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Impact on the Virtual Learning Environment Due to COVID-19

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Abstract: As a result of the global pandemic caused by COVID-19, universities have carried out teaching in a digital way, accelerating the inclusion and use of technologies in methodological adaptation. The research aims to ascertain the perception that students at the Faculty of Education Sciences of the University of Granada have regarding the pedagogical model adopted in the virtual learning environment during confinement through the second semester of the 2019–2020 academic year. The information collection method was an online questionnaire, using simple random sampling with proportional affixing 0.5, 95% confidence level and maximum permissible error of 4.7%. The results demonstrate a generalised dissatisfaction of the students, being fundamental to carry out the transition of the educational processes and training of the teaching staff. The implementation of active methodologies increases due to the virtual condition, specifically the flipped classroom methodology, but students manifest generalised dissatisfaction regarding the adequate methodological development and the involvement of professors. There is an outstanding use of e-mail and the virtual learning platform (PRADO), although they consider that they do not have the appropriate knowledge about image editors, video, computer graphics, synchronous response systems and anti-plagiarism tools. The students surveyed express that the tutoring functions, tasks and beliefs of the teaching staff in e-learning are not satisfactory.

Keywords: virtual environment; online education; e-learning; active methodology; ICT; university training; COVID-19

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1. Introduction

As a result of the global pandemic caused by COVID-19, higher education has been affected at a global level and more specifically in Spain, wherein mid-March the state of alarm was declared, with the state and university academic authorities decreeing that, for the remainder of the 2019–2020 academic year, teaching and learning processes would be carried out digitally. Consequently, the means for their development through information and communication technologies (ICT) have been incorporated. Although the teaching and learning processes in higher education were already in continuous evolution in relation to the influence of technology on the incorporation of emerging methodologies, the truth is that due to the confinement caused by the coronavirus it seems the full use of ICTs in methodological adaptation has been enforced and its inclusion accelerated, as a test of organisational agility [1], and fostered a process of transformation also accelerated to a digitalized university through online processes with new pedagogical models and learning environments. In this way, all these transformations have become a more sustainable model of education [2].

Higher education faces important challenges in the process of transforming learning models to satisfy new demands [3]. It must be considered that quality teaching and learning processes in higher education are practically unthinkable without the use of technology,

especially because of its impact on the development of the skills and abilities needed for the 21st century [4]. ICTs are already part of the teaching of higher education to integrate formal learning contexts, being used by students in support of their formation [5]. In its continuous scientific and pedagogical actualization, university education must master the new methodologies and the importance of ICT requires a responsibility, and it is up to its professionals to preserve, improve and update the levels of digital competence for the progress of the teaching and learning processes [6].

Different authors have expressed that the expectations created by the impact of ICT in the educational context have not been satisfactorily fulfilled [7,8], by its superficial and merely instrumental integration of ICT in the teaching and learning processes, due to the attitudinal response of teachers in the integration of techno pedagogical tools [9,10]. We must emphasize the lack of formation denounced by the teachers of the diverse educational levels, that leads to approaches of effective use of the ICT from the initial formation and permanent during the professional development to adapt to the technological change in education [4], establishing digital competencies that include skills, knowledge, strategies and attitudes [11].

The results shown by several studies [8,9,12,13] establish that teachers' perceptions of ICT are positive, since they consider them to be tools that favour active, motivational and interactive learning, and they manage to respect the students' individual rhythms. However, other studies point out limitations, highlighting the lack of technological knowledge, traditional training and the economic investment required to implement these tools [11].

The need for a change in the teacher's profile at all levels is raised [9], proposing an active methodological renewal in which it assumes a guiding role in the teaching–learning process by focusing on students, increasing their participation, encouraging their collaborative work, promoting their learning autonomy and fostering their acquisition of competencies and skills so that they can develop in the face of the demands of the 21st century [14–16].

The digital transformation in higher education has experienced a set of important changes, stimulated by technological and social trends towards digitalization to adapt to the changes imposed by new technologies [17], its acceptance in this educational field is related to a change of paradigm in an interconnected environment that allows digital learning [18], which implies focusing the formative interest on the students and their learning experiences.

Consequently, the digital transformation of higher education is a necessity for the improvement of the teaching experience, teaching materials and the training process in general [19]. However, the digital possibilities must be united with the qualification of its professionals to reveal its power of transformation, so the digital transformation needs both technology and people [20]. The potential offered by ICT becomes a real possibility of digital transformation through the application of active methodologies adopted in the real context of university classrooms [21].

The dimensions of the digital transformation processes are teaching (digital platforms and content for teaching and learning, innovative pedagogical methodologies, digital literacy and digital skills and the teaching management process) [22–24], infrastructure (digital media for teaching, security and data, and software for universities) [25,26], curriculum (its modernization and digital curriculum) [27,28]; administration (technological financing, reorganization of administrative units and informed decision-making) [29,30]; research [31]; human resources [32,33]; extension [34,35]; governance of the digital transformation [22,25,34]; information and marketing [36,37] and business processes [26,29,34,36].

Therefore, if the traditional educational model is giving way to new adjustments in teaching practice to meet the needs and demands of society in general and employers in particular [38], the set of changes linked to confinement by COVID-19 has been a comparison and distinction of the main characteristics between regular distance education and emergency distance education [39,40]. Online education requires careful instructional

design and planning [41], while emergency distance education has been an alternative process due to the situation of a sanitary crisis [42–47]. The transition to online teaching in these circumstances has signified a hurried process of adaptation [48], and repeated educational disruptions are occurring for the same reason as the pandemic. In fact, even in the future there may be the possibility of further educational disruptions for other emergencies [49]. For these reasons, it is necessary to analyze what has been done and what should be improved in order to effectively develop the digitalization of education and thus improve the quality of education.

Effective integration of technology in education must involve the combining of pedagogical skills, subject content and technology in a particular educational ecosystem where the educational process takes place. The involvement of teachers in curriculum change has been a challenge for professional and teaching development. The adaptability of the professions in the face of an unprecedented pandemic has been made possible in many ways by the ability to communicate, learn and act through the use of technology [50].

Given the limitations imposed, a number of different training approaches have emerged to help address the needs of teachers [51], and alongside virtual online preparation, a personalised learning experience that directly supports teachers' pedagogical practice is provided [52]. The digital pedagogy is characterized by strengthening the development of competences in the field of technological entrepreneurship [53], it implies a renewal of the methodological approach that reflects the challenges of the digital era [54]. Its success needs the commitment of students and it needs to be digitally dynamic by offering everything: personalized comments from teachers, discussion forums, tests with immediate feedback and lessons with reading materials [55].

In addition to the constant challenge for higher education professors to discover new methods in order to involve students and increase the effectiveness of the learning process [56], the active methodology must focus on student understanding, motivation and participation from a constructivist perspective to enhance learning in order to learn competence and problem-solving skills [57], with teachers mediating the learning process so that students develop their own knowledge [58].

2. Materials and Methods

The research presented is focused on finding out the perception that students at the Faculty of Education Sciences of the University of Granada have about the pedagogical model assumed in the virtual learning environment, during the confinement by the COVID-19, in the second semester of the 2019–2020 academic year, associated with the use of digital technologies and applied methodologies. This allows a more precise vision of what students think about the aspects to be studied and it would enable, to the extent that it is necessary, to make (or not) changes in those areas in which students show generalised dissatisfaction.

Based on this purpose, the following specific objectives are established in relation to what the students think:

- Know the use, creation and distribution of technological resources by teachers so that they are in line with the objectives, students and teaching style.
- Determine the functions, tasks and beliefs of the teaching carried out in the virtual learning environment.
- Value the degree of involvement of teachers in the development of active methodologies.

In order to know the students' opinions, the information collection method has been by means of a questionnaire filled in directly by the students online. The questionnaire was sent through the means made available by the University of Granada, so that each student received it in their institutional mail account. The message explained the purpose of the project, stressed that their answers would be anonymous and encouraged them to fill in the questionnaire. Of the 4.947 students who were enrolled in the 2019–2020 academic year in any of the degrees taught in the Faculty of Education Sciences of the University of Granada, a total of 398 finally completed the questionnaire satisfactorily. This, together with the

method of data collection, results in a simple random sampling with a proportional fixation of 0.5, at a confidence level of 95% and with a maximum admissible error of 4.7%.

The average age of respondents is 22.58 ± 6.11 years, with 74.1% being female and the rest male. In turn, 33.8% of the participants belong to a first-year degree, while 22.4% of students are second year students. Likewise, 20% and 23.8% correspond respectively to third and fourth year students.

As a preliminary step to the dissemination of the questionnaire to the whole population, a pilot sample of 50 students was carried out, sending to the selected students the questionnaire for its completion and feedback. The objectives were to debug any linguistic/typographic errors that the questionnaire might contain, to measure the time taken to complete it, to adapt the language so that all the students were able to understand it and complete it correctly, to alter the order of the questions, and to add and/or eliminate questions that were necessary and/or redundant.

The questionnaire was developed through the Google Forms platform. This tool was chosen because it automatically stores all the answers in an Excel file. However, for subsequent data processing and analysis, all the information in the database was input into the statistical programme SPSS, version 24 [59]. The statistical programme R was also used to perform the corresponding data analysis [60].

The questionnaire consists of a total of 155 items, in which the first three collect the descriptive information of the study (gender, age and year). The rest of the items are grouped into three big blocks:

- Digital resources: made up of 58 items and whose answers are collected using Likert scales [61], with a minimum score of 1 and a maximum of 4.
- Digital pedagogy: made up of 67 items, 25% of which are answered by Likert scales with 5 categories and the rest by Likert scales with 4 categories.
- Active methodology: made up of 12 items, of which 8 collect answers using a 4 category Likert scale, 1 is a multiple choice and the remaining 3 are YES/NO.

The quality of the questionnaire was evaluated through a study about the validity and reliability of the same one. Regarding the validity, this part can be divided in two parts: questionnaire content validity and construct validity. The first one has already been explained above when the preliminary steps to the dissemination of the tool were described. In relation to the construct validity, the Kaiser–Meyer–Olkin (KMO) [62] for sampling adequacy and Barlett's test of sphericity [63] were employed for this purpose. The results (KMO equals to 0.911 and being the p-value associated to the Barlett's test less than 0.001) showed that it is worthy to apply the factorial analysis [64,65]. Later, it is observed from the confirmatory factorial analysis that the all defined factors have eigenvalues higher than 1 and that they explain a considerable percentage of the total variability. On the other hand, to study the reliability of the tool, Cronbach's alpha coefficient [66] was used, with a value of 0.872. Following the general recommendation of George and Mallery [67], it can be concluded that the tool used is very adequate for the study and, therefore, the items measure the same construct and are highly correlated.

3. Results

With regard to each of the proposed research objectives, the results obtained are as follows.

Know the use, creation and distribution of technological resources by teachers so that they are in line with the objectives, students and teaching style.

Among the technological resources in which the surveyed students think they have total knowledge about (see Table 1), the use of email and chat (Whatsapp, Telegram . . .) stands out. The use of learning platforms (Moodle -PRADO-, Google Classroom . . .), videoconferences (Google Meet, Skype, Zoom, . . .), social networks (Twitter, Facebook, Instagram . . .) also receive a lot of weight on good management in this section, tools for collaborative work and file management on the network (Google Drive, Dropbox . . .), tools for searching and publishing information (Google, Yahoo, Wikipedia, . . .) and

office tools (Word, PowerPoint, Excel ...). On the other hand, students believe that teachers lack the necessary knowledge to use image editors (Photoshop, Canva, Paint ...), video editors (VideoPad, iMovie, Windows Movie Maker ...), computer graphics editors (Visme, Genially, Canva ...), gamification and real-time response systems (video games, Kahoot, Quizizz, Edmodo, ...) and tools for detecting coincidences and anti-plagiarism (Turnitin, Safe assignment) and to a lesser extent forums (Google Groups, Tapatalk, Convo ...), tools for searching academic databases and institutional repositories (SciElo, Dialnet, Google Scholar, ScienceResearch ...) and tools for creating presentations (Prezi, Canva ...). The latter two are of particular concern, since they are considered a fundamental technological resource for students to be able to successfully develop their university studies from the beginning of their training. It is extremely important to find the factors that prevent students from reaching an optimal level in the treatment of these tools during the course of their studies, which will allow them to adopt another series of techniques and/or decisions.

Table 1. Students' assessments of the degree of competence.

	Students				**Teachers**				**Spearman**	
	N.C	**S.C.**	**I.C.**	**T.C.**	**N.C**	**S.C.**	**I.C.**	**T.C.**	**ρ**	**P**
A	2.3%	6.5%	14.8%	76.4%	2%	20%	33%	45%	0.46	<0.001
B	5.53%	6.03%	18.09%	70.35%	19.6%	27.1%	30.4%	22.9%	0.29	<0.001
C	24.9%	30.9%	27.9%	16.3%	24.9%	37.4%	27.1%	10.6%	0.39	<0.001
D	4.5%	21.6%	39.4%	34.4%	4.8%	29.9%	42.2%	23.1%	0.28	<0.001
E	6.3%	19.3%	36.4%	37.9%	18.1%	36.4%	34.4%	11.1%	0.29	<0.001
F	8.8%	13.1%	23.9%	54.3%	34.67%	35.43%	19.85%	10.05%	0.21	<0.001
G	8.29%	15.33%	37.94%	38.44%	22.6%	37.9%	26.6%	12.8%	0.30	<0.001
H	4.3%	16.6%	36.4%	42.7%	18.1%	25.4%	31.2%	25.4%	0.42	<0.001
I	16.8%	30.9%	36.7%	15.6%	15.8%	23.4%	27.1%	33.7%	0.48	<0.001
J	3%	14%	33%	50%	10.6%	25.4%	37.7%	26.4%	0.35	<0.001
K	31.2%	38.4%	18.6%	11.8%	45%	33%	17%	5%	0.45	<0.001
L	52.8%	28.1%	12.5%	6.5%	53%	29%	15%	4%	0.43	<0.001
M	41.2%	33.4%	17.3%	8%	51.3%	30.4%	13.8%	4.5%	0.36	<0.001
N	60.1%	22.4%	11.6%	6%	52%	28%	15%	5%	0.48	<0.001
O	22.4%	25.1%	36.9%	15.6%	30.65%	29.15%	30.15%	10.05%	0.47	<0.001
P	35.43%	34.67%	20.6%	9.3%	48%	32%	16%	4%	0.37	<0.001
Q	55.3%	26.6%	11.8%	6.3%	22.11%	25.88%	25.63%	26.38%	0.41	<0.001

N.C. = no competence, S.C. = some competence, I.C. = important competence, T.C. = total competence) in relation to the knowledge of themselves and the teaching staff in the following technological resources: (A) email, (B) chat, (C) forums, (D); earning platforms. (E) videoconference, (F) social networks, (G) tools for collaborative work and administration of network files, (H) tools for searching and publishing information, (I) search tools for academic databases and repositories, (J) office automation tools, (K) image editors, (L) audio editors, (M) video editors. (N) computer graphics editors, (O) tools for the creation of presentations, (P) gamification and real time response systems, and (Q) matching and anti-plagiarism detection tools. The test of independence is also shown through Spearman's correlation coefficient, where ρ is the value of the correlation and P is the value associated to the test of independence.

It is impossible to avoid the fact that students' personal perceptions of the level of knowledge of the use of technological resources is determined, to a certain extent, by their opinion of their teachers' degree of competence in this type of tool. To a certain extent, teachers are the instructors who present and invite students to apply these resources in the classroom in order to be taken into account in the work to be developed later. Similarly, if the teaching staff have a high level of knowledge of the use of technological resources and are able to transmit this to their students, the students will consequently acquire greater skills in these. Therefore, it is worth noting that students are not very sure about the skills of their teachers when dealing with image, audio, video, computer graphics and real-time response systems, precisely those resources in which students think they do not have enough knowledge to use them properly. This relationship is corroborated by the independence test carried out through Spearman's correlation coefficient, which is demonstrated in Table 1. Here we show Spearman's correlation coefficient (ρ) between

two variables, that is, in this case the opinion that students have about the ability that they and their teachers have to manipulate each technological resource, and the P value that is used to contrast if ρ is significantly different from 0 (independence test). In view of the results, and considering the usual level of significance $\alpha = 0.05$, there is significant evidence of the above-mentioned relationship, that is to say, it can be concluded that the opinion that students have about the abilities of their teachers when they use technological resources, depends directly on the competences that they themselves have about these instruments, especially in those where $\rho > 0.4$, in which the strength of the association is considered moderate.

Another variable that is highly related to the level of competence of the technological resources is the degree of use made of them in the planning of their learning (the greater the dedication, the greater the mastery in the exploitation of the instruments), as well as the way in which they are used. In fact, this is in line with the data collected through the questionnaire, where more than half of the respondents do not invest time in using image editors (54.8%), audio (68.3%), video (63.3%), computer graphics (66.1%), real time response systems (55.8%) and matching and anti-plagiarism tools (58.8%). Likewise, 36.4% and 25.6% of those surveyed do not use the forums and the search tools for academic databases and institutional repositories, respectively, which are other resources that students lack the skills to use correctly. The planning of tasks by the teaching staff encouraging the use of electronic tools and platforms in class activities would lead to a better treatment of these resources by students motivated by the subject itself.

With regard to the last comment made, the students' opinions were analysed on the degree of foresight that teachers possess when they use, imitate, adapt and/or create the technological resources by adjusting them to the learning skills. Almost one in every two students estimated that teachers rarely have them in mind, while 25% of them considered that they did not even value them. Similarly, the results are practically identical to the degree of consideration that teachers have when they use, imitate, adapt and/or create technological resources by adjusting them to their students.

Determine the functions, tasks and beliefs of teaching carried out in the virtual learning environment.

With regard to knowing the pedagogical model, the study focuses on the vision that the surveyed students have regarding the tasks and tutoring functions of the teaching staff in e-learning. At this point, the analysis is divided into three areas: care and support, organisation and planning, and monitoring and control. The opinions recorded on these aspects are summarised in bar plots in Figures 1–3, in which each bar represents the percentage of students who marked the corresponding manner.

Firstly, with regard to care and support, the graph reveals that more than half of the students do not express a favourable opinion (dissatisfied or very dissatisfied) on any issue. There is real dissatisfaction with individual follow-up, as almost 74% of those surveyed said they were not satisfied with the teaching work in this area, while three out of five students felt that the task of support in order to go deeper into the subject, give advice and stimulate students, involve students and follow up in groups, was rather scarce on the part of the teachers. Only over 50% of favourable opinions were expressed in terms of reinforcement and resolution of doubts.

With regard to organisation and planning, the results of disagreement in this respect do not differ much from the previous module. The modalities "Tasks are evaluated quantitatively", "Contents are based on competences" and "Tasks are carried out with communication tools" are the ones that obtain the best qualification. On the other hand, with dissatisfaction at over 60%, there is concern that the skills to be transmitted are not appropriate and adapted to e-learning, as well as the timing and evaluation instruments.

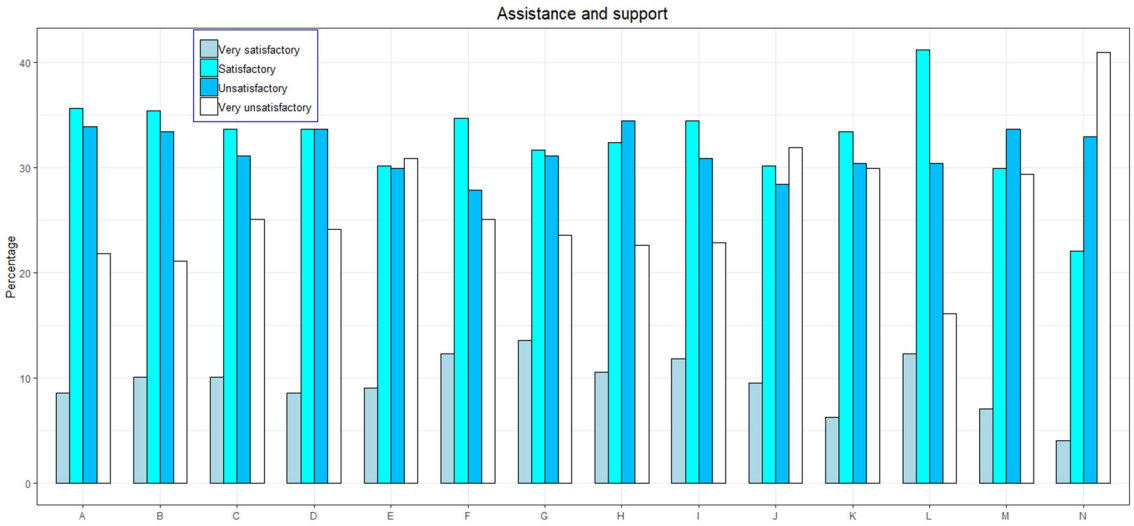

Figure 1. Assessment by students of the level of satisfaction they have with the following functions and tutoring tasks of the teaching staff in their e-learning regarding assistance and support: (**A**) They explain contents and guide the learning process. (**B**) They guide the study and completion of tasks. (**C**) They accompany and encourage participation. (**D**) They support the search for commitment with the students. (**E**) They help to go deeper. (**F**) They provide attention and advice to the group. (**G**) They provide individual attention and advice. (**H**) They support and attend to technical difficulties. (**I**) They support and attend in a prudent time. (**J**) They give advice and stimulate the students. (**K**) They involve the students. (**L**) They reinforce and resolve doubts. (**M**) They follow up the group. (**N**) They do individual follow-up.

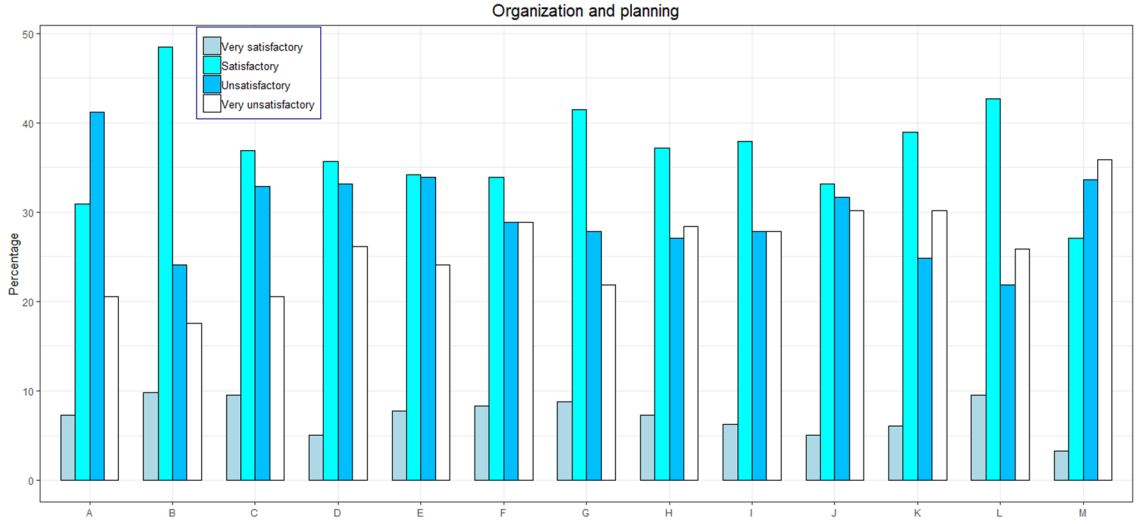

Figure 2. Assessment by the students of the level of satisfaction they have with the following functions and tutoring tasks of the teaching staff in their e-learning regarding organisation and planning: (**A**) The competences to be transmitted are adequate and adapted. (**B**) The contents are competency-based. (**C**) The contents are well organised and sequenced. (**D**) The contents are of a practical nature. (**E**) The tasks present a progressive difficulty. (**F**) The tasks are reasonably adapted to the time of completion and delivery. (**G**) The tasks are carried out with communication tools. (**H**) The additional material is organised. (**I**) The evaluation criteria are based on competences. (**J**) The assessment instruments are in accordance with the competences. (**K**) Tasks are evaluated qualitatively. (**L**) Tasks are assessed quantitatively. (**M**) Timing is adequate and adapted to the length of time the semester lasts during confinement.

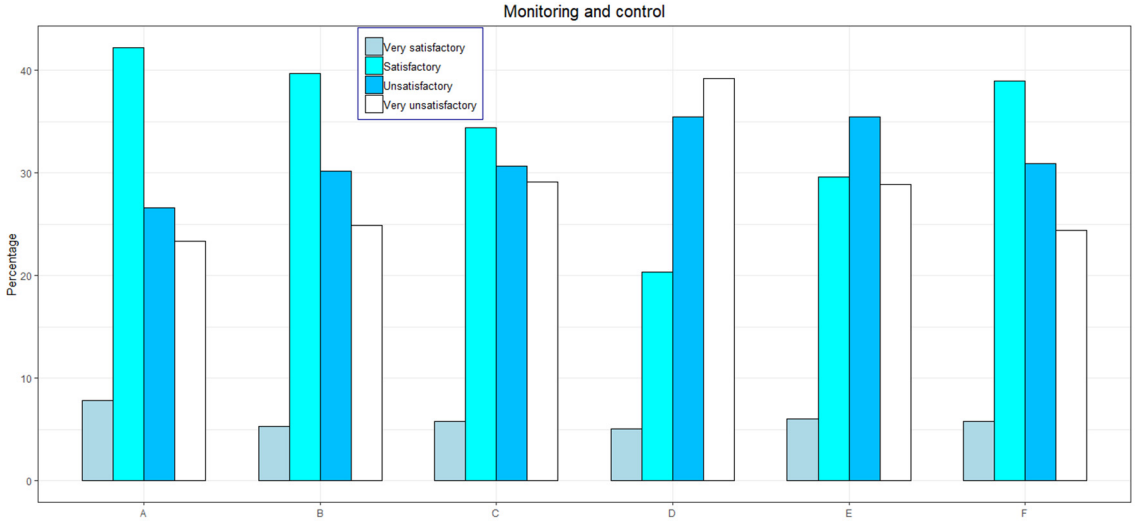

Figure 3. Assessment by students of the level of satisfaction they have with the following functions and tutoring tasks of the teaching staff in their e-learning with regard to monitoring and control: (**A**) Connection and habitual frequency. (**B**) Control of student activities. (**C**) Group monitoring. (**D**) Individual monitoring. (**E**) Degree of participation. (**F**) Connection time.

As far as monitoring and control is concerned, once again the pattern of disagreement by students with the performance of the teaching staff is repeated, as one out of every two students has marked the unsatisfactory or very unsatisfactory option in the items considered. It is even considered appropriate to study the level of satisfaction which respondents have with the beliefs of the teaching staff in e-learning regarding the educational use of technological resources (Figure 4). On this occasion, the results reflect an even worse situation than the previous ones, since barely 40% of those polled manifest a complacent verdict for the good course of e-learning.

Value the degree of involvement of teachers in the development of active methodologies.

With regard to the assessment of the progress of active methodologies in the classrooms and, therefore, the involvement of teachers in them, 44% of those surveyed responded that the flipped-classroom methodology has encouraged the development of their learning when applying technological resources. This means that, firstly, the teacher provides the theory so that students can study it autonomously, then there is a sharing in class to resolve any doubts that may arise, and finally practical tasks are proposed together with the teacher. These results show the rise of active methodologies in the classroom, and more specifically the flipped-classroom approach. However, there is general dissatisfaction among students about the involvement of teachers in this type of methodology, which reflects the fact that these methodologies are currently far from being taught satisfactorily. Figure 5 demonstrates students' judgment on the level of involvement of teachers in the development of active methodology.

It was observed that the students appreciated the fact that teachers were not sufficiently involved in the implementation of this methodology, and even reached really high figures in the "no involvement" mode in some items, where the "development of participatory and constructive group learning" was of particular concern, with 39.2% of the votes. Results show doubt on the viability of the virtual learning environment assumed during confinement and reveal the urgent need for the teaching staff and, although to a lesser extent, the institutions and the Faculty, to carry out self-criticism and reflect deeply on the aspects in which they can improve. Likewise, the whole educational system is being forced to be restructured online in order to adapt to the available means and to facilitate student access.

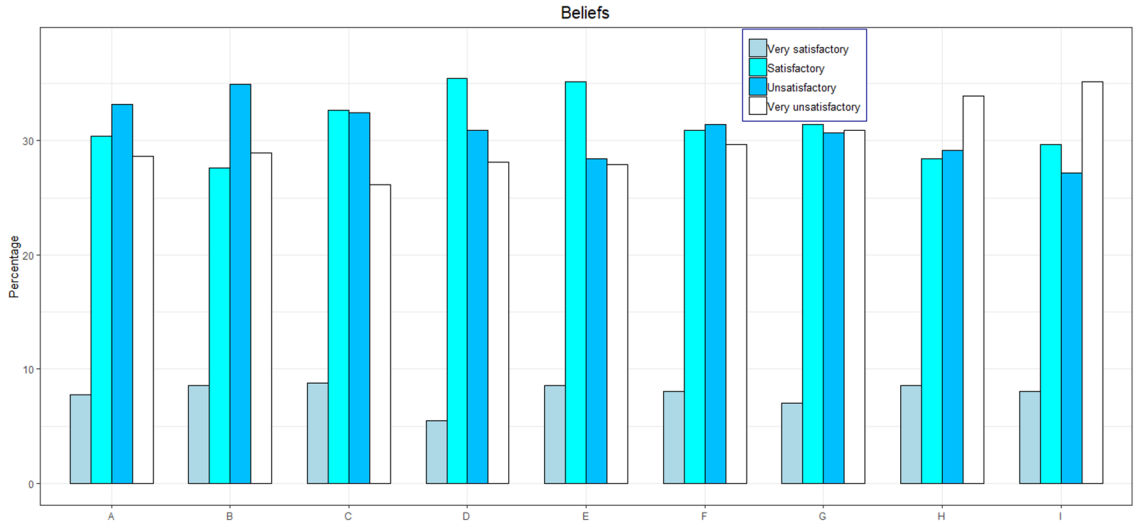

Figure 4. Assessment by students of the level of satisfaction they have with the following beliefs about the educational use of technological resources by teachers in their e-learning: (**A**) They favour a better disposition for student learning. (**B**) They facilitate the analysis and monitoring of student learning. (**C**) They help to provide timely feedback to students. (**D**) They allow the collective construction of knowledge in networks and learning communities. (**E**) They encourage the development of educational projects that promote self-learning. (**F**) They allow the development of research activities with students. (**G**) They facilitate the self-evaluation of teaching activity. (**H**) They facilitate the self-evaluation of student learning. (**I**) They help to generate innovative educational strategies.

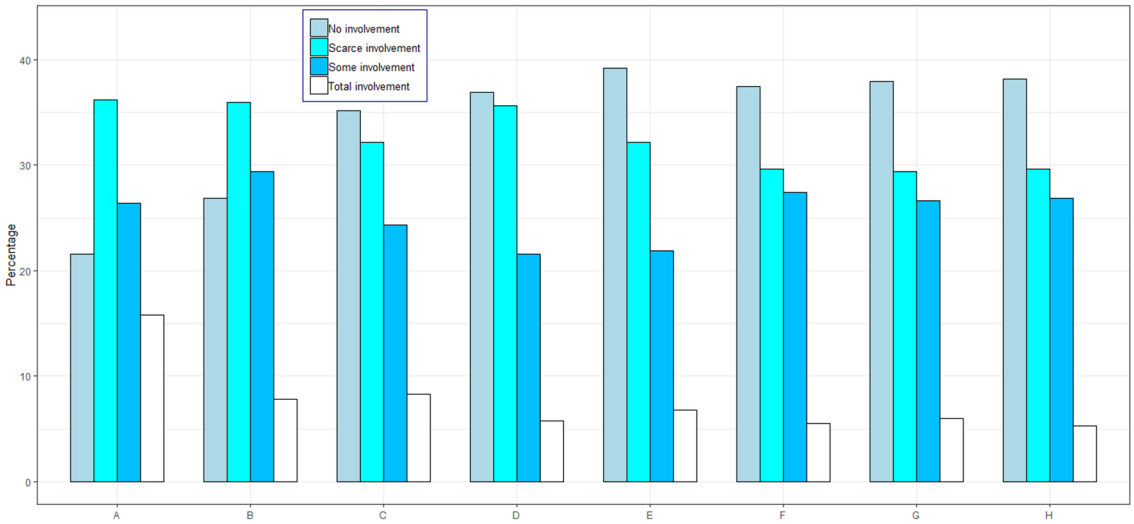

Figure 5. Assessment by students of the degree of involvement of teachers in the development of an active methodology. (**A**) The students are the protagonists of the teaching-learning process. (**B**) The participation and creation of projects by students is encouraged for active learning. (**C**) Motivation is encouraged so that students become involved. (**D**) The application of knowledge and practical skills is connected to real life. (**E**) Participatory and constructive group learning is developed. (**F**) Coordinated and multidisciplinary work is developed. (**G**) Technological resources are really and effectively applied to favour the teaching–learning process. (**H**) The use of technological resources in student learning is really and effectively valued.

Finally, the study focuses on determining the assessment tools that have been applied in the e-learning carried out during the pandemic. It should be reminded that there is a fairly general dissatisfaction with the idea that the assessment instruments have not been in line with the established competencies. Because the teacher may have used different means of assessment, respondents were allowed to select one or more options (multiple choice). Figure 6 demonstrates a barplot showing the percentage of students who have been tested with each of the instruments described at the time of assessment.

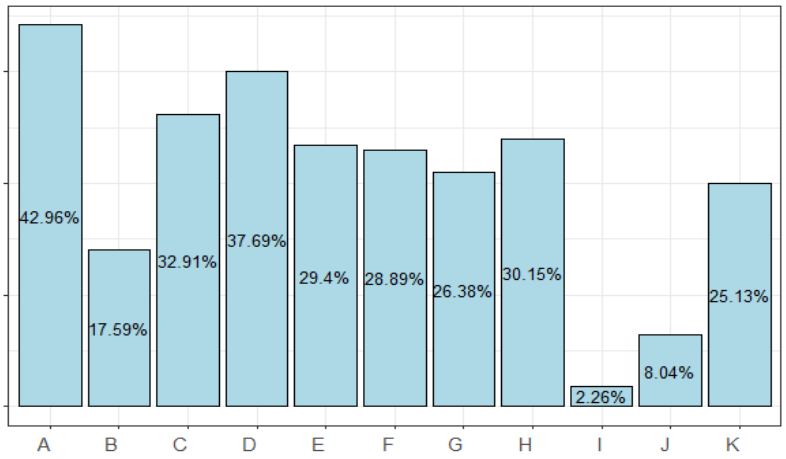

Figure 6. Assessment instruments that are being or have been applied in your e-learning. (**A**) Objective test. (**B**) Test. (**C**) Work guides. (**D**) Assumptions or practical cases. (**E**) Problem solving. (**F**) Projects. (**G**) Recorded exhibitions. (H) Exhibitions by videoconference. (**I**) Interviews by videoconference (**J**) Oral evaluation by videoconference and (**K**) Others.

The choice of "objective testing (test)" to assess students has been the preferred option for teachers, with almost half of the students being tested virtually during confinement. The second option is "Assumptions or case studies", followed by "Work guides" and "Video conference exhibitions". It is especially surprising that little use is made of "Essays" to establish the grades (one in every five students has written this type of text to be evaluated) and it is also surprising that "Oral evaluations by videoconference" are used very little (only 8.04% of students have been evaluated using this instrument).

4. Discussion

In the light of the results obtained, it can be argued that the context and culture of the centre where the research has been carried out is important for establishing a more favourable educational model, as is the case with e-learning when using innovative digital content and resources [68]. A virtual educational environment is characterised by various aspects, such as teachers becoming guidance counsellors; students transforming their learning into active and participative; independence in space and time through digital tools (e-mail, chat, forums, videoconferences or social networks, among others); a wide audience; interactive multimedia content through digital resources; methodological diversity in terms of pedagogical design, allowing self-instruction, collaborative learning and gamification. It is also characterised by control of student learning, or monitoring of student progress in real time with usually instantaneous feedback [69–73]; although student appreciation and motivation decreases in the absence of such interactions [74] and it is difficult to evaluate online in areas requiring applied practices [75].

The comparison and distinction between regular and emergency distance education has highlighted the main challenges facing the current learning system, such as change management, technical factors and lack of financial support [76], as well as the internal procedures, processes and decisions of the faculty and the change in usage behaviour of its students and faculty [77], the global dependence on technologies during the epidemic and the benefits of the e-learning process along with the updating of its use [78], or the renewal of teaching learning to follow the rules of social distancing and the need for online classes [79].

From the effective integration of technology in education, which involves the combination of pedagogical knowledge, subject content and technology in the educational ecosystem researched, we can highlight in terms of the use of virtual resources that higher education should invest in planning studies that provide results in relation to the importance and potential of ICT in the faculty and university [80], as progress cannot be made in

a growing digital world with a low level of digital literacy that diminishes training and employment opportunities [81]. Thus, results indicate that 67.6% of the students surveyed determine as null (22.1%) or scarce (45.5%) the degree of foresight of the teaching staff in relation to the adjustment of technological resources with their teaching skills; or that 68% consider equally null (26%) or scarce (42%) the degree of consideration of the teaching staff in relation to the adjustment of technological resources with student learning. ICTs play a fundamental role in training teachers to improve their pedagogical skills and in making teaching and learning more effective [82], with space and time being considered the main obstacles to improving the quality of teaching according to the number of students in the institution, since they influence the interaction between teachers and students [83].

In line with professional commitment, the sudden transition to distance teaching and learning has increased concerns about the digital divide [84], with email being the most widely used means of communication (93%), followed by video conferencing (72%). However, videos (15%), audios (9.8%) or computer graphics (9.5%), despite their benefits in a virtual environment, have been among the least used. Furthermore, 67.6% felt that teachers did not consider (20.1%) or considered only slightly (47.5%) the revision of the syllabus to adapt it to the virtual environment. Although the most significant data with regard to the assessment of professional commitment can be seen in the degree of willingness perceived by students of the teaching staff towards their professional development with technological resources, since in the overwhelming 96% of cases it is considered that they have no (17%) or little (79%) willingness.

As far as digital pedagogy is concerned, as a result of this changing situation, content is prioritised alongside design, ease of use and organisation, as one of the key factors in the higher quality of the online e-learning system [85]. The opinion of students is mostly unsatisfactory regarding the functions and tasks of tutoring teachers in their e-learning in the three facets: care and support, organization and planning, and monitoring and control.

And in terms of an active methodology, under the circumstances, both for students and teachers, there is a significant lack of digital literacy [86,87], as a large number of teachers do not have a sufficient level of digital competencies, nor the necessary skills linked to the design of online courses, and do not use the varied range of tools offered by technology, requiring collaboration and training with technical staff [88,89]. 71% of students say that their learning has not involved active methodology. All these demonstrate a considerable resistance to change, and there is a need to establish appropriate incentives and systems of training and permanent support available to teachers and students, for the good development of the teaching and learning process [90], so the foundations must be laid for future developments in the university field, bearing in mind all the circumstances we are currently going through.

Considering the number of students enrolled in the Faculty of Education (4.947), the number of participants who satisfactorily completed the questionnaire (398), a simple random sampling with proportional affixing of 0.5, with a confidence level of 95% and a maximum permissible error of 4.7%, the results obtained are considered to be representative and can be generalized to the study population.

5. Conclusions

Many universities are developing specific digital strategies as a reaction to the massive change towards the use of new technologies, but lack the vision, capacity or commitment to implement them effectively. In this work we gained knowledge of the perception of the students of the Faculty of Education Sciences of the University of Granada about the pedagogical model assumed in the virtual learning environment, during the period of isolation due to the coronavirus pandemic, in the second semester of the 2019–2020 academic year, associated with the use of digital technologies and applied methodologies; the central purpose of the research has been achieved.

Proposals for improvement in areas where widespread dissatisfaction has been identified are admissible. Thus, as we move beyond the survival phase of distance teaching and

learning due to confinement, it is essential to make the transition to a prosperous phase of teaching, learning and teacher training. More specifically, regarding the use, creation and distribution of technological resources by teachers, their need to adjust them to the objectives, students and teaching style has been recognised. The functions, tasks and beliefs of the teaching carried out in the adaptation to a virtual learning environment have been determined, and the degree of involvement of teachers in the development of active methodologies has been assessed.

In relation to the first purpose, the students interviewed consider that the teaching staff are fully aware of email and chat (synchronous and asynchronous messaging), because they are common resources. On the other hand, they appreciate an outstanding knowledge of the University of Granada's learning platform (PRADO) and videoconferences, for the virtual training courses proposed to the teaching staff by the University of Granada and other institutions during the confinement. The students also value the fact that the teaching staff have an outstanding knowledge of the tools for collaborative work and the administration of networked files, and internet search engines and office tools, because they are also everyday resources with a notable familiarity of use.

However, they consider that teachers lack appropriate knowledge regarding the use of image editors, video editors, computer graphics editors, synchronous response systems, anti-plagiarism tools and, to a lesser extent, social forums and networks. As can be seen, these are precisely visual and audiovisual resources that are closely related to active methodologies, so that the first proposal for improving the training of teachers can be highlighted in this respect, which are essential for the consequent methodological improvement in a virtual environment. And even to a lesser extent, students consider teachers' limited knowledge of academic database search tools and institutional repositories. Given its importance as a fundamental resource for students to be able to develop their academic process with satisfaction, another proposal for improving the training of teachers is aimed at this effect, suggesting a course that highlights the most important and relevant technological resources, and consequently reaches students with a full level of competence in these tools. It could also be interesting to give the resources to students before the start of the course, in order to familiarise them with these tools, although this requires an extra effort on the part of the university and teachers when it comes to disseminating it.

Regarding the second goal, more than half of the students surveyed opine that the functions, tasks and beliefs of the tutoring of teachers in e-learning are not satisfactory. Dissatisfaction is significant both in terms of care and support and in terms of organisation, planning, monitoring and control. A third proposal for improving the training of teachers is outlined in this aspect, as in the virtual environment it is not necessary to insist with messages reminding us that the tasks have not yet been completed, but rather it would be better to propose training in virtual tutoring related to accompanying students during the teaching and learning process, with suggestions related to the subject to be worked on, with the willingness to help and support when in doubt, with advice and empathy for the circumstances themselves, and with the strengthening of the performance of the work required.

Concerning the third aim, considering in short the progress of active methodologies in the virtual environment, an increase in their implementation is revealed, and more precisely the flipped-classroom approach, although student dissatisfaction is widespread regarding the involvement of teachers and the appropriate development of these methodologies. In other words, attempts have been made to apply more active methods, but not in a satisfactory manner, and this makes sense due to the training shortcomings that have been detected. Therefore, another fourth proposal for improving teacher training focuses on this issue. Confinement has led to a change which may be definitive in the current educational context, where work dynamics that accentuate the roles of teachers and students in the implementation of knowledge of technology, pedagogy and content are proposed.

Therefore, based on the results obtained, we recommend the following proposals for educational improvement:

- Visual and audiovisual resources: image editors, video editors, computer graphics editors, real-time response systems and anti-plagiarism tools.
- Search tools for academic databases and institutional repositories.
- Tutoring functions, tasks and beliefs in virtual environments.
- Active methodologies.

We suggest that for future research we should once again look at the opinion of the students at the same institution on the aspects addressed, to check the degree of improvement achieved in the new academic year 2020–2021, which has also continued in a virtual environment. Another proposal is to find out the opinion of the teaching staff in order to highlight their work and opinion, which consequently leads to a third initiative in which it can be compared with what is perceived by the students. And also to evaluate the means available and their quality at the University of Granada in relation to other universities.

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