Article

Models of Future Teachers' Adaptation to New Post-Pandemic Digital Educational Scenarios

Ángela Martín-Gutiérrez [1], María Dolores Díaz-Noguera [2], Carlos Hervás-Gómez [2,* and Gloria Luisa Morales-Pérez [3]

[1] Department of Education, International University of La Rioja (UNIR), 26006 Logroño, Spain; angela.martin@unir.net and Department of Theory and History of Education and Social Pedagogy, University of Seville (US), 41013 Seville, Spain
[2] Department of Teaching and Educational Organisation, University of Seville (US), 41013 Sevilla, Spain
[3] University School of Osuna, 41640 Osuna, Spain
* Correspondence: hervas@us.es

Abstract: The aim of this study was to determine the post-pandemic learning adaptation scenarios from the perspective of university students from the Faculty of Education Science of the University of Seville (Spain) as a function of the competencies identified in the context of digital transformation. This was a non-experimental, descriptive study that used a short version of the Scale of Attitudes on the Perceptions of Future Teachers toward the New Post-pandemic Educational Scenarios (SANPES). The sample consisted of 972 students of the University of Seville (Spain) (72% women, 28% men), registered in the academic year 2021–2022. A cluster analysis was performed, using a hierarchical procedure (dendrogram), followed by a non-hierarchical procedure (k-means algorithm). The results show significant differences in the responses of the university students. Conclusions: progressive models or scenarios of adaptation to post-pandemic learning based on some student competencies, such as motivation, collaboration, self-learning and digital methodology: (a) initial adaptation model, (b) moderate adaptation model, and (c) advanced adaptation model.

Keywords: post-pandemic; higher education; digital competence; motivation; collaboration; digital methodology

1. Introduction

The education community, in general, and Higher Education (HE), in particular, are in a constant process of digital evolution. Undoubtedly, the COVID-19 pandemic caused unexpected learning situations in which everyone had to adapt to a different way of communicating. This led to deep reflections on aspects that impact the educational organisations, the students and the educators. The educational scenarios have changed, although in the last few decades, new active methodologies have been rapidly developed as a consequence of the advance of the digital resources, generating new educational actions. However, the pandemic forced us to rethink the teaching methods and to incorporate online teaching methods; therefore, it is important to explore the effect of these new learning models on future teachers, which resources are the most adequate, what educational benefits have been obtained, and how the new learning landscapes (are interdisciplinary educational situations that are designed in active learning methodologies, and allow to have diverse and inclusive processes in the classroom) must be designed. The present study contributes to the literature on the perceptions of students during the state of alarm [1].

2. Literature Review

The hangover caused by the passage of the COVID-19 pandemic in Higher Education (HE) has provided us with a lot of information on the learning models adopted. This is not a statement without arguments, we can corroborate that there have been abundant systematic reviews [1] on the needs that have been detected during this period (organisational variables, material resources, perceptions of students, teachers, etc.). The objectives have been very diverse, we would like to highlight how the research sought to understand the impact of what had happened in different areas, for example, to understand the landscape of sustainability [2], as indicated by these authors, there has been a change in the objectives that higher education had set globally. The Sustainable Development Goals (SDGs) of the United Nations were the challenge, but these priorities were changing due to the pandemic. With this premise of change in teaching and learning situations in Higher Education we are fortunate to find ourselves with assessments of the prior situations essential for authentic sustainability studies plans to be developed [3]

2.1. The Influence of Motivation in Post-Pandemic Scenarios

Motivation has been the focus of numerous studies [4,5]. It is a combination of multiple cognitive, metacognitive, motivational and social factors that affect the performance of the aspects inherent to the learning process. The key scientific research on motivation aims to identify the internal state of students, with the aim of determining its activation mechanisms in learning [6].

Motivation is linked to the students' freedom of choice regarding the education itineraries: the purpose is that each student can design his/her own education itinerary or Personal Learning Environment (PLE). This option allows advancing in Educational Digital Transformation (EDT). In the educational scope, it is possible to develop the multiple learnings and opportunities offered by Learning Ecologies (LEs). Moreover, we had the chance to identify the key elements that allow for these learning situations, thanks to the experience of the New Post-pandemic Scenarios [7]. This newly acquired knowledge leads us to continue working on the concept of autonomy and the self-regulated learning of our students, which are key in the participation of the educational robotics practical lectures.

Overcoming this challenge will give students the opportunity to incorporate to the new social projection, where the labour environments emerge in constant crisis management (health, economic or social), and thus they must be very sensitive to the demands of development agendas, such as the 2050 Agenda.

2.2. Collaboration in the Post-Pandemic Scenarios

Cooperative learning is defined as an educational methodology based on working in small groups, generally heterogeneous, in which the students work together to improve their own learning and that of the other members of the group [8]. In educational robotics, cooperative learning is an essential aspect to attain this open and flexible pedagogy. However, personal learning is a fundamental element for the significance of the entire process. In the last few decades, new methods have been proposed to integrate the digital and physical spaces in Higher Education. In this sense, the COVID-19 pandemic caused the modification of the traditional roles, placing the focus of learning on the student and recognising his/her face-to-face and online work. Personal Learning Environments (PLEs) are key; the studies conducted on these environments analyse the positive attitudes that students must develop to make the most of this work proposition. Thus, studies such as that performed by [9] lead us to reflect on capacities related to self-regulation, e.g., metacognition and time management.

Students must be aware of their own PLE, which requires them to be literate in emerging digital tools.

2.3. Self-Learning in Post-Pandemic Scenarios

Learning-by-doing is generally considered the most effective way of learning [10]. Situated learning is a modality that emerges from practice, in meaningful situations of real life, which requires the dynamic and conscious participation of the student. In this learning approach, all knowledge is defined as situated, since it occurs in a certain context, as a result of the activity, context, culture and social interaction with other people. Similarly, to attain a situated learning, this must be accompanied by reflective and experiential teaching-learning strategies that allow transforming the daily practices of the classroom. In this sense, the experiences of educational robotics meet this objective. Thus, it can be asserted that the paradigm of situated learning goes beyond "doing" and performing activities, as it involves a social practice within a context in which the student participates in a community. The great potential of digital situated learning is the improvement of student motivation, due to its interactive nature, which allows manipulating the robot and verifying, with the group of students, the problems and solutions proposed [11].

2.4. Digital Methodology in the Post-Pandemic Scenarios

Educational communities are composed by users who share similar views and behaviours, establishing knowledge networks. Therefore, the changes in interactive learning environments are ecologically related among individuals and communities. In this sense, research has been focused on academic performance, the efficacy of learning (both cognitive and emotional), satisfaction and self-efficacy. Baturay (2011) identified a strong relationship between the content proposed and the students in interactive learning [12]. Consequently, it is especially interesting to know how learning ecologies and the communities that compose them adapt to the changes in the educational environment caused by the COVID-19 pandemic, particularly in higher education and future teacher training. Thus, studies must go beyond isolated digital training actions. Universities must design and develop adequate strategies, such as in the case of teacher digital competence, with policies of teacher recognition, counseling and support in the use of digital resources [13]. Likewise, several studies have pointed out the key elements of institutional strategies [14].

Students must develop their critical thinking, becoming content curators in the era of information overflowing. They must be able to integrate emerging resources and technologies and carry out activities that allow them to express themselves creating digital products and developing communication processes with their peers in networks collaboratively.

Derived from the above, this research aims to find out whether there are different scenarios of adaptation to post-pandemic learning depending on the competences identified in the context of digital transformation (motivation, collaboration, self-learning and digital methodology), that influence the learning of future education professionals.

3. Materials and Methods

The aim of this descriptive, non-experimental study was to identify the possible scenarios of adaptation to post-pandemic learning from the perspective of university students of Early Childhood and Primary Education from the Faculty of Education Science of the University of Seville (Seville, Spain) as a function of the competencies identified in the context of digital transformation.

Considering the accessibility of university students as the selection criterion, a non-probabilistic sampling was applied, which produced a sample of 972 students from the University of Seville, registered in the Faculty of Education Science in the academic year 2021–2022. Specifically, 716 students were registered in the Degree of Early Childhood Education and 256 students were registered in the Degree of Primary Education.

Next, Table 1 presents the characteristics of the sample.

Table 1. General and specific characteristics of the selected sample.

Students of the Faculty of Education Science = 972	
Characteristics of Early Childhood Education students	Characteristics of Primary Education students
• Most of the participants were women (86.5% women; 13.5% men).	• Most of the participants were women (77% women and 23% men).
• Of this subsample, 43.2% were 18–24 years old.	• Of this subsample, 85.9% were 18–24 years old.
• Of the entire sample of 972 students, 716 were registered in the Degree of Early Childhood Education.	• Of the entire sample of 972 students, 256 were registered in the Degree of Early Childhood Education.
• The percentages of students according to year of the degree were 20.3%, 34.4%, 3.1% and 42.2% in the 1st, 2nd, 3rd and 4th year, respectively.	• The percentages of students according to year of the degree were 36.5%, 12.9%, 21.3% and 29.3% in the 1st, 2nd, 3rd and 4th year, respectively.

The instrument selected in this study was the Scale of Attitudes on the Perceptions of Future Teachers toward the New Post-pandemic Educational Scenarios (SANPES) [15]. This questionnaire emerged from the exploration of previous questionnaires [4,16,17]. To create the SANPES, from among the cited instruments, we selected 32 items (scored in a Likert scale, where 1 = "I totally disagree", and 5 = "I totally agree") that encompass questions gathered in the following dimensions: resources (hardware-software) used in online teaching; professional collaboration among students in this modality; knowledge about digital pedagogy; and student empowerment. Moreover, we added another 5 items related to the creation of the respondent profile (sex, age, degree year, group and degree).

Next, Table 2 presents the structure of the selected instrument.

Table 2. Structure of the Scale of Attitudes on the Perceptions of Future Teachers toward the New Post-pandemic Educational Scenarios (SANPES).

Dimensions	Items
Sociodemographic data	1. Sex
	2. Age
	3. Year
	4. Group
	5. Degree
Resources (hardware-software)	6. If the computers of the faculty were available to me, I would have used them instead of my own computer.
	7. My devices/tools help me to better learn the subjects compared to those provided by the faculty.
	8. My devices/tools meet the requirements of the platform.
	9. How difficult was it to learn the use of the digital environment of the platform?
	10. In the future, I would rather use my own resources (devices/tools) instead of those provided by the faculty.
Professional collaboration	11. How does online education affect your interaction with your peers? (very negatively–very positively).
	12. How frequently do you ask your peers for help during online teaching?
	13. To what extent do you ask other students for help exclusively for academic purposes?
	14. How frequently are your online meetings with other students focused on academic purposes?

	15. How much do you miss being face-to-face (without masks) with your classmates?
	16. How important do you think it is that the teacher uses a web cam in the lectures?
	17. In my opinion, I learn better in face-to-face lectures than in online lectures.
	18. How important is it for you to verbally interact with the teacher every week?
	19. To what extent does the teacher help you to understand the topics of the subject if you can ask questions during the online lecture?
	20. Do you prefer online lectures in the future?
Digital pedagogy	21. Is it difficult to adapt to the situation of online theoretical lectures?
	22. Is it difficult to adapt to the online practical assignments/activities/tasks?
	23. To what extent did you participate in the online lectures?
	24. Do you believe that online education is useful?
	25. To what extent do you enjoy online education?
Student empowerment	26. In an online lecture, I prefer the material of the subject that truly challenges me to learn new things.
	27. I believe that online teaching significantly improves the quality of university education.
	28. Online lectures are less interesting than face-to-face lectures.
	29. If I study adequately, I can learn the subject matter.
	30. I think I can use what I learn in this subject for other things.
	31. I believe that I will get an excellent mark in this subject.
	32. Obtaining a good mark in this subject is most satisfactory to me at present.
	33. For me, it is important to learn the topics of this subject.
	34. When I take an exam, I think about the consequences of failing.
	35. I am strongly interested in the contents that I am learning in this subject.
	36. I am sure I can do a great job in the assignments and exams of this subject.
	37. I believe that the material of subject is useful for learning.

Source. Developed by author from Díaz-Noguera et al., (2022) [15].

The factors that integrate the SANPES define a model that determines the capacity of students to adapt to digital transformation in university education through their perceptions. This questionnaire was administered in November 2021 through the Google Forms platform. All participants were informed that their anonymity was guaranteed, and they gave their consent to participate voluntarily; it was explained to them why the research was being conducted, how their data would be used and that there were no associated risks. Ethical approval is not required for this type of study. Therefore, after ethical acceptance of the research, the questionnaire is sent to the study population. The final sample participates voluntarily by providing their contact e-mail address for further study results. To respond to the objective set in this study, a cluster analysis was conducted. Firstly, an exploratory, hierarchical cluster analysis was performed, following the group clustering method and using Squared Euclidean Distance as the interval measure, obtaining a dendrogram, which was employed to determine the number of groups for the next classification test. Then, a K-means cluster analysis was carried out, with K being the number of groups determined by the mentioned dendrogram, applying the iterate-and-classify method. Lastly, after this analysis, we interpreted the final centres of the clusters that

would determine the classification. These analyses were performed using IBM SPSS Statistics software v26.

4. Results

4.1. Scenarios of Adaptation to Post-Pandemic Learning and Associated Competencies

This section presents results that demonstrate the scenarios of adaptation to post-pandemic learning from the perspective of university students of the Faculty of Education Science of the University of Seville, based on the competencies identified in the context of digital transformation. Firstly, the exploratory hierarchical cluster analysis revealed that there are two natural types; however, with the approximation of the perceptions of the university students of Early Childhood and Primary Education and the variables, three groups were identified. This phenomenon is reflected in the dendrograms generated in the first analysis. Exploratorily, these data reveal that there are different scenarios of adaptation to post-pandemic learning as a function of the competencies identified in the context of digital transformation.

Secondly, to ensure this classification, a K-means cluster analysis was performed, which showed that, based on the perspective of the Early Childhood and Primary Education students, there are three types of scenarios of adaptation to post-pandemic learning and four competencies linked to them (motivation, collaboration, self-learning and digital methodology). Specifically, Table 3 gathers the characterisation of these scenarios of adaptation and the competences.

Table 3. Characterisation of the types of scenarios of adaptation to post-pandemic learning and associated competence levels.

		Final Cluster Centres					
		Cluster of Primary Education Students			**Cluster of Early Childhood Education Students**		
		1	**2**	**3**	**1**	**2**	**3**
Scenarios of adaptation to post-pandemic learning (global)		3.45	2.70	3.42	3.99	2.99	3.54
Student competencies	Global valuation	3.78	1.57	2.77	4.11	2.24	3.27
	Motivation	3.90	1.48	2.60	4.11	2.12	3.21
	Collaboration	4.54	4.00	4.06	4.05	2.41	3.44
	Self-learning	3.37	1.63	2.76	4.19	2.41	3.50
	Digital methodology	4.01	1.42	2.81	4.10	1.91	2.80

The data gathered in Table 3 show that there are three groups of scenarios of adaptation to post-pandemic learning and four competencies that develop in the students that are immersed in such scenarios. Moreover, the perceptions of the Early Childhood and Primary Education students are quite similar.

Cluster 1 includes scenarios of adaptation to post-pandemic learning in which the impact of the competencies received a medium-high score, with an average score in the range of 3.45–3.99, in a scale of 1–5. Thus, these scenarios favour the development of competencies for the personal growth of students and for the improvement of group interactions. Regarding the competence levels of the students immersed in these scenarios, medium-high values were reached, since the average scores range between 3 and 4 in all the itemised dimensions (motivation, collaboration, self-learning and digital methodology). A total of 31.15% and 36.22% of the Primary and Early Childhood Education students, respectively, reveal the presence of this type of scenario and the associated competence levels (Table 4).

Table 4. Number of cases in each cluster (%).

		Primary Education Students	**Early Childhood Education Students**
Cluster	1	31.15%	36.22%
	2	24.60%	21.33%
	3	44.25%	42.45%

Cluster 2 encompasses scenarios with considerably lower score compared to those included in Cluster 1 ($\bar{x}$ = 2.70–2.99); in addition, these scenarios correspond to low competence levels of the Early Childhood students ($\bar{x}$ = 1.57 – 2.24). The perception of the Primary Education students was different, as the level of collaboration was valued with an average score of 4 points (Table 3). A total of 24.60% and 21.33% of the Primary and Early Childhood Education students, respectively, show the existence of this type scenarios of adaptation to post-pandemic learning and these associated competence levels (Table 4).

Lastly, Cluster 3 integrates scenarios of adaptation to post-pandemic learning in which the impact of the competencies was valued with a medium-high score ($\bar{x}$ =3.42 – 3.54), although such score was slightly lower than that obtained in Cluster 1. The Early Childhood students linked to these scenarios were associated to medium competence levels (Table 4). However, as in the case of Cluster 2, according to the perception of the Primary Education students, it is surprising that the average score of the level of collaboration was, once again, above 4 points. In this case, this is the most common type of adaptation scenario and associated competence levels based on the perception of the Primary and Early Childhood Education students, with a frequency of 44.25% and 42.45%, respectively (Table 4).

Both the characterisation of the clusters (Table 3) and the appearance frequency proportion (Table 4) reveal that there is a correlation between the perceptions of the Early Childhood and Primary Education students about the existence of heterogeneity of scenarios of adaptation to post-pandemic learning and student competence levels. That is, these results show that the impact of technologies on the adaptation scenarios and the acquisition of competencies is not uniform, identifying gradients.

Specifically, we obtained three types of scenarios of adaptation to post-pandemic learning associated with different student competence levels, generated by the use of technologies. Cluster 1 includes scenarios of adaptation to post-pandemic learning in which the impact of technologies is greater than in the other scenarios, associated with students of greater competence level. On the other hand, Cluster 2 encompasses the adaptation scenarios that were least influenced by technologies, associated with the students of lower competence levels. In an intermediate position, Cluster 3 comprises the most frequent scenarios, according to the perceptions of the students (Table 4).

Therefore, we detected progressive models or scenarios of adaptation to post-pandemic learning as a function of some student competences, such as motivation, collaboration, self-learning and digital methodology. These models are: (a) initial adaptation model (Cluster 2), (b) moderate adaptation model (Cluster 3), and (c) advanced adaptation model (Cluster 1).

4.2. Discriminant Variables in the Classification of Scenarios of Adaptation to Post-Pandemic Learning and Associated Competences

Once the adaptation scenarios and learning levels were distributed into three clusters, the next step was to determine the relevance of these variables in the discrimination of these typologies. In other words, we analysed whether the variables used for the classification (i.e., scenarios of adaptation to post-pandemic learning and competence levels: motivation, collaboration, self-learning and digital methodology) generate valuable information about the actual impact of technologies in the classroom.

The results of the ANOVA reveal that all variables were significant ($p < 0.05$), that is, all dimensions considered to describe the impact of technologies are relevant for these

groupings (Tables 5 and 6). Moreover, it was shown that each typology is different from the rest, since $p < 0.005$, which indicates that the average scores for each of the variables are statistically different; therefore, the null hypothesis of equality is rejected, that is, the obtained means are significant in each of the dimensions.

Table 5. ANOVA of the perceptions of Early Childhood Education students.

	Cluster		Error		F	Sig.
	Root Mean Square	df	Root Mean Square	df		
Motivation	32.202	31	0.165	1318	194.852	0.000
Collaboration	23.736	31	0.166	1318	142.936	0.000
Self-learning	35.452	31	0.164	1318	216.117	0.000
Digital methodology	50.338	31	0.190	1318	265.604	0.000
Global valuation	23.555	31	0.042	1318	555.555	0.000
Global adaptation scenario	17.821	31	0.209	1318	85.306	0.000

Note. The F tests should only be used with descriptive purposes, since the clusters were selected to maximise the differences between the cases of different clusters. The significance levels observed are not corrected for this and, therefore, cannot be interpreted as tests for the hypothesis that the cluster means are equal.

Table 6. ANOVA of the perception of Primary Education students.

	Cluster		Error		F	Sig.
	Root Mean Square	df	Root Mean Square	df		
Motivation	32.202	31	0.165	1318	194.852	0.000
Collaboration	23.736	31	0.166	1318	142.936	0.000
Self-learning	35.452	31	0.164	1318	216.117	0.000
Digital methodology	50.338	31	0.190	1318	265.604	0.000
Global valuation	23.555	31	0.042	1318	555.555	0.000
Global adaptation scenario	17.821	31	0.209	1318	85.306	0.000

Note. The F tests should only be used with descriptive purposes, since the clusters were selected to maximise the differences between the cases of different clusters. The significance levels observed are not corrected for this and, therefore, cannot be interpreted as tests for the hypothesis that the cluster means are equal.

Once the intergroup differences were determined, the distribution of the surveyed students was graphically plotted (Figures 1 and 2).
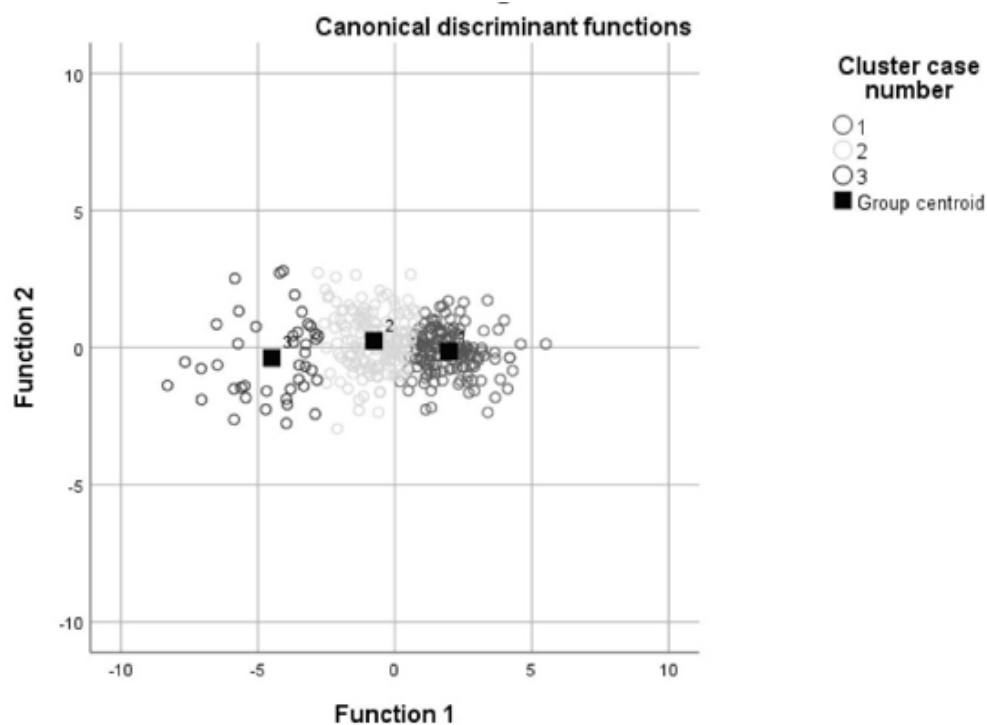
Figure 1. Scatter plot of cases according to the perception of Early Childhood Education students.
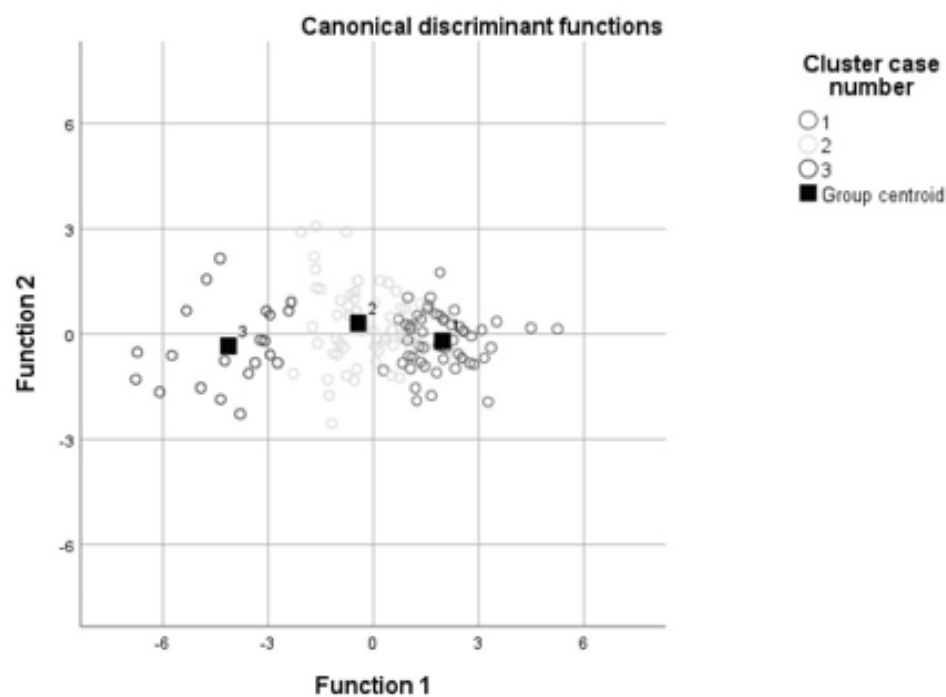

Figure 2. Scatter plot of cases according to the perception of Primary Education students.

As is shown in Figures 1 and 2, a certain parallelism is observed again in the clustering of the three groups by the students of both Early Childhood and Primary Education. It is worth highlighting that the sample of the former is considerably greater than that of the latter, thus more cases are classified. However, the three groups detected are close to each other and, in some cases, they can include individuals who are quite similar.

Furthermore, once the significance of the variables was verified, the next step was to obtain canonical discriminant functions that can predict future positionings of cases as a

function of the perceptions of students. Table 7 presents the values of the coefficients of both canonical functions.

Table 7. Standardised coefficients of canonical discriminant function.

	Primary Education Students		Early Childhood Education Students	
	1 (β)	2 (β)	1(β)	2 (β)
Motivation	0.684	−0.602	0.485	−0.031
Collaboration	0.063	−0.196	0.346	0.560
Self-learning	−0.306	0.688	0.520	0.260
Digital methodology	0.109	0.359	0.712	−0.664
Global valuation	0.494	0.006	0.213	−0.119
Global adaptation scenario	−0.023	0.561	0.485	−0.031

In the case of the perception of Primary Education students, the canonical discriminant functions were:

YPerception_Students (Primary Education) 1 = 0.684 * Motivation + 0.494 * Global valuation − 0.306 * Self-learning + 0.109 * Digital methodology + 0.063 * Collaboration − 0.023 * Global adaptation scenario

YPerception_Students (Primary Education) 2 = 0.688 * Self-learning − 0.602 * Motivation + 0.561 * Global adaptation scenario + 0.359 * Digital methodology − 0.196 * Collaboration + 0.006 * Global valuation

In the first canonical function, the variables with the greatest discriminant power to predict future cases were motivation ($\beta = 0.684$), global valuation ($\beta = 0.494$) and self-learning ($\beta = -0.306$). In the second function, the standardised coefficients were greater in more discriminant variables. In this case, the variables with the greatest predictive power were self-learning ($\beta = 0.688$), motivation ($\beta = -0.602$), and global adaptation scenario ($\beta = 0.684$), with a decrease in the effect of the global valuation of the competence level. Despite the fact that the first canonical function explains 97.1% of the variance and the second function only explains 2.9% (Table 8), they are both significant, since the contrast statistic reveals *p* values below 0.05 (Table 9).

Table 8. Self-values of the canonical functions of the Primary Education students.

Self-Values				
Function	Self-Value	% of Variance	% Accumulated	Canonical Correlation
1	6.269 [a]	97.1	97.1	0.929
2	0.186 [a]	2.9	100.0	0.396

Note. [a] The first 2 canonical discriminant functions were used in the analysis.

Table 9. Significance of the canonical functions of the Primary Education students.

Wilks Lambda				
Function Test	Wilks Lambda	Chi-Squared	df	Sig.
1 to 2	0.116	119.575	12	0.000
2	0.843	9.485	5	0.001

In the case of the perception of the Early Childhood Education students, the canonical discriminant functions were:

YPerception_Students (Early Childhood Education)_1 = 0.712 * Digital methodology + 0.520 * Self-learning + 0.485 * Global adaptation scenario + 0.485 * Motivation + 0.346 * Collaboration + 0.213 * Global valuation

YPerception_Students (Early Childhood Education)_2= −0.664 * Digital methodology + 0.560 * Collaboration + 0.260 * Self-learning − 0.119 * Global valuation − 0.031 * Motivation − 0.031 * Global adaptation scenario.

In the first canonical function, the variable with the greatest discriminant power was digital methodology ($\beta = 0.712$), followed by self-concept ($\beta = 0.520$) and global adaptation scenario and motivation, with the same standardised coefficients ($\beta = 0.485$). In the second function, the standardised coefficients are lower in more discriminant variables and, once again, the variable with the greatest predictive power was digital methodology ($\beta = -0.664$), followed by collaboration ($\beta = 0.560$).

In the case of the perception of Early Childhood Education students, the first canonical discriminant function explains 99.2% of the total variance, whereas the second one only explains 0.8% (Table 10). However, as was observed with the functions related to the perception of Primary Education students, they were both significant, since the *p* values of Wilks Lambda test were below 0.05 (Table 11).

Table 10. Self-values of the canonical functions of the Early Childhood Education students.

Self-Values			
Function	**Self-Value**	**% of Variance**	**% Accumulated**	**Canonical Correlation**
1	5.031 [a]	99.2	99.2	0.913
2	0.043 [a]	0.8	100.0	0.203

Note. [a] The first 2 canonical discriminant functions were used in the analysis.

Table 11. Significance of the canonical functions of the Early Childhood Education students.

Wilks Lambda				
Function Test	**Wilks Lambda**	**Chi-Squared**	**df**	**Sig.**
1 to 2	0.159	2473.232	10	0.000
2	0.959	56.486	4	0.000

The analysis of the standardised coefficients (β) generated new matrices that enriched our results, since, despite the correlation between the typologies of adaptation scenarios and competence levels perceived by both groups of students, the variables analysed in the perceptions of Early Childhood and Primary Education students show different discriminant relevance.

Lastly, we analysed the confounding matrices obtained for the Primary Education students (Table 12) and for the Early Childhood Education students (Table 13), with the aim of determining the goodness of fit based on Fisher's linear function, that is, whether the classifications were conducted correctly.

Table 12. Results of the classification performed as a function of the perception of the Primary Education students.

Classification Results [a]					
		Cluster Number	**Group Belonging Predicted**			**Total**
			1	**2**	**3**	
Original	%	1	94.7	0.0	5.3	100.0
		2	0.0	93.3	6.7	100.0
		3	0.0	3.7	96.3	100.0

Note. [a] 95.1% of original grouped cases correctly classified.

Table 13. Results of the classification performed as a function of the perception of the Early Childhood Education students.

		Cluster Number	Group Belonging Prediced			Total
			1	2	3	
Original	%	1	98.6	0.0	1.4	100.0
		2	0.0	97.9	2.1	100.0
		3	0.3	1.2	98.4	100.0
		Ungrouped cases	21.9	20.4	57.6	100.0

Note. [a] 98.4% of original grouped cases correctly classified.

The data presented in the previous tables indicate an adequate goodness of fit of the analysis, which guarantees that the classification was performed correctly and that it discriminates between groups. Based on the perception of the Primary Education students, it was revealed that 95.1% of the grouped cases were correctly classified (Table 12), whereas, in the case of the Early Childhood Education students, the result improved considerably, since the fit increased to 98.4% of the grouped cases being correctly classified (Table 13). This reveals the consistency of the obtained results.

To summarise, the presented results show the existence of heterogeneity in the scenarios of adaptation to post-pandemic learning and the student competence levels, as a result of the impact of technologies. Moreover, these variables are significant and consistent in the determination of the typologies, since all of them are statistically relevant in terms of the description of adaptation scenarios and student competence levels. Furthermore, the reciprocity detected between the itemisation levels of the competencies and its global valuation strengthen the understanding of what is theoretically addressed in this study.

5. Discussion

As we can see from the results, the data show that there are different scenarios of adaptation to post-pandemic learning depending on the competencies identified in the context of digital transformation. We identified that there are three types of post-pandemic learning adaptation scenarios and four competencies linked to them (motivation, collaboration, self-learning and digital methodology). These results coincide with other research carried out in this research focus [15]. They also reveal that there is a correspondence between the perceptions of university students of Early Childhood Education and those of Primary Education, on the existence of heterogeneity of adaptation scenarios to post-pandemic learning and students' levels of competence. In other words, it is clear that the impact of technologies on adaptation scenarios and the achievement of competences is not uniform, with gradients being detected [2].

Progressive models or scenarios of adaptation to post-pandemic learning are therefore identified according to certain student competences, such as motivation, collaboration, self-learning and digital methodology. These models are: (a) initial adaptation model (Cluster 2), (b) moderate adaptation model (Cluster 3) and (c) advanced adaptation model (Cluster 1).

Having detected the distribution of adaptation scenarios and learning levels in three clusters, the aim is now to find out the weight of these variables in the discrimination of these typologies. In other words, it will be determined whether the variables used for the classification: post-pandemic learning adaptation scenarios and competence levels (Motivation, Collaboration, Self-learning and Digital methodology) are determinant in providing valuable information about the real impact of technologies in the classroom.

The results presented here highlight the existence of heterogeneity in post-pandemic learning adaptation scenarios and students' levels of competence as a result of the impact of technologies. Moreover, these variables are meaningful and consistent in determining

the typologies, as they are all statistically relevant in describing the adaptation scenarios and students' competence levels. On the other hand, the reciprocity detected between the levels of competence breakdown and the overall assessment of competence reinforces the understanding of what has been theoretically addressed in this work.

This assertion is in line with the studies conducted in the last decades, which conclude that universities, as well as the rest of the members of the educational and scientific system, promote the digital ecosystem that will dominate this century [18–22]. The scenarios that we identified in the post-pandemic adaptation are in agreement with other studies in which the competences associated with them were motivation, collaboration, self-learning and digital methodologies [5,6,8,23].

The findings of this study demonstrate the existence of heterogeneity in the scenarios of adaptation to post-pandemic learning and in the student competence levels, as a result of the impact of technologies [24–26]. Similarly, the variable are significant and consistent, thereby contributing to the literature on this topic.

6. Conclusions

The aim of this study was to identify the scenarios of adaptation to post-pandemic learning from the perspective of university students from the Faculty of Education Science of the University of Seville (Spain), as a function of the competencies identified in the context of digital transformation. However, we believe that there are many factors that need to be considered for an in-depth analysis of the situation. We know from systematic reviews [2,3] that there is a critical need to better understand the effects of the COVID-19 pandemic on the sustainability of teaching and learning practices. This research perspective allowed us to delve into the different scenarios that emerged in the literature review [1]. It was observed that the adoption of these tools has increased, along with the great variety of training experiences, that is, activities based on the informative use of the Internet, multimedia resources, e-learning, b-learning, etc… [27]. We also explored some strategies, tasks and activities founded on discovery learning, meaningful learning, information processing and learning associated with quality of life [5]. In the scope of digital transformation in education institutions, there are numerous challenges related to fundamental competencies from the technological framework that future teachers must acquire. The resources are a means to attain this objective; the international organisations work in this line through the global application of their educational policies, such as the OECD Learning Compass 2030 [28], which is an evolving learning framework that establishes an ambitious view for the future of education. It provides guiding points toward the future we want: individual and group well-being. We identified a model that can explain the willingness of teachers to adopt Educational Digital Transformation (EDT).

7. Limitations

It is important to continue research along the lines proposed [2,3] in relation to changing priorities identified in higher education institutions in relation to incorporating sustainability into curricula. We agree with these authors on the need to continue to address the unique challenges of developing nations.

Institutional Review Board Statement: Ethical review and approval for this study was waived because the subjects participating in the study (972) responded to the signed consent form before answering the questionnaire. This is a non-interventionist study (we have used the Attitudes Scale on the Perceptions of Prospective Teachers towards New Post-Pandemic Educational Scenarios - SANPES-). All participants were informed that their anonymity was guaranteed, and they gave their consent to participate voluntarily; it was explained to them why the research was being conducted, how their data would be used and that there were no associated risks. Ethical approval is not required for this type of study.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Due to confidentiality and privacy agreements, it is not possible to make these data publicly available.

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