire was administered, and focus groups were conducted with a sample of students from the first levels of the Salesian Polytechnic University.

This research hypothesised that the rapid transformation to virtual education due to the COVID-19 pandemic has negatively impacted students' learning and academic performance, resulting in a decreased quality of education. In addition, students who have transitioned from a virtual baccalaureate to face-to-face higher education in the post-pandemic period have faced unique challenges and have had to use specific strategies to adapt to this new mode of

delivery. This case study sought to demonstrate these hypotheses by collecting and analysing data on students' challenges and adaptation strategies.

The results of this study may be of great relevance to higher education and strategic decision-making in the post-pandemic period by providing valuable information on the challenges students faced during the transition to face-to-face higher education and how the lack of understanding of the basic principles in a post-pandemic context impacted their learning experience.

2. Materials and Methods

This case study employed a mixed methodology combining quantitative and qualitative data collection techniques. An online questionnaire was designed for this research to collect quantitative data, complemented by a focus group technique to obtain more detailed qualitative data.

The focus group technique is used in qualitative research to gather information through group interaction and dialogue among participants. It consists of bringing together a group of individuals with similar characteristics and experiences and guiding them through an in-depth discussion on the research topic (Bloor et al., 2001; Greenbaum, 1998).

2.1 Population and sample

The study population consisted of 300 students currently studying the first four levels of an engineering degree at the Salesian Polytechnic University of Ecuador, of whom 212 are male and the rest are female. Most respondents, specifically 229, are between 18 and 21 years old, while 68 students are between 22 and 35. In addition, two respondents are under 18 years old, and one is over 35. Initially, in addition to gender and age, the 300 students were asked in an online questionnaire to indicate the type of education they completed their baccalaureate, with the following results: 169 completed their baccalaureate in face-to-face mode, 24 online and 107 online.

The study sample consisted of 107 students who completed their baccalaureate in virtual mode, as this sample was in line with the general objective of the

research, which was to evaluate the transition of students who had completed their baccalaureate in virtual mode to a face-to-face higher education model in the post-pandemic period. This sample was selected to avoid research bias and to obtain more accurate and representative results.

2.2 Data collection

The students selected to form the sample were asked to answer 20 additional questions designed to collect quantitative data in the same online questionnaire that was structured in two parts, each with ten questions related to the study's specific objectives, with the above possible, collecting objective and accurate data about the student's experiences and perceptions concerning the study's aim.

2.2.1 The questionnaire

The questionnaire was designed using Forms, an online tool from Microsoft that allows to creation forms and surveys in an efficient way. In the first stage, 20 multiple-choice questions were drafted to measure the research's objectives. To validate the questionnaire, four PhDs in educational sciences collaborated in evaluating the instrument using a scale of 1 to 5, where 1 represented a negative evaluation and five a positive evaluation, taking into account the following specific criteria:

Relevance: Is the question relevant to measure the specific objective mentioned?

Clarity: Is the question straightforward to understand, and does it avoid jargon or technical language that might confuse the respondent?

Accuracy: Is the question formulated in a precise and specific manner? Is ambiguity or vagueness avoided in the wording of the question?

Coherence: Is the question consistent with the previous and subsequent questions in the questionnaire, and is it ordered logically and sequentially?

Complexity: The question does not require specific technical knowledge that respondents may not have.

The average of the four evaluations received to validate the questionnaire was 4.79, indicating a high quality in its design and content. In addition, the evaluators provided valuable feedback to improve the instrument, which allowed for the creation of a final version of the questionnaire that was applied in the research. The tables 1 and 2 show the 20 questions that made up the questionnaire:

Table 1

Questions to measure the first specific objective

Questions	Objective: <i>To identify the challenges that a group of students faced during the pandemic in completing their baccalaureate and to study how this situation may have affected their academic performance in higher education.</i>
Q 1.1	What challenges did you face during your virtual baccalaureate due to the pandemic?
Q 1.2	How did the virtual mode of education during the pandemic affect your academic performance?
Q 1.3	What strategies did you use to adapt to face-to-face education after the online baccalaureate?
Q 1.4	How would you rate access to educational and technological resources during the pandemic?
Q 1.5	Do you think that the virtual baccalaureate provided you with the same learning opportunities as face-to-face education?
Q 1.6	What aspects of face-to-face education at university did you find most challenging after the virtual baccalaureate?
Q 1.7	Do you think face-to-face university education is more effective than virtual baccalaureate education?
Q 1.8	Do you think that the virtual baccalaureate adequately prepared you for face-to-face education at university?
Q 1.9	How would you rate the quality of the virtual baccalaureate compared to face-to-face education at the university?
Q 1.10	How do you think the virtual mode of the baccalaureate affected your ability to acquire social and communication skills necessary for social interaction at university?

Table 2

Questions to measure the second specific objective

Questions	Objective: <i>To analyse how students' lack of understanding of basic principles may have impacted their learning experience during a face-to-face mode of study.</i>
Q 2.1	Do you feel that you had a sufficient understanding of basic principles during your online baccalaureate?
Q 2.2	Do you think that a lack of understanding of basic principles has affected your academic performance in face-to-face higher education?
Q 2.3	Have you had difficulties in adapting to the face-to-face mode of university education due to a lack of understanding of basic principles?
Q 2.4	Have you had to spend more time studying basic principles to keep up

	with the pace of face-to-face university education?
Q 2.5	Do you feel that a lack of understanding of basic principles has affected your learning experience in face-to-face higher education?
Q 2.6	Do you think that virtual learning gave you the tools you needed to understand basic principles?
Q 2.7	Do you feel that your virtual education adequately prepared you for face-to-face higher education?
Q 2.8	Do you think that the lack of face-to-face interaction with your teachers during virtual education affected your understanding of basic principles?
Q 2.9	Do you think that the lack of face-to-face interaction with your classmates during virtual education affected your understanding of basic principles?
Q 2.10	Do you think virtual education is suitable for teaching basic principles fundamental to higher education?

After applying the questionnaire, the student's answers were quantified to conduct a statistical analysis of the information and test the hypothesis put forward. The quantitative information was then triangulated with the qualitative data from group discussions.

2.2.2 Focus groups

After collecting quantitative data through the online questionnaire, the focus group technique was used to collect complementary qualitative data. Four focus groups were formed, with the voluntary participation of six students in each. The discussion was guided by a script designed by the researcher, which allowed for the exploration of specific topics related to the theme of the study. It was decided to conduct only four focus groups, as, after the third group, a pattern was observed in the opinions and responses of the participants.

The focus groups were conducted face-to-face at the university premises, facilitating close and natural interaction between participants. Each group focused on specific issues related to the transition from virtual to face-to-face education in the context of the pandemic. This technique allowed for qualitative data on students' perceptions and experiences about the specific objectives, enriching the results obtained through the online questionnaire.

Several strategies were implemented to ensure the validity and confidentiality of the open-ended question script. Firstly, a pilot test was conducted with a group of participants to assess the clarity and effectiveness of the questions,

considering comments and feedback from participants to make changes to the script. In addition, different types of validity were used to assess whether the hand measured what it was intended to measure, including content, construct, and criterion validity. In this way, the reliability of the script as a research tool was ensured. Tables 3 y 4 present the final script used to guide the focus groups with separate questions for each specific objective:

Table 3

Question script for measuring the first specific objective in the focus groups

Questions	Objective: <i>To identify the challenges that a group of students faced during the pandemic in completing their baccalaureate and to study how this situation may have affected their academic performance in higher education.</i>
S 1.1	Could you describe the main challenges you faced during the pandemic to complete your baccalaureate?
S 1.2	How do you think these challenges might have affected your academic performance in face-to-face higher education?
S 1.3	What resources did you use to overcome these challenges?
S 1.4	Did you receive any support from your educational institution to face these challenges?
S 1.5	Do you feel that virtual education during the pandemic adequately prepared you for social interaction in face-to-face higher education? Why?

Table 4

Question script to measure the second specific objective in the focus groups

Questions	Objective: <i>To analyse how students' lack of understanding of basic principles may have impacted their learning experience during a face-to-face mode of study.</i>
S 2.1	Could you describe any issues that you consider fundamental that you had difficulty understanding during virtual learning during the pandemic?
S 2.2	How do you think this lack of understanding might have affected your learning experience during face-to-face higher education?
S 2.3	Have you had difficulties in adapting to the face-to-face mode of university education due to a lack of understanding of basic principles?
S 2.4	Do you feel that virtual education during the pandemic provided you with adequate preparation for understanding the basic principles in face-to-face higher education? Why?
S 2.5	What changes in virtual education during the pandemic would have helped you to understand better the basic principles needed for face-to-face higher education? Why?

After the focus groups were held, all the information collected was organised by the thematic classification of the generalised responses (tables 5 and 6).

Finally, the data was triangulation based on the results presented from the questionnaire and the focus groups.

2.2.3 Triangulation of quantitative and qualitative data

Once the data was collected, the results obtained were triangulated by combining quantitative and qualitative data. It allowed for a more complete and accurate analysis of the research findings.

Firstly, quantitative analysis of the questionnaires was used to determine general trends and statistics of the data by analysing participants' responses in frequency and percentages. Secondly, qualitative analysis of the focus group discussions was used to delve deeper into participants' experiences and perceptions by analysing participants' responses regarding emerging themes and recurring patterns.

Finally, quantitative, and qualitative data were triangulation to validate and complement the results obtained. These findings were compared to identify similarities, discrepancies and more complete explanations to answer our hypothesis.

2.3 Study limitations

Limitations of this study include the purposive sample selection of 107 participants, which may restrict the generalisability of the results to the target population. In addition, the application of the online questionnaire may have generated selection and response biases, which could have affected the validity of the results. Nevertheless, measures were taken to minimise these biases, such as ensuring the confidentiality and privacy of participants and validating the questionnaire through experts in the field.

3. Results and Discussion

As for the analysis of the data obtained in the research, descriptive statistical techniques were used, such as calculating frequencies and percentages. The

aim was to identify patterns and trends in the student's responses to the questionnaire. In addition, content analysis was used to process the qualitative data. This way, it was possible to identify emerging themes and categories in the focus groups. Then, the data was triangulation to compare the quantitative and qualitative results.

3.1 Quantitative Results: Data Analysis from the Questionnaire

The questions were classified into three cross-cutting categories for each specific objective to carry out the quantitative analysis of the results obtained through the questionnaire.

3.1.1 Analysis of the first specific objective

The ten questions related to the first specific objective have been classified into three main categories addressing the following aspects: *student experience in virtual education due to the pandemic*, which includes questions Q 1.1, Q 1.2, Q 1.4 y Q 1.10; *the comparison between virtual and face-to-face education*, comprising the questions Q 1.5, Q 1.7 y Q 1.9; and *student adaptation to face-to-face education after virtual education*, involving the questions Q 1.3, Q 1.6 y Q 1.8.

Student experience in virtual education due to the pandemic: Appendix A.1 details the results of each question related to students' experience in virtual education during the pandemic.

After analysing the survey conducted with the 107 students who made up the study sample, various conclusions can be highlighted.

Regarding question Q 1.1, which sought students' opinions on the quality of virtual education during the pandemic, 40% of respondents considered the quality "good", while 35% rated it as "fair". This result suggests that most students felt that virtual education during the pandemic was not optimal, but it was sufficient to enable them to continue their education.

In question Q 1.2, which looked to discover how the virtual modality affected students' academic performance, 32% of respondents stated that adapting was

challenging, and their performance temporarily decreased. At the same time, 28% indicated that their academic performance worsened due to the lack of face-to-face interaction with peers and teachers. These findings imply that the virtual modality presented significant challenges for students and harmed their academic performance.

In question Q 1.4, which pursued students' opinions on access to educational and technological resources during the pandemic, 37% of respondents felt it was "good", while 39% rated it as "fair". Only 18% rated it as "excellent". The above indicates that, although most students had adequate access to the necessary resources, they had some obstacles and constraints.

Concerning question Q 1.10, which sought to find out whether students felt that the online mode affected their ability to acquire social and communication skills necessary for social interaction at university, 44% of respondents stated that the online mode prevented them from developing these essential skills, suggesting that online education presents significant challenges in terms of developing social and communication skills.

The questionnaire results suggest that the virtual modality presented significant challenges for high school students during the pandemic. While many could adapt and maintain their academic performance, most felt that virtual education presented limitations in learning opportunities and developing social and communication skills. Considering these findings when planning and designing future virtual learning programmes is essential to ensure that students have adequate access to the necessary resources and can develop the skills necessary for academic and personal success. These results are consistent with those of other studies that have investigated students' experiences of virtual education during the pandemic (Benites, 2021).

Therefore, virtual education programmes must be designed and planned with a broader perspective and focus on learners' needs and expectations. It includes special attention to the accessibility of resources and tools needed for online learning and the promotion of online interaction and collaborative work. Strategies for developing online communication and social skills should also be

implemented to ensure students' more complete and enriching learning experiences.

Comparison between virtual and face-to-face education: Appendix A.2 shows the results of the questions aiming at the comparison between virtual and face-to-face education.

In question Q 1.5, 12% of respondents indicated that virtual baccalaureate education provided them with the same learning opportunities as face-to-face education. In comparison, 24% stated that it generally did provide them with the same opportunities with some challenges. On the other hand, 33% of respondents believed virtual baccalaureate education provided fewer learning opportunities than face-to-face education. In comparison, 31% indicated that it provided them with far fewer opportunities. Overall, there is a trend towards the perception that virtual education is less effective than face-to-face education regarding learning opportunities.

Regarding question Q 1.7 of the questionnaire, the results show that most respondents (67%) believe face-to-face education at university is more effective due to more direct interaction with lecturers and other students, which allows for more comprehensive and deeper learning. On the other hand, 21% of respondents indicated that effectiveness depends on the type of course and the quality of virtual education. In comparison, 9% believe that virtual education can be equally effective due to the flexibility and accessibility it offers. It is important to note that 3 per cent of respondents needed to learn how to answer the question.

Regarding question Q 1.9, which focused on the quality of the virtual versus face-to-face bachelor's degree at the university, 50% of the respondents indicated that the face-to-face education at the university was of higher quality compared to the virtual bachelor's degree due to more interaction with teachers and other students. On the other hand, 21% of the respondents indicated that it was difficult to compare the quality of the two learning approaches as they had different strengths and weaknesses. In comparison, 17% felt that the quality of the virtual baccalaureate was equally good as the face-to-face education at the university and did not notice a big difference in the quality of learning. In

addition, 11% of respondents indicated that the quality of virtual education was better than face-to-face education because of the flexibility and accessibility it offered.

These results reveal a range of views on the effectiveness of virtual education compared to face-to-face education. Most respondents believe that face-to-face education is more effective; a significant proportion of respondents believe that effectiveness depends on the type of course and the quality of virtual education and value the flexibility and accessibility offered by this mode of education. These results support the idea that the quality of learning does not depend exclusively on the mode of delivery but on other factors, such as the quality of instruction and course design (Cano Ibarra et al., 2022; Stecula & Wolniak, 2022).

Overall, the questionnaire results indicate that most participants consider face-to-face education at the university to be more effective and of higher quality than virtual education at the baccalaureate. Participants mentioned that direct interaction with professors and classmates, achieved in face-to-face education, fosters more comprehensive and deeper learning. In addition, the flexibility and accessibility of virtual education were mentioned by some participants as an advantage, but most still prefer face-to-face education at university in terms of educational quality. These results align with previous studies that have found that face-to-face education at university is considered more effective than virtual education in terms of teaching and learning quality (Segovia-García et al., 2022).

However, it is essential to note that the pandemic has led to an unprecedented increase in virtual education, which has led to further exploration and improvement of virtual teaching techniques and tools. As such, the quality and effectiveness of virtual education may improve over time, which could change students' perceptions of how it compares to face-to-face education in the future. *Student adaptation to face-to-face education after virtual education:* This category was analysed from the results summarised in the appendix A.3, where it can be seen in question Q 1.3, related to the strategies used by students to adapt to face-to-face education after the bachelor's degree in virtual mode, that the majority of students (50%) established a daily routine and study schedule to

make sure they were up to date with their homework and assignments. In addition, more than half of the students (53%) used virtual resources and tools, such as virtual tutorials and digital libraries, to complement their classroom learning. These results suggest that students were willing to change their study methods to adapt to face-to-face education.

In question Q 1.6, which asked about the aspects of face-to-face education at university that were most challenging after the virtual bachelor's degree, it was found that lack of social interaction was the biggest challenge reported by students (55%). In addition, the pace of classes (46%) and attention in the classroom (48%) were also reported as significant challenges. It suggests that students may need additional support to adapt to face-to-face education classes' social interaction and pace.

In question Q 1.8, which asked whether students felt that the online bachelor's degree adequately prepared them for face-to-face education at university, it was found that a large percentage of students (40%) did not feel that online education provided them with sufficient social and practical interaction to prepare them for face-to-face education at university adequately. In addition, a considerable percentage of students (22%) felt that virtual education prepared them only to a limited extent for face-to-face education. Given the results, virtual education cannot provide complete preparation for students for face-to-face education, indicating certain limitations that need to be considered in the design and implementation of virtual educational programmes.

Overall, the results of these questions suggest that adapting to face-to-face education after the online baccalaureate may be challenging for students and require changes in their study methods and additional support. In addition, the results indicate that virtual education may have limitations in preparing students for face-to-face teaching. These results are consistent with other research on virtual and face-to-face education (López-Aguilar et al., 2022; Mohammadzadeh et al., 2022), which suggests integrating novel educational methods into curricula to optimise training and minimise the adverse effects of the pandemic on education.

These partial results reveal that students who completed their bachelor's degree in virtual mode during the pandemic faced challenges such as a lack of social interaction and difficulty maintaining motivation. In addition, virtual education may have limitations in preparing students for face-to-face teaching, affecting their academic performance in higher education. There is a need for additional support for students in their transition to face-to-face education and more research on how virtual education may affect students' preparation. Exploring ways to improve students' practice for face-to-face teaching and encourage social interaction would be beneficial. These findings could influence how virtual education and face-to-face education are approached.

3.1.2 Analysis of the second specific objective

About the second specific objective, three cross-cutting themes were identified, addressing the following aspects: *understanding basic principles in virtual education and their impact on face-to-face higher education*, comprising questions Q 2.1, Q 2.2, Q 2.3, Q 2.4 and Q 2.5; *preparing virtual education for face-to-face higher education*, comprising questions Q 2.6 y Q 2.7; and *face-to-face interaction and its impact on the understanding of basic principles during virtual education*, comprising questions Q 2.8, Q 2.9 y Q 2.10.

Understanding basic principles in virtual education and their impact on face-to-face higher education: Virtual education has become an increasingly common mode of delivery today. However, its impact on understanding the basic principles and its relationship to academic performance in face-to-face higher education is still a matter of debate. This part of the research sought to assess university students' perceptions of their understanding of basic principles during their online bachelor's degree and its relationship to academic performance in face-to-face higher education. The appendix A.4 shows the detailed results described in the following lines.

The results indicate that 60% of the respondents needed more support to understand basic principles during their virtual bachelor's, or they felt they needed more practical examples to improve their understanding. In addition, 48% believe that a lack of knowledge of fundamental principles has harmed their academic performance in face-to-face higher education. Furthermore, 38%

of the respondents have needed help adapting to the face-to-face mode of university education due to the lack of these principles. This result suggests that including practical activities can be beneficial in improving the understanding of basic principles in virtual learning.

Based on the above, many respondents experienced difficulties understanding the basic principles during their virtual bachelor's. This lack of understanding has negatively affected their academic performance in face-to-face higher education and has made some of them have difficulties adapting to the face-to-face mode of university education. These results highlight the importance of providing adequate support to students during virtual education to transition to face-to-face education and continue their academic success effectively.

Regarding the need for more understanding of the basic principles of the learning experience in face-to-face higher education, 76% of respondents believe it has had a negative impact to a greater or lesser extent. These findings are consistent with previous research that has found that virtual education can harm the understanding of the basic principles and their relationship to academic performance in face-to-face higher education (Ferrer et al., 2023). In this regard, it is essential to consider these results when designing virtual learning programmes and evaluating the effectiveness of this in the long term.

Preparing virtual education for face-to-face higher education: The data presented in the appendix A.5 shows a mixed perception among respondents. In question Q 2.6, which asked whether virtual education provided the necessary tools to understand critical issues, 32% of respondents said no, while 47% said yes or to some extent. It is important to note that these responses may be influenced by factors such as the quality of the virtual education received and the respondents' previous experience with virtual learning. Therefore, further research in this area is recommended to obtain a more complete picture of the benefits and limitations of virtual learning in understanding key topics.

In this regard, other studies point out that virtual education can effectively teach the basic principles as long as appropriate pedagogical strategies are used

(Villa-Ochoa et al., 2023), and interaction between students and teachers is encouraged. In addition, the results can be influenced by factors such as the level of motivation and the student's self-management skills.

In question Q 2.7, which asked whether virtual education adequately prepared them for face-to-face higher education, 41% of respondents said no, while 48% said yes or to some extent. However, it is essential to note that virtual and face-to-face education are not mutually exclusive but can complement and reinforce each other. Therefore, the results suggest that virtual education can effectively teach the basic principles and prepare for face-to-face higher education, provided that appropriate pedagogical strategies are implemented and interaction between students and teachers is encouraged.

Face-to-face interaction and its impact on the understanding of the basic principles in virtual education: Concluding the analysis of the quantitative results, appendix A.6 shows the statistics obtained for questions Q 2.8, Q 2.9, and Q 2.10 of the questionnaire.

In the responses to questions Q 2.8 and Q 2.9, most respondents indicated that the lack of face-to-face interaction with teachers and classmates during virtual education negatively affected their understanding of the basic principles. Approximately 77% and 65% of respondents indicated that the lack of interaction affected their knowledge of essential topics at least somewhat.

The above is a common concern in virtual education, as in-person interaction and non-verbal communication can be essential to students' understanding and practical learning (Wang et al., 2022). That is, a lack of in-person interaction can lead to increased isolation and disconnection from the learning community, which can negatively affect students' motivation and engagement.

Regarding question Q 2.10, most respondents (78%) indicated that virtual education is suitable for teaching basic principles, although only 18% said it is entirely reasonable. It suggests that students consider virtual education effective for certain types of learning and that it can be a complement or alternative to face-to-face teaching.

Based on the above, it can be assumed that students who completed secondary education in virtual mode during the pandemic faced significant challenges in transitioning to face-to-face teachings, such as a lack of social interaction and difficulty maintaining motivation. However, the effectiveness of virtual education depends mainly on how it is integrated into the higher education curriculum, with curriculum designs adapted to a post-pandemic reality (Engelbrecht et al., 2023). Therefore, educators and institutions should prioritise the effective implementation and integration of virtual education by providing additional support to students, fostering communication and collaboration among them, and conducting further research to improve the quality of education in all domains.

Furthermore, this study phase highlights that the lack of face-to-face interaction during virtual education can harm understanding the basic principles. However, most students still consider virtual education suitable for teaching these subjects to some extent. Therefore, priority should be given to implementing and integrating virtual education in higher education to maximise its effectiveness.

3.2 Qualitative Results: Analysis from the Focus Group Discussions

The qualitative data obtained through the focus groups related to students' learning experience during virtual education in the context of the COVID-19 pandemic and their transition to face-to-face education are discussed below.

The focus groups provided a platform for participants to share their experiences, perspectives, and opinions on the challenges they faced during virtual education and their expectations and perceptions of face-to-face teaching. The data analysis sought to identify the recurring themes that emerged in the focus groups to understand better the student's experience and the basic principles that require attention in transitioning from virtual to face-to-face education.

The student responses to each question were categorized into generic themes for easy analysis and presentation, as shown in Tables 5 and 6.

Table 5
 Responses classified by themes for the first specific objective

Questions	Answers	Themes
S 1.1	Adaptation, access to technology, lack of motivation, mental health problems, lack of concentration, limited interaction with peers and teachers, challenges in time management and organisation of schoolwork.	Challenges during the pandemic
S 1.2	Difficulty in completing homework, participating in classes, and meeting deadlines. Poor performance and difficulty in keeping up with the pace of the course.	Academic performance.
S 1.3	Support from family and friends, participation in virtual study groups, finding online resources and working in a structured environment to separate academics from personal life.	Strategies to overcome challenges
S 1.4	Little or no support was received from their educational institutions to address these challenges. Those who received some support mentioned providing online resources and emotional support from teachers.	Educational support.
S 1.5	Some students reported that they experienced a lack of social interaction during virtual education, which affected their ability to interact with their peers and teachers in face-to-face teaching. They also indicated that virtual education did not provide them with the social and emotional skills necessary to adapt adequately to face-to-face instruction.	Social challenges

In terms of the challenges faced by students during the pandemic (S 1.1), several factors have been mentioned, such as adaptation to virtual education, lack of access to appropriate technology, lack of motivation, mental health issues, lack of concentration, limited interaction with peers and teachers, challenges in time management and organisation of schoolwork. These findings suggest that the COVID-19 pandemic has significantly impacted students' educational experience and that multiple challenges have emerged that need to be addressed to improve the quality of education in similar situations.

On the other hand, regarding academic performance (S 1.2), students reported difficulties in completing assignments, participating in classes, and meeting deadlines, which has affected their ability to keep up with the pace of the course and their overall performance. These results are worrying, as they indicate that virtual education could harm students' academic performance if the challenges related to adapting to this mode of delivery are not adequately addressed. Therefore, educational institutions must consider these challenges when

developing future teaching and support strategies for students facing similar situations.

Concerning the strategies used by students to overcome challenges during the pandemic (S 1.3), the importance of support from family and friends was highlighted, as well as the search for online resources. Participation in virtual study groups and the need to work in a structured environment to separate academic work from personal life were also mentioned. These results indicate that students had to draw on various resources and strategies to overcome the challenges of the pandemic and suggest that adaptability and resilience are important factors for academic success during difficult times. However, it is essential to note that institutional support was rare and that students had to rely heavily on their own ingenuity and personal resources to cope with these challenges.

In question S 1.4, it was revealed that most of the students surveyed needed more support from their educational institutions to face the challenges of virtual education. Those who received some support mentioned providing online resources and emotional support from teachers. These findings highlight the need for educational institutions to provide more comprehensive and practical support to students during crises, such as the pandemic, so that they can overcome challenges more effectively and succeed in their education.

Finally, in question S 1.5, it was revealed that most students felt unprepared for face-to-face education due to various reasons. Lack of social and emotional skills needed to interact with peers and teachers, poor quality of education received during virtual education and lack of social interaction were the main factors. The results mentioned are consistent with other research conducted during the COVID-19 pandemic that has highlighted the multiple challenges students face in virtual education, including lack of motivation, mental health issues and difficulties managing time and schoolwork. Previous studies have also mentioned the importance of emotional support and online resources. Overall, these findings underline the need for educational institutions to provide more comprehensive and practical support to students during crises and to work to prepare students effectively for face-to-face education.

Against this background, educational institutions must take steps to adequately prepare students for the transition from virtual to face-to-face education. Attention needs to be paid to academic content and the development of social and emotional skills that enable them to interact effectively with their peers and teachers in a face-to-face learning environment. In addition, educational quality issues must be addressed during virtual education to ensure that students receive adequate instruction and are prepared for the next step (UNESCO, 2022). Overall, educational institutions must consider these factors and work to prepare students for face-to-face teaching effectively.

Table 6 shows the ranking of the answers obtained by the students after sorting by general topics.

Table 6
Responses classified by themes for the second specific objective

Questions	Answers	Themes
S 2.1	Participants mentioned different topics they considered fundamental, such as calculus, physics, chemistry, and statistics. Some indicated they had difficulties understanding these topics due to the lack of interaction with teachers and classmates during virtual education.	Deficiencies in understanding the basic principles.
S 2.2	Students indicated that a lack of understanding of basic principles might have negatively affected their learning experience during face-to-face higher education. Some of these topics are necessary to understand other concepts in later courses. In addition, a lack of understanding could affect their ability to keep up with and actively participate in class.	Impacting the learning experience.
S 2.3	Some participants noted needing help adjusting to the face-to-face teaching mode due to a need for more understanding of the basic principles. One of the main problems mentioned was the fast pace of teaching in face-to-face higher education compared to virtual education.	Difficulties in adjusting to the traditional teaching environment.
S 2.4	Students indicated that virtual education during the pandemic needed to adequately prepare them for face-to-face higher education in terms of understanding basic principles. They noted that a lack of practice in problem-solving was among the factors that contributed to this lack of preparation.	Academic preparedness.
S 2.5	Participants noted that implementing changes to virtual education during the pandemic, such as increased interaction with professors and classmates, immediate feedback and the inclusion of more hands-on activities,	Changes needed in education virtual.

would have improved their understanding of the basic principles needed for face-to-face higher education.

Based on the participants' responses, a lack of understanding of fundamental topics can significantly affect the learning experience during a face-to-face mode of study in higher education. Students mentioned that the lack of interaction with lecturers and classmates was one of the main reasons they needed help understanding these topics.

This finding is consistent with previous literature, highlighting the importance of social and academic interaction in students' learning in higher education. Lack of interaction can limit students' ability to ask questions and receive immediate feedback on their work, affecting their understanding and ability to participate in class actively. In addition, students indicated that a lack of knowledge of the basic principles may also affect their ability to keep up with and actively participate in class. It can increase the risk of students feeling demotivated and disengaged from learning.

On the other hand, students also highlighted that virtual education during the pandemic did not adequately prepare them to understand fundamental topics. Lack of practice in problem-solving was one of the factors contributing to this lack of preparation. It suggests the need to improve the quality of virtual education and to ensure that students have access to sufficient opportunities for practice and feedback to develop fundamental skills and knowledge.

Findings from the group discussions highlight the need to address fundamental topics in higher education that should have been acquired in the baccalaureate to improve students' learning experience in face-to-face study modes. These results have important implications for educational practice and suggest the need for careful attention to core subjects in higher education. Specifically, lecturers may consider strategies that allow for more immediate interaction and feedback with students and include more hands-on activities to enhance understanding of these essential topics. In addition, the results highlight the importance of well-structured virtual education for face-to-face higher education.

On the other hand, students also highlighted that virtual education during the pandemic did not adequately prepare them to understand fundamental topics. Lack of practice in problem-solving was one of the factors contributing to this lack of preparation. It suggests the need to improve the quality of virtual education and to ensure that students have access to sufficient opportunities for practice and feedback to develop fundamental skills and knowledge.

Findings from the group discussions highlight the need to address fundamental topics in higher education that should have been acquired in the baccalaureate to improve students' learning experience in face-to-face study modes. These results have important implications for educational practice and suggest the need for careful attention to the basic principles in higher education. Specifically, lecturers may consider strategies that allow for more immediate interaction and feedback with students and include more hands-on activities to enhance understanding of these essential topics. In addition, the results highlight the importance of well-structured virtual education for face-to-face higher education.

Thus, strategies are needed to improve social and academic interaction in the classroom and improve the quality of virtual education and the preparation of students for the face-to-face mode of study. It could enhance understanding of the basic principles required for face-to-face higher education and ultimately improve students' learning experience and academic success.

3.3 Results Triangulation: Analysis of Quantitative and Qualitative Data

About the first specific objective, the results of quantitative data revealed that most students faced difficulties adapting to virtual education during the pandemic, resulting in a temporary decrease in their academic performance. Furthermore, virtual education presented significant challenges in limited access to educational and technological resources and social and communication skill development. Qualitative data suggest that virtual education may harm students' academic performance if the challenges of adapting to this teaching mode are not adequately addressed.

Regarding the comparison between virtual and face-to-face education, both quantitative and qualitative data indicate that most students believe that face-to-face education is more effective and of higher quality than virtual education in high school. However, a significant proportion of respondents believe that effectiveness depends on the type of course and the quality of virtual education. Likewise, quantitative, and qualitative data suggest that transitioning from virtual education to face-to-face education in the post-pandemic period presents unique challenges. Students were willing to change their study methods to adapt to face-to-face education, but they may need additional support to adjust to social interaction and the pace of classes. Additionally, most students felt unprepared for face-to-face education due to a lack of social and emotional skills, poor quality of education received during virtual education, and lack of social interaction.

On the other hand, concerning the second specific objective, triangulation of the results obtained suggests that virtual education may harm understanding fundamental topics, which can negatively affect academic performance in face-to-face higher education. Online interaction during virtual education can also help in understanding fundamental topics. However, virtual education can effectively teach fundamental topics and prepare for face-to-face higher education if appropriate pedagogical strategies are implemented and interaction between students and teachers is encouraged.

Furthermore, qualitative findings highlight the need to revisit fundamental topics in higher education and improve the quality of virtual education. Specifically, in virtual education, teachers may consider strategies that allow for more significant interaction and immediate feedback with students and include more practical activities to enhance understanding of these essential topics. Additionally, strategies must be implemented to improve the interaction between students and teachers during virtual education.

4. Conclusions

In conclusion, the data obtained in this research support the hypothesis that the rapid transformation to virtual education due to the COVID-19 pandemic has

harmed students' learning and academic performance and that the transition from a virtual baccalaureate to face-to-face higher education in the post-pandemic period has presented unique challenges and required specific adaptation strategies. The results also suggest that a lack of social and emotional skills and poor educational quality may have left students in a difficult situation to adapt to face-to-face education in higher education. These findings are essential for educators and educational institutions in designing and implementing virtual education programmes and in planning for the transition to face-to-face teaching in the future since, although it is no longer a pandemic where this type of education is mandatory, it is becoming increasingly common for educational institutions to have virtual offerings in their academic programmes.

Finally, it is recommended that virtual education programmes be designed with the results of this research in mind and that attention be paid to the implementation and effective integration of virtual education in higher education to maximise its effectiveness. It is essential that the fundamental issues in higher education are revisited and that interaction between students and teachers is encouraged in both virtual and face-to-face education.

Appendix

Results obtained in the questionnaire for first specific objective.

Appendix A.1

Student experience of virtual education due to the pandemic

Questions	Frequency	%
1.1-What challenges did you face during your virtual baccalaureate due to the pandemic?		
Lack of face-to-face interaction with my peers and teachers	82	77%
Difficulty in staying motivated and focused in virtual education.	73	68%
Lack of access to appropriate technology equipment and tools at home.	29	27%
Difficulty in adapting to new virtual education systems and platforms.	44	41%
Lack of emotional support and mental well-being.	48	45%
Lack of opportunities to participate in extra-curricular activities and social events.	57	53%
1.2 How did the virtual mode of education during the pandemic affect your academic performance?		
It improved my academic performance due to the flexibility	16	15%

that virtual learning offers.		
My academic performance deteriorated due to the lack of face-to-face interaction with my peers and teachers.	30	28%
I found it challenging to adapt to virtual education and my academic performance temporarily decreased.	34	32%
Despite the challenges, I was able to maintain my academic performance thanks to the help and support of my teachers and classmates.	27	25
1.4 How would you rate access to educational and technological resources during the pandemic?		
Excellent: Students had easy and full access to the necessary educational and technological resources.	19	18%
students generally had adequate access to the necessary educational and technological resources.	40	37%
Fair: Students faced some challenges in accessing the necessary educational and technological resources.	42	39%
Poor: Students had limited or no access to the necessary educational and technological resources.	6	6%
1.10-How do you think the virtual mode of the baccalaureate affected your ability to acquire social and communication skills necessary for social interaction at university?		
I had enough opportunities to develop social and communication skills.	21	20%
The virtual mode of the baccalaureate prevented me from developing social and communication skills.	47	44%
The virtual mode of the baccalaureate did not significantly affect my ability to acquire social and communication skills.	27	25%
I am not sure.	12	11%

Appendix A.2

Comparison between virtual and face-to-face education

Questions	Frequency	%
1.5-Do you think that the virtual baccalaureate provided you with the same learning opportunities as face-to-face education?		
Yes, definitely.	13	12%
In general, yes: albeit with some challenges.	26	24%
I am not sure.	35	33%
No, definitely not.	33	31%
1.7- Do you think face-to-face university education is more effective than virtual baccalaureate education?		
Yes, because it allows for more direct interaction with teachers and other students, which fosters more complete and deeper learning.	72	67%
It depends on the course type and the virtual education quality. If a good platform is used and sufficient virtual interaction with teachers and other students is provided, then it can be equally effective.	22	21%
Not necessarily, as virtual education can offer greater	10	9%

flexibility and accessibility for those with personal and professional responsibilities.		
I don't know, as it depends on many factors, such as the quality of education, the type of subject taught, the type of student and personal preference.	3	3%
1.9-How would you rate the quality of the virtual baccalaureate compared to face-to-face education at the university?		
I think the quality of my online baccalaureate was just as good as the face-to-face education at the university, and I did not notice a big difference in the quality of learning.	19	17%
Overall, I feel that the face-to-face education at the university has been of higher quality than my online bachelor's degree due to more interaction with professors and other students.	54	50%
I believe that the quality of my education in the virtual baccalaureate was better than the face-to-face education at the university because of the flexibility and accessibility it offered.	12	11%
I believe that the quality of my education in the virtual baccalaureate and the face-to-face education at the university are difficult to compare, as they are different learning approaches with different strengths and weaknesses.	23	21%

Appendix A.3

Student adaptation to face-to-face education after virtual education

Questions	Frequency	%
1.3 What strategies did you use to adapt to face-to-face education after the virtual baccalaureate?		
Attend orientation sessions and workshops offered by the university for first-level students.	19	18%
Established a daily routine and study schedule to ensure I was on top of my homework and assignments.	54	50%
Ask questions and seek help from teachers and classmates when I had doubts or difficulties.	43	40%
Participate in extracurricular activities and social events to meet other students and make connections.	17	16%
Use virtual resources and tools, such as virtual tutorials and digital libraries, to complement my classroom learning.	57	53%
1.6-What aspects of face-to-face education at university did you find most challenging after the virtual baccalaureate?		
Lack of social interaction: Difficulty in adjusting to social interaction in a face-to-face university environment, especially if you are not used to working in a team with other students.	59	55%
Attention in the classroom: Challenge to maintain attention in a university classroom due to the presence of other students and other stimuli.	51	48%

Time management: Difficulty managing time effectively to fulfil all responsibilities, including attending classes and meeting deadlines for assignments.	38	36%
Pace of classes: Adapt to the pace of classes in a face-to-face university environment, which may be faster than you are used to.	49	46%
Workload: Difficulty managing your workload, especially if you have other responsibilities such as a part-time job or extracurricular activities.	43	40%
1.8-Do you think that the virtual baccalaureate adequately prepared you for face-to-face education at university?		
Yes, I believe that the online baccalaureate prepared me adequately for face-to-face education at university.	19	19%
To some extent, as virtual education allowed me to acquire valuable knowledge and skills, but it did not fully prepared me for the face-to-face university environment.	24	22%
Not really, as virtual education did not offer enough social interaction and practice to prepare me for face-to-face education at university adequately.	43	40%
It depends on the courses and the quality of the virtual education I received, but in general I feel that I could have been better prepared if I had more experience in a face-to-face environment.	21	20%

Results obtained in the questionnaire for the second specific objective.

Appendix A.4

Understanding basic principles in virtual education and their impact on face-to-face higher education

Questions	Frequency	%
2.1-Do you feel that you had a sufficient understanding of basic principles during your online baccalaureate?		
Yes, I think that was enough.	27	25%
No, I feel I needed more support to understand the basic principles.	43	40%
While I think I understood most of the basic principles, I think it would have been useful to have more practical examples and exercises.	21	20%
I am unsure if my understanding was sufficient during my virtual baccalaureate; I would have to evaluate my performance and knowledge in each subject.	16	15%
2.2-Do you think that a lack of understanding of basic principles has affected your academic performance in face-to-face higher education?		
No, I don't think so.	34	32%
Yes, I feel it has had a negative impact on my academic performance.	51	48%
I am unsure, as I am still in my first year of face-to-face higher education and have not had enough opportunity to	10	9%

assess how my prior knowledge has affected my performance.		
I think the lack of understanding of some fundamental subjects has affected my performance in certain subjects, but overall, it has not been a determining factor in my academic performance.	12	11%
<hr/>		
2.3- Have you had difficulties in adapting to the face-to-face mode of university education due to a lack of understanding of basic principles?		
Yes, I have had difficulties.	41	38%
No, I have had no difficulties.	32	30%
I have had some difficulties in adapting, but not necessarily due to a lack of understanding of the basic principles.	22	21%
I cannot determine whether the lack of understanding of the basic principles has affected my adaptation to the face-to-face mode of university education, as I have had other factors that have also played a role.	12	11%
<hr/>		
2.4- Have you had to spend more time studying basic principles in order to keep up with the pace of face-to-face university education?		
Yes, I had to invest a lot of time in it.	45	42%
I had to invest some time.	40	37%
No, I didn't have to invest a lot of time.	19	18%
No, I didn't have to invest any time.	3	3%
<hr/>		
2.5- Do you feel that a lack of understanding of basic principles has affected your learning experience in face-to-face higher education?		
Yes, it has definitely done so negatively.	39	36%
Yes, I think it has affected my learning experience in face-to-face higher education a bit.	43	40%
No, I don't think it has affected my learning experience in face-to-face higher education very much.	18	17%
No, it has not affected my face-to-face higher education learning experience.	7	7%

Appendix A.5

Preparing virtual education for face-to-face higher education

Questions	Frequency	%
2.6- Do you think that virtual education gave you the tools you needed to understand basic principles?		
Yes, virtual education provided me with the necessary tools to understand the basic principles.	19	18%
Yes, to some extent, virtual education gave me the tools I needed to understand the basic principles.	31	29%
No, virtual education did not provide me with the necessary tools to understand the basic principles.	34	32%
I am unsure if virtual education gave me the tools to understand the basic principles.	23	21%

2.7- Do you feel that your virtual education adequately prepared you for face-to-face higher education?		
Yes, my virtual education prepared me adequately for face-to-face higher education.	18	17%
Yes, to some extent, my virtual education prepared me for face-to-face higher education.	33	31%
No, my virtual education did not adequately prepare me for face-to-face higher education.	44	41%
I am unsure if my virtual education prepared me adequately for face-to-face higher education.	12	11%

Appendix A.6

Face-to-face interaction and its impact on the understanding of basic principles in virtual education

Questions	Frequency	%
2.8- Do you think that the lack of face-to-face interaction with your teachers during virtual education affected your understanding of basic principles?		
Yes, definitely.	52	30%
Yes, I think it affected it a little bit.	50	47%
No, I don't think it has affected me.	15	14%
No, it did not affect it at all.	10	9%
2.9-Do you think that the lack of face-to-face interaction with your classmates during virtual education affected your understanding of basic principles?		
Yes, it definitely had a negative impact.	29	27%
Yes, I think it affected it a bit.	41	38%
No, I don't think it has affected much.	29	27%
No, it did not affect it at all.	8	7%
2.10- Do you think virtual education is suitable for teaching basic principles fundamental to higher education?		
Yes, virtual education is appropriate.	19	18%
Yes, to some extent virtual education is appropriate.	37	35%
No, virtual education is not adequate.	44	41%
I am not sure.	7	7%

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