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Research Article

Evaluating the impact of digital dance competitions on university students' digital competence amidst COVID-19

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ABSTRACT

Digital competences develop professional profiles that are more and more attainable for labor communities in constant transformation. The aim is to verify the impact of dances performed in virtual environments on the digital skills of university students affected by coronavirus. An experimental design of two groups of subjects with sequel due to COVID-19 was developed. The total number of participants was 106 students of the Professional Career of Primary Education of a university in Lima. A rubric to measure skills and a self-report questionnaire were used. The experiment was carried out through the execution of a dance competition in the professional practice, which was part of the curricular program. The results showed that the gamified dances in their virtual format developed better digital competencies than the dancers in the face-to-face format. Digital dances had a positive impact on digital competences in their procedural component, and evidence on perceived self-efficacy received insufficient impact. The study contributes has reported digital competence with variable characteristics in subjects with severe and mild sequel, considering that their perceived self-efficacy develops to a lesser extent than their skills.

Keywords: virtual art, digital competence, dance, virtual teaching, group teaching

INTRODUCTION

The adaptation of the face-to-face educational system to distance education has served to develop effective educational systems and as a response to social isolation implemented between 2020 and 2021 (Decreto Supremo No. 004-2020-PCM, 2020). This mechanism has responded to urgent problems such as the health insecurity of the university population due to COVID-19 (Ministry of Education of Peru, 2021), although it has increased such as reluctance towards preventive vaccination (Cuellar et al., 2021). As of 2022, more than 45% of the university population remained infected (Dextre-Vilchez et al., 2022; Lopez-Reyes et al., 2022). Indeed, the danger for bodily proximity in Higher Education has driven universities to access blended learning with an obvious lack of digital instructional strategies. Here we address a group of students from a private university in Lima, who executed learning sessions in their terminal internship demonstrating certain technological weaknesses between the years 2021 and 2022. Most of these participants presented after-effects of COVID-19, so it is in the interest of the study to verify the impact of virtual dance skills on digital skills.

Digital Competences: Approaches and Evidence

The diversity of technological means to access information allows digital inclusion, requires the use of effective and transmittable skills in virtual environments (Aristizabal Llorente & Cruz Iglesias, 2018; Engen,

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2019; Garzón et al., 2020). For this reason, digital competences are understood as sustainable skills and attitudes for virtual interaction. Findings refer that university students force the use of their digital skills in different complex virtual fields (Dalsgaard et al., 2019; Scolari et al., 2018; Weidlich & Bastiens, 2019). According to the DigCompEdu dimensional framework, digital competences for pre-service teachers are defined as the set of skills, knowledge and beliefs to use technology, materials and challenging tasks in teaching (Lucas et al., 2021; Runge et al., 2023; Smestad et al., 2023; Tourón et al., 2018). Research shows that the professional teaching profile should include the following skills and attitudes (Lucas et al., 2021):

(a) organizational communication,
(b) information selection, creation, and management,
(c) collaborative learning,
(d) feedback,
(e) media and information literacy,
(f) content creation,
(g) responsible use/safety, and
(h) problem-solving.

The vast majority of research assessing this competence shows a greater predilection for using self-efficacy assessment instruments. Few studies have used tools based on demonstrative or performance tasks (Claro et al., 2024).

Some studies have identified dimensions based on the agents of education (Smestad & Gillespie, 2020; Smestad et al., 2023): beneficiary, teaching role, attitudes, knowledge and skills, competences, disciplinary relations, and assessment. However, the trend to use indicators based on DigCompEdu has been sustainable in different research environments, as it is agreed that teacher training foundations need to be implemented specifically for increasingly technological teachers (Hee Yoon, 2022), especially if they will use intuitive and non-intuitive technologies for more time in the classroom to execute distance learning sessions. These arguments are clear, and are in line with the Ibero-American literature (Aristizabal Llorente & Cruz Iglesias, 2018; Garzón et al., 2020; Tourón et al., 2018), where dimensions have been proposed:

(a) informational, to use strategies to deal with information,
(b) communication, as a skill to transfer knowledge,
(c) content creation in the development of materials and the use of media information,
(d) safety, in order to establish means to provide security to users when using information, and
(e) problem solving, where skills and attitudes are applied to solve obstacles in didactic planning.

These dimensions are part of professional development, yet they have been affected in different contexts during the COVID-19 pandemic in developing countries such as Ghana. There, it has been found that secondary school leavers reported problems in searching for information on search media during the COVID-19 stage, more so for the more intuitive and traditional learners who were unable to find thematic information (Sambah et al., 2023). Poor digital health in the United States also adds to the digital pathologies found in teachers who learned to adapt in environments that suggest the specific use of these competencies (Hassel et al., 2021). For this reason, there was a growth curve in the quality and effectiveness of teaching during COVID-19. Still, the question by Carle et al. (2024) clearly demonstrates that teaching in virtual environments involves the use of digital competences, the need to include contextualized content, verifying psychological influences on practitioners. In South Africa, transmitting technology-enhanced learning has generated greater interest in online research because of the possibility of developing better skills in vulnerable contexts (Mesuwini & Mokoena, 2024).

In Asia, the use of sports software has enabled young people to develop digital content creation skills (Zulkifli & Danis, 2022), in other cases artistic environments have been implemented with digital technologies to shape indigenous content (Li et al., 2023). In Europe, students' direct processing of specialized information strengthens their professional profile (Pramila-Savukoski et al., 2023), determines their specialization (Serrano et al., 2022; Zulkifli & Danis, 2022), and their skills to apply digital security and online problem solving (Antón-Solanas et al., 2022; Argelagós et al., 2022; Serrano et al., 2022; Svensson et al., 2022). Thus, the contributions of technologies and gamification complement the development of the professional profile from the beginning of university studies.

Digital Dance: Culture and Interaction

The development of digital dance is usually guided by a mediator, and sometimes by the participants themselves. They adapt regional cultural information and re-signify it in their dances representing their most representative characteristics, this method is applied to university didactics using social learning and cognitive abilities (Li et al., 2022; Zhao, 2022). This proposal seeks to generate:

(a) cognitive cooperation,
(b) creativity,
(c) fun, and
(d) graphic and corporal expression (Ribosa & Duran, 2023; Salas-Rueda et al., 2022).

Especific studies have found that collaborative dance with didactic methods leads to innovative thinking (Durrani et al., 2022; Salas-Rueda et al., 2022; Seufert et al., 2022), collaboration and gamified methods in creative peer learning and improve kinesthetic abilities. Evidence located in the field of cultural expression has reported collaboration between artisans and design researchers as an instrument of cultural resignification (Kolay, 2016). In tourism, cultural and tourism gamification has been implemented to preserve the environment in Europe, cooperative learning, and Asian tourism permanence (Frías-Jamilena et al., 2022; Hamilton et al., 2023; Hsiao & Tang, 2021). These experiences of gamification and resignification contribute to the development of digital dances with leadership in the cultural manifestation in students interested in expressing themselves and leading academic groups (Villalustre & Del Moral, 2015; Vizcaíno-Verdú & Abidin, 2023).

COVID-19 has been a direct influence on dancers around the world, including in Korea, dancers have been forced to adapt the intelligent use of their technologies to learn in a more comfortable way for body learning, which they have found to be satisfying to them as long as they are intuitive and facilitate their interpretations (Hahm et al., 2022); and in Portugal the use of video-enabled dance training and photographic representations improved their body flexibility in pandemic confinement (Batista et al., 2022), however, in some cases unforced and more artificial representations should be avoided in the use of media resources that may generate representational disconnection (Blanc, 2018). Other research has found that the use of teleconferencing with creative elements for therapy can improve self-efficacy, reduce asymptomatic-symptomatic stress from online clinical treatment, which has been understood within virtual education systems for its effectiveness and ability to generate freedom for students to apply art-in-motion techniques through the interactive use of virtual platforms (Feniger-Schaal et al., 2022; Grasser et al., 2021; Oertel, 2024). Similarly, the breathing and mental health of young students has also been reduced through the use of smartphones and lazy breathing techniques (Ko & Lee, 2023). Such strategies have even been developed since before the pandemic using video recordings for qualitative storytelling (Sakellariou et al., 2021). This method constitutes a benefit for strengthening communication in learning (social connection), as it strengthens the learner's introspective ability to immerse himself in the cultural environment and use his perspective, his vision in adapting his traits for dance. The cultural transposition of this information enables the creation of autonomous-creative learning systems.

On what has been developed, we seek to answer the question: What is the impact of dances performed with dance activities represented in virtual environments on the digital competences of students affected by COVID-19?

Research Hypothesis

According to evidence, idea generation, self-regulation and collaboration in dance adapted to cultural and folkloric meanings can develop better cooperative and sensitizing profiles (Durrani et al., 2022; Hamilton et al., 2023; Kolay, 2016; Li et al., 2022; Zhao, 2022). On the other hand, socially challenging activities in the gamification format, motivate the learner, moderate their academic habits and attitudes, to predispose them to take on increasingly complex learning situations (Mǿgelvang et al., 2023; Rosa-Castillo et al., 2022; Sjǿlie et al., 2022; Svensson et al., 2022; Wong et al., 2023; Wu, 2023). In this respect, skills can be high-yielding if mediated by a teacher acting as a virtual organiser or reflective leader in preparatory activities (Huang et al., 2022; Llorent et al., 2020; Svensson et al., 2022; Vizcaíno-Verdú & Abidin, 2023; Zhou et al., 2023).

Table 1. Characteristics associated with COVID-19 infection levels

Levels	Sequel
Very severe	Insistent pulmonary or cardiac fatigue, excessive sweating due to recurrent stress, apparent muscle weakness, continuous respiratory dyspnoea, constant lack of concentration.
Severe	Intermittent pulmonary fatigue, excessive recurrent stressor sweating, apparent muscle weakness, discontinuous respiratory dyspnoea, situational lack of concentration.
Moderate	Mild pulmonary fatigue, normal sweating, no apparent muscle weakness, usual concentration.
Mild	Very mild sweating and fatigue, sustained concentration.

In this hypothesis, we consider that virtual dance performance media such as the use of videos and mediated communication environments can enhance students' connection to their cultural traits. Thus, it was found that virtual drama activities can enhance the intellectual and social skills of elementary school students (Zhang & Jiang, 2024), as well as feed reflection on the technical processes of learning ballet with recorded choreography (Leijen et al., 2009), and physiological responses and self-perceived control in sports replicated with recorded video and asynchronous classes (Bronner et al., 2015; Moon et al., 2023). Yet, it has not been differentiated in the literature that students use their technological capabilities to obtain social and cultural information about the origin of a dance before performing it corporeally. Much less, the evidence reports whether this is effective in students with difficulties associated with COVID-19 sequel. Therefore, the hypothesis is posed: The impact of virtual dances significantly impacts the development of digital competencies of students with COVID-19 sequel. This research seeks to compare their skills with those who perform dances in a face-to-face format (without using intermediary virtual environments).

METHOD

The research is outlined in the quantitative approach, and the study is developed under the experimental design with pre- and post-test in two comparison groups. The research question guiding the study is: What is the impact of dances performed with dance activities represented in virtual environments on the digital competences of students affected by COVID-19? In this sense, the aim is to verify the impact of virtual dances on the digital competences (dependent variable) of a group of university students affected by COVID-19. The hypothesis to be tested is to identify the impact of virtual dances and their impact on the development of digital skills of students affected by COVID-19.

Participants

The study was conducted on a sample of 106 students enrolled until semester 2023-0 semester of the professional school of education of a private university in Lima. In this case, probability sampling was not used because essential characteristics were needed to select subjects for the convenience of the experiment. All subjects were drawn from the six academic semesters taken between 2020, 2021 and 2022. Regarding the type of infection by COVID-19 (very severe = 7, serious = 10, moderate = 17, mild = 44), the historical records of the care and health area of the university were taken into account, which served to the selection of the subjects included in the sample (**Table 1**).

The group of individuals also included those subjects with sequel (n = 28). In order to involve all those involved, each guest was consulted about their participation under the condition of informed consent. The care and health area contributed to this registration in order to establish the steps to follow in participating in the experiment, since it was proposed to intervene in the students through the execution of a dance and dance contest in two modalities: virtual and face-to-face.

Each group was made up of 53 subjects in a non-probabilistic way with selection criteria (experimental group [EG] = virtual dance; control group [CG] = face-to-face dance). Subjects were distributed as evenly as possible, based on their condition or type of infection. The criteria described above allowed students to be added to each group according to school year, and type of sequel. This required a random draw of the total number of subjects who were initially listed on a general list. Subsequently, a randomization system was used in MS Excel to assign each participant to each group. Three teachers were also included for each comparative group, in order to consider them as guides in the contest to be developed. The average age also served to standardize each group, although there were very slight differences between them [$M_{(EG)}$ = 38.5; $SD_{(EG)}$ = 1.45; $M_{(CG)}$ = 39.2; $SD_{(CG)}$ = 1.33]. Regarding gender, female students prevailed in both groups [$EG_{(f)}$ = 69%; $CG_{(f)}$ =

74%]. Regarding the ethical criteria, all the included subjects participated by agreeing to be part of this study. In this sense, they all signed a letter of informed consent, which were administered without giving any indication of the experiment itself, in terms of its timing, design, and format; and thus, avoid methodological biases.

Instruments

Two instruments were used to collect data that help corroborate the skills and self-perception of digital skills. It was therefore decided to measure both their skills and their academic beliefs. First, a rubric called Digital Skills Rubric 2.0 (DSR-2.0) was developed based on the indicators from the 2.0 assessment framework, initially proposed by Evangelinos and Holley (2015), but adapted by Vishnu et al. (2022) in students from India. This allowed evaluating the performance in digital skills in the students involved in the study sample. On the other hand, the Digital Competence Questionnaire for Teachers (DCT) by Tourón et al. (2018), which aims to assess the perception that the teacher presents about their own technological, informational and problem-solving capacities. Both instruments were validated by the judgement of two experts in education and three experts in research methodology, considering criteria of coherence, clarity and relevance. This process lasted about one month, with validation letters being sent to the e-mail addresses of each expert contacted. The experts' recommendations were based on corrections to the content and linguistic profile of the questions and answers, which were corrected and returned to them. This enabled their approval, calculating a higher average acceptance rate among all evaluators. This achieved 98% of total item acceptance.

The decision to use both instruments was made because both studies were theoretically based on the proposals of the European Union as part of the teacher 2.0 profile in line with other Ibero-American studies (Aristizabal Llorente & Cruz Iglesias, 2018; Domingo-Coscollola et al., 2020; Falcó Boudet, 2017; Garzón et al., 2020; Jiménez Hernández et al., 2021). Another criterion was that both studies presented similar characteristics in the study population they addressed. Finally, both were considered to be homologous in terms of their dimensions:

(a) information and data literacy,
(b) communication and collaboration,
(c) creation of digital content,
(d) security, and
(e) problem solving.

Each question or assessment item had intensities calculated from 5 to 1. In the case of DSR-2.0, levels from Very High to Very Low were considered; and for the DCT, response scales from Always to Never were stipulated. In terms of reliability (**Table 2**, **Table 3**), the indices for DSR-2.0 were significant (α = 0.849) taking into account 90 data from an initial application. The validation and reliability processes were carried out due to the lack of research that demonstrated its adaptation to the Peruvian reality.

Table 2. Reliability indices of the scales and DSR-2.0 items*

Dimensions (α)	Items	α
Information and data literacy (0.81)	Navigation, search and filtering of data, information and digital content	0.81
	Evaluation of data, information and digital content	0.83
	Management of data, information and digital content	0.79
Communication and collaboration (0.79)	Interacting through digital technologies	0.80
	Sharing through digital technologies	0.75
	Engage with citizenship through digital technologies	0.83
	Collaborating through digital technologies	0.80
	Netiquette	0.78
	Digital identity management	0.77
Creation of digital content (0.84)	Digital content development	0.86
	Integration and re-elaboration of digital content	0.83
Security (0.89)	Protection devices	0.91
	Protection of personal data and privacy	0.89
	Protection of health and well-being	0.90
Problem resolution (0.91)	Resolution of technical problems	0.91
	Identification of needs and technological responses	0.89
	Creative use of digital technologies	0.89
	Identification of digital competence gaps	0.93

Note. *α (0.849), instrument obtained from Vishnu et al. (2022).

Table 3. Reliability indices of the scales and items of DCT*

Dimensions (α)	Items	α
Information and information literacy (0.821)	Internet browsing strategies	0.81
	Strategies to search for information in different supports or formats	0.83
	Specific channels for the selection of educational videos	0.79
	Rules or criteria to critically evaluate the content of a website	0.80
	Criteria to assess the reliability of information sources, data, digital content, etc.	0.81
	Tools for the storage and management of files and shared content	0.83
	Tools to recover files that have been deleted, damaged, inaccessible, with format errors, etc.	0.81
	Information management strategies	0.78
Communication and collaboration (0.78)	Tools for online communication: forums, instant messaging, chats, video conferencing, etc.	0.74
	Projects of my center related to digital technologies	0.73
	Software available in my center	0.79
	Spaces to share files, images, work, etc.	0.81
	Social networks, learning communities, etc.; to share information and educational content	0.78
	Educational experiences or research of others who can contribute content or strategies	0.77
	Tools for shared or collaborative learning	0.75
	Basic rules of behavior and etiquette in communication through network in the educational context	0.80
	Ways of managing digital identities in the educational context	0.79
Creation of digital content** (0.79)	Tools to develop assessment tests	0.71
	Tools to create rubrics	0.72
	Tools to create presentations	0.78
	Tools for creating educational videos	0.79
	Tools that facilitate learning such as infographics, interactive graphics, concept maps, timelines, etc.	0.78
	Tools to produce QR (Quick Response) codes	0.75
	Tools to create voice recordings (podcast)	0.77
	Tools that help gamify learning	0.766
	Content tools based on augmented reality	0.73
	The software of the Interactive Digital Whiteboard of my center	0.78
	Open Educational Resources (OER / REAs)	0.83
	Tools to rework or enrich content in different formats	0.81
	Different types of licenses to publish my content	0.79
	Sources to locate regulations on copyright and licenses	0.80
	The basic logic of programming, understanding its structure and basic modification of digital devices and their configuration	0.77
	The potential of ICTs to program and create new products	0.76
Security (0.787)	Protection for devices from threats of viruses, malware, etc.	0.75
	Protection of information related to people in your immediate environment	0.76
	Device or document protection systems	0.81
	Ways to delete data/information for which you are responsible about yourself or that of third parties	0.80
	Ways to control the use of technology that become distracting aspects	0.77
	How to maintain a balanced attitude in the use of technology	0.721
	Rules on the responsible and healthy use of digital technologies	0.78
	Recycling points to reduce the impact of technological waste on the environment	0.79
Problem resolution (0.813)	Basic energy saving measures	0.834
	Basic computer maintenance tasks to avoid possible operating problems	0.81
	Basic solutions to technical problems derived from the use of digital devices in the classroom	0.78
	Peripheral compatibility...	0.79
	Solutions for management and storage in the “cloud”, file sharing, granting of access privileges, etc.	0.74
	Digital resources adapted to the educational project of the center	0.79
	Tools that help to attend to the diversity of the classroom	0.80
	Ways to solve problems among peers	0.81
	Options to combine digital and non-digital technology to find solutions	0.77
	Tools to carry out the evaluation, tutoring or follow-up of the students	0.76
	Creative didactic activities to develop digital competence in students	0.751
	Ways to update and incorporate new devices, apps or tools	0.78
	Spaces to train and update my digital competence	0.791

Note. *α (0.91), instrument obtained from Tourón et al. (2018); **To evaluate this dimension, workshops were held for each group in which weaknesses were found to master these skills.

The Cronbach's alpha results obtained for each subscale were acceptable (Information and data literacy = 0.81; Communication and collaboration = 0.79; Digital content creation = 0.84; Security = 0.89; Problem solving = 0.91). In the results of the DCT scale, 0.91 was obtained, and the reliability range of the subscales fluctuated between 0.78 and 0.82 reliability.

Procedure

Initially, each subject was required to have at least the third dose of vaccination to be included in the experiment. Although, during the process of this research, the Ministry of Health had requested that the entire Peruvian population be vaccinated with up to four doses, students were monitored to ensure that they reached the required number of vaccinations. This was due to the fact that the vaccination coverage in Peru for those over 18 years of age had reached 26% by the time the study was completed. Data were collected and verified on the Ministry of Health's OGEI-OGTI source platform on the COVID-19 vaccine in Peru: https://www.minsa.gob.pe/reunis/data/vacunas-covid19.asp. For this reason, the researchers decided to require the participants to have up to three doses as a mandatory condition to be included in the dance and dance contest that the professional school would execute. After the advance notice of the dance and dance contest, a large percentage of participating students was obtained with four doses acquired against the virus (86%).

Regarding the development of the experiment, it was decided to propose a dance competition at the vocational school of education, which we called *Dance is your talent*. The work scheme lasted six months, developed during the last academic semester of 2022. Students from early childhood education courses, applicants for the bachelor's degree in Primary Education and the bachelor's degree in Sports Science participated. The competition took place in three phases:

(a) preparation and enquiry,
(b) practice, and
(c) implementation, grading, and feedback.

Participation was carried out in two ways:

(1) Zoom platform and
(2) face-to-face mode.

The first format corresponded to the experimental group, in whose process the three phases of development were developed, and in the second, similar phases were carried out with on-site attendance at the university. In a first phase, participants were grouped according to their tastes and needs (without rotating or exchanging members). Here they interacted through the Zoom platform, however, many of them chose to use additional means of communication (WhatsApp, Teams, etc.). Each group was tasked with researching the cultural traits of each dance in traditional media such as YouTube.

In the second phase, the subjects in the experimental group coordinated the dance steps to be performed on the Zoom platform. As can be seen in **Figure 1**, many of them decided to attend the university spaces to carry out the practice, in turn, they carried out the transmission through Zoom to communicate with their classmates at the other end. Each group was allowed to opt for the combined use of these technologies at all times. In part of the third phase (execution), the students had organized themselves in such a way that they

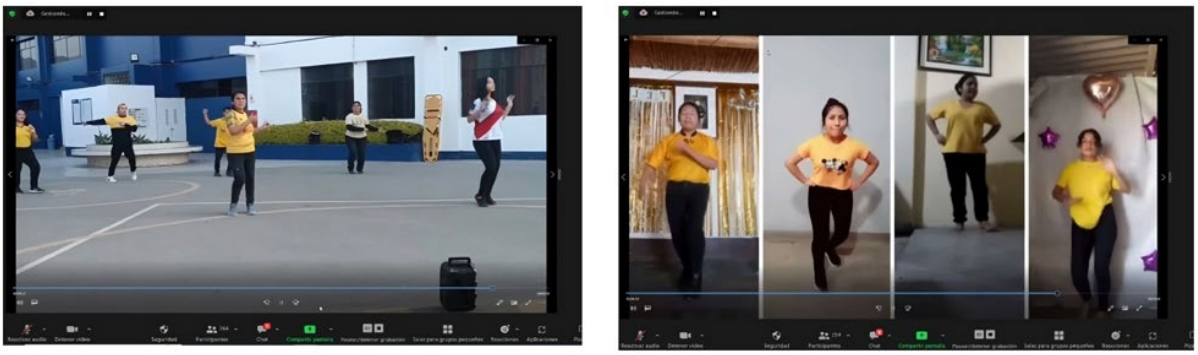

Figure 1. Phases of practice and execution of the Zamacueca dance (Source: Research project database)

Table 4. Comparison of pre- and post-test scores in digital competence in DSR-2.0 and DCT

Statistics	*t*	*df*	*Sig*. (bilateral)	Difference of means	Standard error difference	95% confidence interval of the difference	
						Lower	Higher
DSR 2.0	-0.879	104	0.381	-1.208	1.373	-3.931	1.515
(pre-test)	-0.879	97.092	0.381	-1.208	1.373	-3.933	1.518
DSR 2.0	10.023	104	0.000	14.849	1.482	11.911	17.787
(post-test)	10.023	103.398	0.000	14.849	1.482	11.911	17.787
DCT	1.460	104	0.147	5.943	4.072	-2.132	14.019
(pre-test)	1.460	101.260	0.148	5.943	4.072	-2.134	14.021
DCT	5.111	104	0.000	25.566	5.002	15.647	35.486
(post-test)	5.111	99.521	0.000	25.566	5.002	15.641	35.491

analyzed different videos recorded on the Zoom platform at the time of their group's participation, in order to include aspects of digital creativity, and thus presenting their interactive dances on the platform. The feedback was offered by the jury in each case, either through Zoom or through the face-to-face qualification in the amphitheater (place of execution of the face-to-face modality of the contest).

The application of the instruments took place in the research and computer laboratories, and in those laboratories that needed to use a computer. The conditions of application were the most appropriate, accessible and cool environments were provided, and the times were flexible. The conditions were the most appropriate regarding the environment and the evaluation and survey time. If any of the students presented problems related to their health, the application will be obvious to continue it at another time, respecting the criteria of justice and benevolence in accordance with the Declaration of Helsinki. Likewise, the approach was approved by the Ethics Committee of the Cesar Vallejo University, in the application for the 2021 Teaching Research Project Funding competition. Regarding the statistical analysis, the Kolmogórov-Smirnov test was used to analyze the normality of the data obtained. Preliminary results allowed us to determine that the summative analysis of the data collected by both instruments was analyzed by t-student tests (RDD 2.0 = 0.00; CDD = 0.00), with the exception of the dimensions Creation of digital content (0.103) and Problem solving (0.254), where the Mann-Whitney test was applied.

RESULTS

Digital Competences: Findings of Skills and Self-Perception

According to the proposed hypothesis and what is demonstrated by **Table 4**, the scores in digital skills proved to be homologated at the beginning of the experiment. Therefore, differences greater than an average point favorable to the control group were obtained when evaluating procedural skills with DSR 2.0 ($M = 50.51$; $p > 0.05$). On the other hand, the self-perception of these competencies had a higher score in the experimental group without presenting statistical significance ($M = 137.55$; $p > 0.05$). In this sense, it can be assumed that the abilities to use digital information and the technology with which it is processed have been similar in both groups before the digital dance contest was developed. It follows that the same has happened with their beliefs in their competences in the pre-test measurement.

After the "*Dance is your talent*" contest (post-test measurement) was developed, the data reflected differences, which are shown in **Table 4**. Thus, the subsequent rating was significant in the data collected by the RDD 2.0 instrument. It should be noted that the scores were higher and significant for the experimental group, whose members participated in the competition in its virtual format ($M = 67.89$; $p < 0.05$). The difference was also verified in the perception of their performance in digital skills in this group ($M = 175.26$; $p < 0.05$). Given this, positive effects of improvement offered by digital dance to students with similar health characteristics to students who danced in person are assumed; developing their digital skills to master technological information as well as the perception of their achievements when using them in academic and leisure tasks.

These differences were also obtained in the medians calculated at the moments of pre- and post-test evaluation (**Figure 2**). To verify the differences in the parametric measurement, these medians were calculated, so that an increase from 50 to 69 ranges can be seen in the experimental group using the DSR 2.0

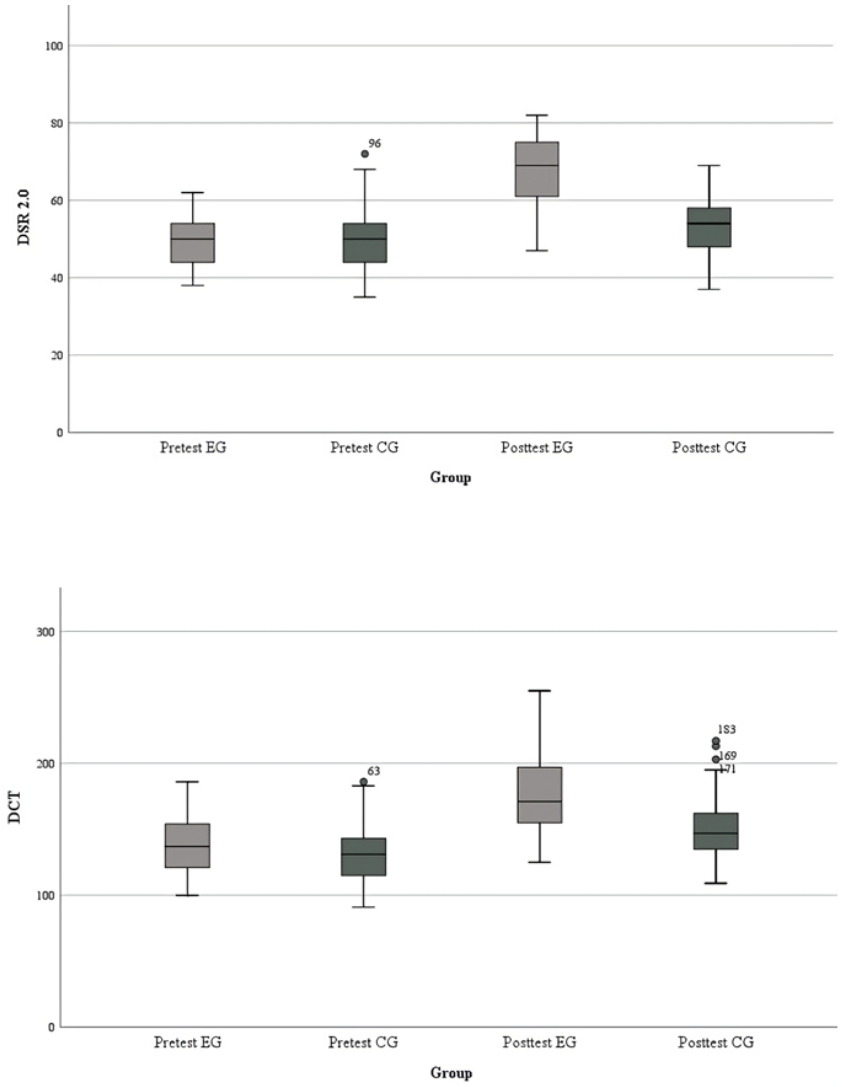

Figure 2. Comparison of digital skills in box diagram (Source: Research project database)

instrument and from 137 to 171 ranges corroborated in the DCT data. Although the free points found in the experimental group should be accepted, especially in the post-test (169, 183, 171). The t-group differences t-test was able to disentangle whether the t-group differences disturb the contrast in non-parametric tests, which was not significant in these values, but was significant in the increase of the scores of the dependent variable (skills and self-perception of digital competences) [$U_{(RDD\ 2.0)} = 245.5$; $U_{(CDD)} = 655.0$; $p < 0.05$].

Digital Skills: Dimensional Analysis in DSR-2.0 and DCT

Table 4 presents the contrasts of the pre-test and post-test of the digital competences reflected by the DSR 2.0 rubric and the DCT to measure the self-perception of its effectiveness. In this sense, it was verified that all the contrasts of the initial scores of each ability in some cases were non-significant differences from the perspectives offered by both instruments, and in others, they did not present differences. With this, it was possible to establish equality between the qualities of each group with respect to the skills they demonstrated before participating in the dance contest. In the post-test measurement, the literacy and informational ability and the data showed significant differences favorable to the experimental group in the DSR 2.0 ($M = 14.26$; $p < 0.05$), which was also manifested in the perception of the subjects who developed the gamified digital dance ($M = 22.21$; $p < 0.05$). In the findings on communication and collaboration, the differences were also favorable for the experimental group in the data obtained by both instruments [$M_{(DSR\ 2.0)} = 18.04$; $M_{(DCT)} = 27.0$; $p < 0.05$].

Table 5. Comparison of pre-test and post-test scores in digital competence in DSR-2.0 and DCT

Skills/Ratings	*t*	*df*	*Sig.* (bilateral)	Difference of means	Standard error difference	95% confidence interval of the difference	
						Lower	Higher
Instrument: DSR 2.0							
Information and data literacy (pre-test)	1.203	104	0.232	0.302	0.251	-0.196	0.800
	1.203	93.355	0.232	0.302	0.251	-0.196	0.800
Information and data literacy (post-test)	9.412	104	0.000	3.585	0.381	2.830	4.340
	9.412	90.982	0.000	3.585	0.381	2.828	4.342
Communication and collaboration (pre-test)	-0.881	104	0.380	-1.019	1.156	-3.311	1.274
	-0.881	103.800	0.380	-1.019	1.156	-3.311	1.274
Communication and collaboration (post-test)	3.359	104	0.001	3.868	1.151	1.585	6.151
	3.359	103.807	0.001	3.868	1.151	1.585	6.151
Creation of digital content (pre-test)	0.253	104	0.801	0.075	0.299	-0.516	0.667
	0.253	103.597	0.801	0.075	0.299	-0.517	0.667
Creation of digital content (post-test)	3.462	104	0.001	1.302	0.376	0.556	2.048
	3.462	102.704	0.001	1.302	0.376	0.556	2.048
Security (pre-test)	0.854	104	0.395	0.245	0.287	-0.324	0.815
	0.854	103.361	0.395	0.245	0.287	-0.324	0.815
Security (post-test)	7.857	104	0.000	3.396	0.432	2.539	4.253
	7.857	83.553	0.000	3.396	0.432	2.537	4.256
Problem resolution (pre-test)	-1.102	104	0.273	-0.811	0.736	-2.271	0.648
	-1.102	100.119	0.273	-0.811	0.736	-2.271	0.649
Problem resolution (post-test)	3.994	104	0.000	2.698	0.676	1.358	4.038
	3.994	103.914	0.000	2.698	0.676	1.358	4.038
Instrument: DCT							
Information and data literacy (pre-test)	0.443	104	0.659	0.189	0.426	-0.656	1.034
	0.443	103.615	0.659	0.189	0.426	-0.656	1.034
Information and data literacy (post-test)	5.656	104	0.000	8.132	1.438	5.281	10.983
	5.656	61.144	0.000	8.132	1.438	5.257	11.007
Communication and collaboration (pre-test)	-0.210	104	0.834	-0.264	1.255	-2.754	2.225
	-0.210	103.456	0.834	-0.264	1.255	-2.754	2.226
Communication and collaboration (post-test)	4.206	104	0.000	6.113	1.453	3.231	8.995
	4.206	92.678	0.000	6.113	1.453	3.227	8.999
Creation of digital content (pre-test)	1.927	104	0.057	4.792	2.487	-0.140	9.725
	1.927	103.174	0.057	4.792	2.487	-0.141	9.726
Creation of digital content (post-test)	1.106	104	0.271	3.208	2.899	-2.542	8.957
	1.106	98.055	0.271	3.208	2.899	-2.546	8.961
Security (pre-test)	1.533	104	0.128	2.113	1.379	-0.621	4.847
	1.533	102.933	0.128	2.113	1.379	-0.621	4.848
Security (post-test)	3.348	104	0.001	5.491	1.640	2.238	8.743
	3.348	73.759	0.001	5.491	1.640	2.222	8.759
Problem resolution (pre-test)	-0.409	104	0.683	-0.887	2.167	-5.184	3.411
	-0.409	103.984	0.683	-0.887	2.167	-5.184	3.411
Problem resolution (post-test)	0.980	104	0.329	2.623	2.675	-2.682	7.928
	0.980	103.975	0.329	2.623	2.675	-2.682	7.928

In relation to the competence called security, favorable differences have been found for the (experimental) digital dance group, with higher scores than the control group ($M = 11.58$; $p < 0.05$). These were verified in the data collected through DSR 2.0. In the data recorded through the DCT, divergences have been found between the scores of both groups, which is why the average reached between the participants of the experimental group is higher ($M = 35.26$; $p < 0.05$). These values, established as statistically significant changes, allow us to assert better capacities developed by the students who developed the digital dance, such as: the usefulness of devices with protection strategies on the Internet, the integration of multiple devices in the use of information. Likewise, their beliefs in the use of the protection of their communication systems and their attitudes about the consumption of technology are efficient and positive in virtual interaction.

Next, a particular analysis is shown on the dimensions of digital content creation and problem solving, since differences without statistical clarity have been found in some of the contrasts made. While it is true, significant differences were found at the level of digital content creation skill (**Table 5**), when evaluated with the DSR-2.0 instrument, so it has been favorable and significant for the experimental group ($M = 8.02$; $p < 0.05$). However, the differences were also favorable for this group in terms of self-perception assessed

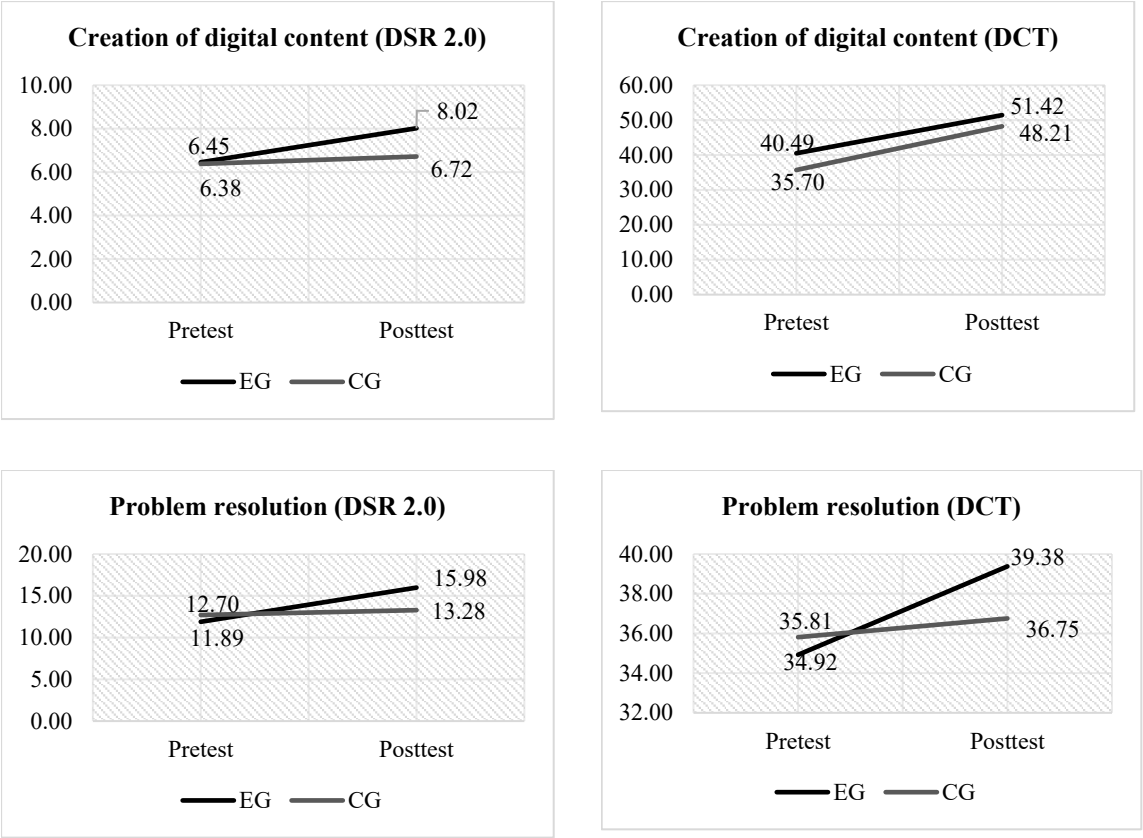

Figure 3. Comparison of pre- and post-test scores in digital content creation and problem solving (DSR-2.0 and DCT) (Source: Research project database)

with DCT (M = 51.42; p > 0.05), although these did not show significance in their statistical analysis. The same has happened with the problem-solving dimension, since the difference is observed in procedural capacity, but it has not been feasible to accept this difference in self-perception in its statistical analysis [$M_{(DSR\ 2.0)}$ = 15.98; p < 0.05; $M_{(DCT)}$ = 39.38; p > 0.05]. With this, it can be argued that the benefits of the "*Dance is your talent*" contest in these dimensions can only be corroborated at the procedural or capacity level, without these effects being acceptable in the self-perception of the participants of this group.

An additional analysis with non-parametric statistics has also corroborated other indices that do not support this part of the hypothesis about these two capacities [$U_{(DCT\text{-}D3)}$ = 1200.5, p > 0.05; $U_{(DCT\text{-}D5)}$ = 1,265.0; p > 0.05]. Although, the gains observed in **Figure 3** allow us to notice prevalence in the development of capacities to create digital content and to solve problems from their procedural perspective. Similarly, it is acceptable to believe that the intervened subjects demonstrated better digital training, without allowing them to be attitudinally convinced of their own demonstrated skills in their social interaction.

Digital Skills and Sequel by COVID-19

In the comparison of digital competences according to the level of sequel by COVID-19, non-significant differences were found between the average pre-test assessment developed in young people with very severe, moderate and mild sequel according to DSR 2. 0 [$Diff._{(very\ severe)}$ = 0.99; $Diff._{(moderate)}$ = 10.97; $Diff._{(mild)}$ = 1.97; p > 0.01], and DCT [$Diff._{(very\ severe)}$ = 7.99; $Diff._{(moderate)}$ = 1.7; $Diff._{(mild)}$ = 7.03; p > 0.01]. As can be seen in **Figure 4**, digital skills are only higher among the groups only in young people with severe sequel. These were favorable for the control group; and the scores differed significantly on the t-Student measure.

The post-test evaluation reported significant differences in the scores obtained by young people with very severe, moderate and mild sequel, which were favorable for students who danced virtually in the competition and demonstrated higher impact skills when responding to the DSR 2.0 instrument. On the other hand, no significant differences in self-perceived competences were found in young people with very severe, severe and moderate sequel (DCT). It is important to note that the differences found in this case were greater for the

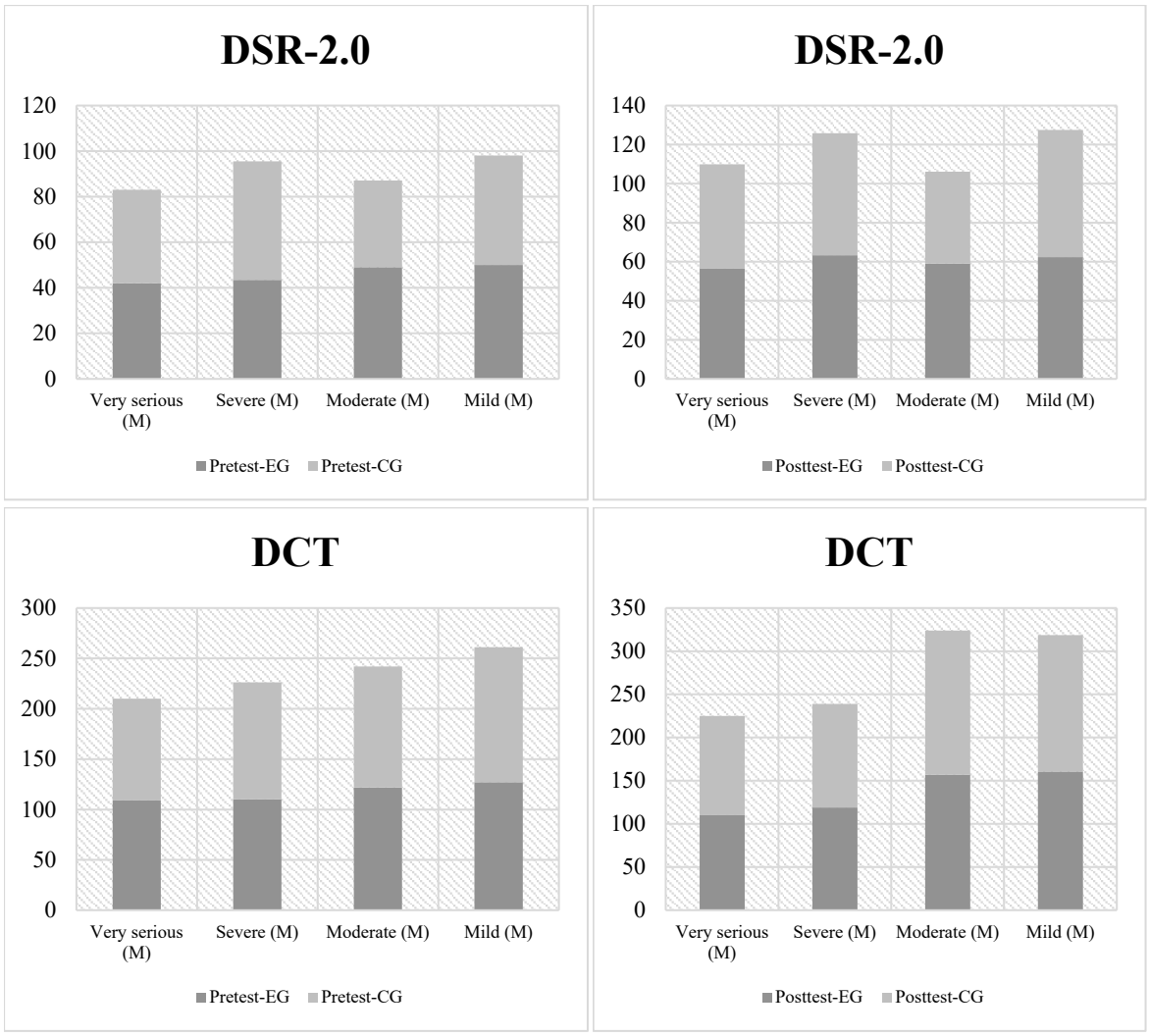

Figure 4. Comparison of digital competencies by type of sequel by COVID-19 (Source: Research project database)

control group despite demonstrating significant statistical evidence. However, differences on this item were found only in young people with mild sequel [$Diff._{(mild)} = 2.58$; $p < 0.01$], which shows a higher incidence of virtual dance performance in those students with better self-perception of their progress at a cognitive level, and who had fewer sequel than the rest of the members. The differences are clear between cognitive performance and the evaluation of self-efficacy from the position of the COVID-19 sequel analysis.

DISCUSSION

The proposed hypothesis made it possible to assume the changes in the digital skills of the subjects with sequel with COVID-19 from two factors embodied in the digital dance strategy:

(a) versatile generation of ideas, self-regulation and collaboration, and

(b) assumption of activities social challengers with gamification.

This is how the effects of this type of dance in the experimental group were verified in the first line of results, so it was possible to verify that the organization, practice and feedback of the dance allowed the generation of ideas in the cooperative activity, as well as what they have done. Other studies have reflected similar situational structures due to gamification with guides or academic tutors (Durrani et al., 2022; Kolay, 2016; Zhao, 2022). On the other hand, it was possible for the participants to obtain digital skills by interacting with other subjects in terms of achieving group goals and overcoming their individual obstacles. The configuration

of the gamified dance activity allowed the subjects to inquire about the themes of the dances, their origin, as well as their bodily practice, which in this part of the hypothesis has been verified in the treatment group.

Predictions have been tested on the subject tested in cooperative but sensitizing activities, of which he has managed to probe the culture by relating more to it (Durrani et al., 2022; Hamilton et al., 2023; Kolay, 2016; Li et al., 2022; Zhao, 2022). Although we do not rule out the possibility that the face-to-face dance also had an effect on the control group, it is likely that the digital media facilitated the introduction of the creativity and self-regulation factors more quickly and automatically among the members of the experimental group. However, from the perspective of exposing them to challenging activities, it has allowed this type of participant to undergo activities that reinforce their attitudes. The student from the Professional School of Primary Education has also managed to predispose his times, adapt his strategies, as well as determine his goals in light of the contest developed. In this case, current evidence has confirmed that gamification mixed with cultural motivational elements can shape students' ways of thinking (Mϕgelvang et al., 2023; Sjϕlie et al., 2022; Svensson et al., 2022; Wong et al., 2023), which pushed them to develop skills to master technology. It should not be forgotten that, in the face of errors, leaders have appeared in the group to guide them together with the teachers who were supportive. This part has also been endorsed by research that indicates the digital mediator as a generator of proven competencies in the ability (Huang et al., 2022; Llorent et al., 2020; Svensson et al., 2022), likewise, it can be grant positive effects of this mediator to the attitudes developed in social interaction (Mϕgelvang et al., 2023; Villalustre & Del Moral, 2015; Vizcaíno-Verdú & Abidin, 2023; Zhou et al., 2023).

The findings found in the first part allow us to deduce that gamified virtual dance had a favorable impact on the development of digital skills. Regarding dimensional development, very positive regulation effects were found in the dimensions of information literacy, communication and collaboration, and security. Therefore, the students who participated in this activity were trained to efficiently navigate the Internet, analyze and evaluate the information found. This has also been revealed in other studies where young people sought to revalue cultural traditions through different types of artistic representation (Durrani et al., 2022; Hsiao & Tang, 2021; Kolay, 2016; Seufert et al., 2022). In addition, they learned to constantly interact in digital communication environments, manage shared learning experiences; and secure your personal and public information when transferring it to others. These characteristics had already been noticed in people who seek to specialize, strengthen their professional profile through the shared use of software, precisely, to be more creative, in turn, more supportive (Serrano et al., 2022; Svensson et al., 2022; Zulkifli & Danis, 2022). The same has happened in their attitudes and self-perception regarding these developed competencies, without witnessing differences in their experimental development. Thus, in the students of Lima, in phase (c) Execution, grading and feedback, predicated some changes by directly participating in the competition, this has probably also been part of the previous inquiry phase, it is important to accept that the jury also served as direct feedback in the execution of each virtual dance. Then, in the digital conversation developed, the participants shared their shortcomings and strengths, analyzed and rectified them to overcome the defects and improve the dance act later in the competition.

At this point, it is important to differentiate the effects found in the procedural component from those found in the perceptual component, of the digital content creation and problem-solving dimensions. This in favor of unravelling the differences between the results of the evaluation of capacities from the use of a rubric and those of self-knowledge by a self-administration survey. Regarding the first perspective (procedural component), differences were found in the digital content creation factor in the post-test evaluation, this presumes the development of skills for the use of audio, graphic and mixed technologies; as well as the use of verbal or literary information to translate it into graphic messages expressed in clothing, dance forms and iconic meanings demonstrated in each dance. This shows that the inquiry and organization activities prompted the students to look for means to elaborate their musical numbers, as well as to adapt information that they collected in textual and digital form. Other studies that support this part of these results have already found that creativity in digital media, as well as cooperative thinking developed in virtual interrelationships, allow more efficient products to be achieved in different academic activities (Li et al., 2022; Salas-Rueda et al., 2022; Zhao, 2022). However, due to the self-perception (perceptive component) it would be necessary to differentiate the reasons that indicate similar scores in the individuals of both groups in this evaluation.

The difference in means was of low score between the groups compared. To this we must add that both groups developed dance strategies from the initial performance of the contest, since it is worth estimating the communication methods with which the subjects of the control group were interrelated, for which it is assumed that the beliefs in both groups they increased since growth was also obtained in this group with respect to their pre-test measurement. Many of the students in both groups did not get rid of using daily virtual environments, such as WhatsApp, TikTok, Twitter, among others. Here, the intelligent use of technology and its gamified effects can also be used to mature attitudes towards cultural and tourism preservation (Bucchiarone et al., 2024; Cheng et al., 2024; Frías-Jamilena et al., 2022; Hsiao & Tang, 2021). Therefore, the self-perception of competencies seems to have been effective in both groups, even though in their procedural perspective the individuals in the experimental group developed truly more efficient capabilities.

Something very similar has occurred in the problem-solving dimension, which is why the results of the procedural evaluation have been differentiated from the self-perceptive perspective. The scores of both groups increased in the evaluation of self-perception, although the improvement in the evidence in the procedural evaluation was greater and significant. In this sense, the discussion can be supported by the fact that the students in the control group also developed a certain form of leadership in their organization and practice, as well as other findings that allowed us to infer that virtual leaders could contribute to solving digital problems (Cabellos et al., 2024; Kolay, 2016; Lin, 2024; Martín-Somer et al., 2024; Villalustre & Del Moral, 2015; Vizcaíno-Verdú & Abidin, 2023). This has led the students of both groups to be equal after setting the goal of winning the contest, since they have solved certain obstacles even if they did so in the face-to-face format. The search to demonstrate better attributes than the dancers in the virtual format forced them to solve problems during the development of the experience.

Regarding the contrasts made on digital competence taking into account the consequences described in the group, the analysis would have shown certain improvements in the group of dancers with virtual means after developing the dance contest, however, the impact would have to be considered positive development in the skills of young people to use technology (DSR 2.0), although with differentiation from those subjects who reported serious consequences. On the other hand, it is contradictory to find another panorama due to the perception they demonstrate about their own procedural performance (DCT), since the tests denoted a positive and clear impact on young people with mild sequel. Here it should be noted that the data collected from young people with other types of sequels (very serious, severe and moderate) have not been clear enough to determine the positive effects at the attitude level. These findings demonstrate that work with intermediary tools with videographic support enables the development of basic dance skills and improves the intuitive interpretation of the dance towards the spectators, as has occurred in other studies (Batista et al., 2022; Blanc, 2018; Hahm et al., 2022). Furthermore, our results confirm the existence of the improvement of digital competencies after using technology-based didactics to perform dance, however, no evidence can be claimed that its application reduces psychosomatic symptomatologies or acute respiratory traumas (Feniger-Schaal et al., 2022; Ko & Lee, 2023; Oertel, 2024), due to the overall scope of the study.

This peculiarity demonstrates that the improvement data found in digital competence could be results exempt from physical performance and attitudinal performance, since the studies reveal advances in areas of psychomotor skills, but are unconvincing in the cognitive investigation of aspects of dance and the interactive rehabilitation of those who have been affected by COVID-19. This is different from what we have hypothetically proposed, considering that intellectual and social skills would attitudinally help the student to achieve more powerful dance capabilities by relying on recording or virtual transmission resources (Leijen et al., 2009; Moon et al., 2023; Zhang et al., 2024). Even so, it should be noted that our study has included subjects with serious and very serious sequel as part of the sample, which has acted as a discriminating methodological means, in turn, as a sampling limitation since the students in the contest They freely adopted the cultural information of dance, but encountered physical difficulties that have diminished the potential of their attitude, and in turn, their own beliefs about their digital competencies.

The scores obtained by a procedural evaluation instrument and those obtained by another attitudinal evaluation instrument have shown that the digital skills of the university student are uneven as long as there are internal obstacles such as those characterized by some physical condition. Attitudes have not been shown to increase as a whole as has the ability to use technology. For this reason, the article has described the cognitive experience that students with certain health characteristics have had, who have responded with

certain attitudes to use technology and be included in the digital community. In that sense, the experience has resulted as a method to strengthen future work skills in young people who will use technological means in the institutions where they will work.

CONCLUSIONS

According to the hypothesis proposed, digital competencies have been regulated in university students approached through virtual dance activities developed in a contest in a face-to-face and virtual format. Also, the effects regulated the competences of information literacy and data use, communication and collaboration and digital security. Of special attention is the creation of digital content and problem solving as developed procedural skills as opposed to their self-perception. This increase was noted in both groups, which prevented obtaining significant differences in the self-perceptive evaluation; and in favor of experimental effects.

Regarding the evaluation methodology, the use of two instruments allowed us to more accurately discriminate the capabilities of self-perceived attitudes in both groups of participants. The procedural assessment was important to understand the skills collected through the use of a task-based rubric. The contribution of the study allows us to provide appropriate instruments for a Latin American situational event. As a contribution, the article reports data from an experience of cooperative-creative situations developed in challenging events with which achievement motivations and technological mastery abilities were regulated in subjects with COVID-19 sequel. This also reveals the limitation to achieve massification of the experience to other university contexts with social and economic differences, which could be of interest to test another comparative study. Likewise, we recognize the lack of time to evaluate teachers longitudinally on their skills. With this we accept the need to evaluate digital competencies with instruments with greater breadth in procedural tasks. This would contribute to finding results that define whether continuing education and pedagogical resilience have effects on the professional development of teaching digital performance.

Even with the results collected, future lines focused on virtual didactics need to be a route to verify the effort of the participants and its equivalence to their beliefs to professionalize optimally. To this end, the terminal practice of education allows us to identify different levels of digital effectiveness, which must also be taken into account in subsequent studies, focused on the use of artistic and virtual teaching techniques. This is crucial if future research takes this contribution to the fields of applied research on organizational decisions, and resource management in education. This is assumed because digital skills are part of a component of the teaching professional profile worth addressing during university training.

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Ethics declaration: This research project was evaluated by the Ethics Committee of Universidad César Vallejo through the process of obtaining funds: INVESTIGA UCV [R.VRI N°. 196-2021-VI-UCV-C. EDP-02]. Regarding the study, participants gave their consent and assent before being exposed to experimental treatment. In the event of any health problem, their decision to re-evaluate their inclusion or withdrawal was respected in order to avoid conditioning them or affecting their individual rights. This obeyed the guidelines established in the Declaration of Helsinki.

Declaration of interest: The authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on reasonable request.

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