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Research article

Self-efficacy scale for university teaching in virtual environments, SSUTVE

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ABSTRACT

Self-efficacy is relevant in explaining performance and well-being in different domains of human behaviour. Despite this need, there are no instruments that assess self-efficacy in university teaching in virtual environments. Therefore, the objective of this study was to design the Self-Efficacy Scale for University Teaching in Virtual Environments (SSUTVE) and analyse its psychometric properties. Three studies were developed to achieve this. First, based on grounded theory, 31 university professors were interviewed in-depth, and the 10 categories that emerged were grouped into two dimensions of the construct. In the second study, 10 expert judges (university professors) evaluated the clarity, relevance, and pertinence of the items developed. In addition, 10 judges assessed the clarity of the items. Subsequently, 33 items were accepted, and the degree of agreement was acceptable (lower limit of confidence interval in Aiken's V above the expected). The third study analysed the internal structure. A total of 554 Peruvian university professors participated, and the scale presented adequate indexes of adjustment for a structure of nine correlated factors: basic technological skills, safety in virtual classes, ethical-legal aspects, guidance and/or advice in the use of technological resources (related to self-efficacy in digital competences) and planning, didactics, group management, mastery of the subject, and evaluation and feedback (related to self-efficacy in pedagogical competences). Additionally, the degree of reliability of the scores and constructs was acceptable. It was concluded that the SSUTVE presents psychometric evidence of validity and reliability for Peruvian university professors working in virtual environments.

1. Introduction

The use of virtual tools is one of the resources to support the teaching-learning process [1,2] which, in the post-pandemic period, has been implemented for continuity at the higher level [3,4] and has been massified through the hybrid modality [5]. Even university students show a more accepting attitude towards online classes after the COVID-19 pandemic compared to the health emergency period [6]. For these reasons, teachers need to develop the required skills and have self-efficacy beliefs. Self-efficacy drives not only the choice of goals and commitments but also the effort and persistence embodied in their achievement [7,8].

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Self-efficacy refers to the belief that a person has in their ability to perform the necessary behavioural responses to succeed in a task [7,9]. Its importance lies in its influence on the capacity for adaptation and change in human beings [10,11], which is why it has been applied to different areas of human development [12]. It favours well-being [13] and is a predictor of action [12]. In the field of education, teachers' self-efficacy is their belief in their ability to provide academic instruction and build positive learning environments [10,14], including the virtual ones.

Teachers with self-efficacy in the use of technological tools have a better handling of them and a greater willingness to use them [1], even in situations of pressure, such as the accelerated learning and overload to which teachers were exposed during the health emergency of the COVID-19 pandemic [15,16]. Therefore, teaching self-efficacy in virtual environments is a very important resource for higher education teachers, especially nowadays, where the demand for virtual education has increased considerably [17]. However, there is a lack of instruments for its evaluation, because teaching self-efficacy scales have focused on special education [7,18–20], inclusive practices [21–24], preschool children [25], mathematics [26], regular basic education [27–31], higher technical education [32], collective university teaching [33], physician training [34], science teaching [35,36], and self-efficacy for research [37].

The closest thing to self-efficacy measures in the field of virtual teaching is an instrument that measures self-efficacy in technological integration using five items [38]. However, it does not incorporate elements of teaching. Another measure is the attitude of university teachers towards the ethical use of information technologies in higher education [39]. Another instrument measures competences in the use of information and communication technology by teachers in training. It includes the dimensions of competences to support students in the application of Information and Communication Technologies (ICTs) in class and competences for its instructional design [40].

Teaching self-efficacy scales are applied to face-to-face work. However, in the post-pandemic era, higher education is taught in a hybrid manner. Therefore, given the existing gaps and the need for a measurement instrument that meets the current needs, the objective of this study is to demonstrate the process of construction and psychometric analysis of the Self-Efficacy Scale for University Teaching in Virtual Environments (SSUTVE) through three studies. Using a qualitative approach, the first study aims to unveil the competences of university teaching in virtual environments, according to the experiences of Peruvian university teachers. The second study aims to obtain evidence of the content validity of the EADU-EV items. Finally, the third study aims to determine evidence of validity based on the internal structure of the SSUTVE, as well as its reliability.

1.1. Review of literature

Social cognitive theory, on which self-efficacy is based, explains how a person constructs their beliefs based on reciprocal determinism between behaviour and the environment [41]. One of its central concepts is human agency, which is based on intentionality and anticipation. This means that people have the capacity to self-regulate based on their power to set purposes, plan their behaviours, and imagine their consequences [42].

Within this theory, self-efficacy is the main construct [10,41], having a reciprocal influence on each of the following elements: outcome expectations, goals and aspirations, affective reactions, and recognition of limitations and opportunities [11]. Self-efficacy develops through experiences of success, actions of other people, verbal prompts, and emotional states [43]. Moreover, they vary in generality, strength, and level; therefore, the importance assigned to such beliefs differs according to the scope of application and cognitive schemas [7].

Although the construct of general self-efficacy has been investigated [44–46], for Bandura [7], self-efficacy beliefs should be understood from the different domains or specific areas of behaviour in which they are applied [7]. One of these domains is teacher self-efficacy, which is an important predictor of performance [47–49] and work engagement [50]. It is negatively related to students' inappropriate behaviour [51,52] and positively related to student enjoyment [53], learning engagement, and participation [54]. However, it is not related to students' academic outcomes [53,55]. The latter results, although controversial, are to be expected considering that academic performance is influenced by various factors [e.g. Refs. [56–61]. Therefore, the influence teachers may exert adds to the set of explanatory factors.

Self-efficacy beliefs in teaching encompass not only the achievement of academic goals for the attainment of expected competences in professional training but also the achievement of autonomy, autonomous motivation, and academic adjustment among students [62]. However, demands change in a virtual environment. This requires the management of virtual tools and a different pedagogy that directs students' attention and motivation to learn [63]. Therefore, teacher self-efficacy in virtual environments requires further investigation. One study collected information on self-efficacy in online teaching during the pandemic. However, a two-item Likert scale was used as a measure, with no reports of validity or reliability and a predominantly qualitative methodology [63].

The construct most closely related to self-efficacy in virtual environments is teachers' information technology integration self-efficacy. A recent meta-analysis found a moderate relationship between teachers' information technology integration self-efficacy and Technological Pedagogical Content Knowledge (TPACK) [64].

Teacher self-efficacy in virtual environments is complemented by Davis' Technology Acceptance Model (TAM) [65] and TPACK. Research has reported that teachers' self-efficacy in using a learning management system [66] and TPACK [67] favours perceived ease of use, attitudes, and intention to use the technology later. The TAM explains technology acceptance for e-learning in students from the perspective of perceived usefulness and intention to use technology [68]. However, during the COVID-19 pandemic, there was low teacher efficacy in using technology, a lack of support for online instruction [69,70], and difficulties in motivating student participation [69].

Although no consensus exists on the definition of teaching self-efficacy [7,14], this study defines teaching self-efficacy in virtual environments as teachers' beliefs about their ability to effectively use digital technologies to plan and implement suitable teaching

strategies and achieve online student learning. This refers to self-confidence in the skills and knowledge required to use virtual resources and promote quality online learning experiences.

For the structure of the self-efficacy construct in virtual environments, it is considered relevant to orient the dimensions and items towards the belief or confidence in the expected competences of university teachers. Therefore, study 1, based on grounded theory, was aimed at fulfilling the objective of revealing the competences of university teaching in virtual environments, according to the experience of Peruvian university teachers. Study 2 sought to obtain evidence of content validity through expert judgement to determine the representativeness, relevance and clarity of the items. In addition, the intelligibility of the items was also assessed by a group of participants from the target population. Finally, study 3 aimed to determine the internal structure of the constructed scale and its reliability. This approach will contribute to creating a measure that helps to understand how teachers perceive and evaluate their own abilities to teach in virtual environments, according to professional expectations.

2. Study 1

An in-depth understanding of human behaviour requires the use of different study methods. Among them, grounded theory allows consideration of previous existing theories, from incipient to advanced levels, to achieve greater solidity of the generated theory [71]. Therefore, the experience of teachers in their daily work can provide relevant information to confirm, expand, or correct theoretical contents related to teaching competences.

In the university environment, the development of integrative competences must respond to the demands of the globalised world [72] and be permanently updated to offer quality instruction [73]. This has led to the digitalisation of educational processes, requiring teachers to master digital competence [74,75] as part of their pedagogical skills, according to the profile of a teacher of excellence [76].

Different studies have indicated that teachers' digital competence is framed into three competences: generic, pedagogical, and transversal. Generic competences encompass basic skills [77] that teachers should acquire expertise in information and communication technologies, including technology management [76,78], ethical, legal, and security aspects [78], and knowledge of policies regarding ICT use in education [79].

Digital pedagogical competences [80] are related to planning, curricular adaptation [76,81], creating experiences that facilitate learning, and evaluation [81]. Additionally, teacher capacity is involved in the development of students' digital competences [80].

Cross-competences reflect on teaching practice, both in its formative and protective roles [76]. They imply a commitment to develop personally and professionally [78,80], the ability to address the affective dimension of students and promote their autonomy [81], and the ability to solve problems [79]. This type of competence will not be considered in the present study because it is compatible with soft skills. Additionally, a previous study that built a measure of self-efficacy in the professional praxis of psychology practitioners initially included the socioemotional skills of social interaction [82]. However, subsequent confirmatory factor analysis excluded this indicator [83].

Based on the categories obtained in the qualitative phase of the study, the items on perceived self-efficacy for virtual teaching can be oriented. Therefore, the aim of this study is to reveal the competences of university teaching in virtual environments based on the experiences of Peruvian teachers.

2.1. Materials and methods

2.1.1. Participants

Thirty-one university teachers from Trujillo (Peru) were interviewed and there was a refusal rate of 14 % (5). Participants were selected by convenience sampling, with 94 % (27) working in private universities and 6 % (2) in public universities. They were mostly male (n = 19; 61.29 %), with ages ranging from 31 to 60 years (M = 43.97; SD = 8.15). Their experience in university teaching ranged from 1 to 26 years (M = 10.81; SD = 6.11), and in virtual environments, synchronous (75 %) or asynchronous (25 %), from 1 to 12 years (M = 3.24; SD = 2.21). A total of 77.42 % (24) were teaching at the undergraduate level, 9.68 % (3) at the graduate level, and 12.9 % (4) at both levels. The majority were psychologists (74.19 %, 23), followed by educators (12.9 %, 4), and, in the minority, from other professions (1 chemical engineer [3 %], 1 microbiologist [3 %], 1 economist [3 %] and 1 lawyer [3 %]). Participation was voluntary, anonymous and ad honorem.

2.1.2. Instrument

An in-depth interview guide was applied, which contained the following questions: 1) What skills or abilities do you consider a university teacher should have in order to effectively perform his/her work in a face-to-face manner?; 2) What attitudes do you consider a university teacher should have in order to effectively perform his/her work?; 3) What skills or abilities do you consider a university teacher should have in order to effectively perform in virtual environments?; and 4) If you had to choose eight necessary skills that a teacher should have in order to perform in virtual environments, what would they be?

The questions were selected in order to cover the largest number of responses regarding the skills expected of teachers in virtual environments, and then, based on this, to focus the items on the beliefs of confidence or mastery of each of the skills detected.

2.1.3. Procedure

The research project, which included the three studies, was approved by the Ethics Committee of the School of Psychology of the Universidad César Vallejo (DICTAMEN 131-CEI-EP-UCV-2022).

Informed consent was requested from the participating teachers through a Google form. The form outlined the objective of the interview, the estimated duration, and the voluntary and anonymous nature of participation. Each member of the research team interviewed participants individually. Participants were informed that each interview would be recorded using the Zoom platform and that participants should rename themselves with a pseudonym and turn off their cameras.

Each question was projected onto a slide and read aloud by the interviewer. In instances where the interviewee's answers were not sufficiently elaborate, the interviewer asked specific questions that allowed for more in-depth information to be gathered.

After the interviews were completed, each researcher manually transcribed the content. Subsequently, the research team conducted categorisation during a meeting.

2.2. Results

Based on the university teachers' experiences, the perceived competences for teaching in virtual environments were categorised as follows: mastery of the subject, technological mastery, professional updating, planning, didactics, knowing how to teach, generating attention, group management, communication, empathy, respect and tolerance, and cognitive flexibility (Table 1). The table of specifications was then structured and the categories obtained were grouped into two dimensions: Self-efficacy in Digital Competences and Self-efficacy in Pedagogical Competences.

Indicators pertaining to Self-efficacy in Transversal Competences were excluded because they encompass soft skills. Items related to Self-efficacy in Research Competences were also excluded as specific tests are already available to measure this construct.

The categories of knowing how to teach and generating attention, motivation, and commitment in students were integrated into the didactics indicator. Competences reported in the literature, such as security of virtual classes, ethical-legal aspects, guidance, and/or counselling in the use of technological resources were included within the digital generic competences dimension. Within the pedagogical competency dimension are evaluation and feedback (Table 2).

Finally, the structure of the self-efficacy scale of perceived competences for university teaching in virtual environments was formed by Self-efficacy in Digital Competences (gamification, basic technological skills, safety in virtual classes, ethical-legal aspects, guidance and/or advice in the use of technological resources), and Self-efficacy in Pedagogical Competences (planning, didactics, group management, subject mastery, and evaluation and feedback). The definitions of the initial indicators and items are listed in Table 2.

2.3. Discussion

Teaching in virtual environments became a widespread containment measure during the COVID-19 health emergency. Its impact has generated changes in university higher education since the development of online courses continued during the post-pandemic period. This required teachers to acquire digital competences to enhance their self-efficacy, which is a relevant construct due to its relationship with performance [47–49], work engagement [50], student enjoyment [53], and student learning engagement and participation [54]. However, no instruments are available to measure teacher self-efficacy in virtual environments. A scale was constructed for this purpose. In the first phase, using a qualitative approach, the objective was to unveil the competences of university teaching in virtual environments based on the experiences of Peruvian teachers.

The categories that served as the basis for the development of the instrument items were derived from grounded theory. This method is recommended for psychometrics [84] and has been reported in other instrumental studies [85–87] because it conveniently combines the strengths of both qualitative and quantitative approaches to obtain in-depth content validity [88,89].

Using content analysis, the dimensions and indicators of Self-efficacy in Transversal Competences and Self-efficacy in Research Competences were excluded. The first dimension refers to soft skills and was excluded based on the finding of an antecedent. In the construction of a self-efficacy scale for pre-professional practices of psychology students, socioemotional items were excluded during factor analysis, because the scale was designed according to the competences expected from psychologists [83]. However, specific measures and theories exist for each soft skill (e.g. cognitive flexibility [90,91], empathy [92,93], tolerance [94], and teacher communication [95]). Therefore, it would be convenient to use independent scales to measure each of these skills.

The dimension of Self-Efficacy in Investigative Competences was excluded from the scale structure because specific tests are already available to measure that construct [37,96]. Furthermore, a study that included the structure of the self-efficacy scale in the professional praxis of psychology practitioners [83] found the absence of a general latent factor integrating self-confidence in research ability and self-confidence in different performance dimensions. This is reflected in the gap between professional praxis and basic science. This justified the use of independent scales for each construct.

The dimensions identified from the interviews included gamification, basic technological skills, safety in virtual classes, ethical-legal aspects, guidance and/or advice on the use of technological resources, all of which are included within digital competences. On the other hand, planning, didactics, group management, mastery of the subject, and evaluation and feedback were considered within pedagogical competence.

The dimensions extracted not only stem from the experiences of university teachers but are also supported by several studies. The massive incorporation of technology into educational processes in recent times demands changes in teaching methodology [97] that are innovative, maintain motivation [98], and promote respect, discipline, and self-determination [99], especially in the virtual environment.

Within digital competences, the dimensions of basic technological skills [100] and the skills to handle information and communication technologies [76,78] were considered. Gamification was separated as a dimension because it is a playful learning methodology requiring additional technological skills [101]. Additionally, the digitisation of daily life implies greater student participation in

Table 1
Categorisation of teaching competences in virtual environments, as perceived by university teachers.

Categorisation	Sample of speech fragments
Mastery of the subject matter	• If you teach a course, you must know how to manage the course (t4, 53 years old, female). ● To have experience in the course to be taught (t5, 32 years old, male). ● Master the subject matter to be taught (L3, 55 years old, male). ● To have technical, theoretical, and methodological knowledge and be up-to-date to be able to teach (L6, 35 years old, female). ● A thorough knowledge of the topics or the course she/he is teaching (O2, 53 years old, male). ● The teacher must master the experience or discipline he/she has to teach and the course he/she is going to teach (C6, 45 years old, female).
Technological expertise	● The teacher must handle technological tools (…). Handling gamification is very important to maintain a dynamic connection with the students since they do not turn on their cameras. So, we don't know if they are there and the ideal way for the teacher to keep in touch and know if the students are paying attention is to perform these games (g1, 41 years old, female). ● When we are in virtual environments we do not know if the student is really present; we would have to use some tools such as Kahoot, Miró or Padlet so that they can participate in a more active way (g2, 60 years old, female). ● To be able to respond to situations in the environment; to use technology not only as a means, but to manage, to build information (t1, 43 years old, female). ● Mastery of virtual tools, knowing how to use ICTs at the right time (t3, 38 years old, male). ● Very good computer or digital skills in the management of information and programmes that will allow the achievement and development of learning (t5, 32 years old, male). ● Having a good command of digital tools and the openness to be able not only to know them but also to apply them, to be able to include them in your daily activities as a teacher (O5, 44 years old, male).
Professional updating	● The university teacher must have the desire to learn more every day to connect with the students and to be trained because not all of us are trained teachers and maybe we lack didactic skills, but we can train ourselves (g2, 60 years old, female). ● Continuous learning, continue to grow professionally (t2, 45 years old, male). ● Preparation and training every day (O2, 53 years old, male). ● Ability to always be willing to learn. Permanent updating (C4, 46 years old, female).
Planning (design of sessions and learning resources)	● To build a whole sequence throughout the course; it should not be seen as a class and then another class with no connection. There should be continuity in a class developed in the syllabus but there should also be continuity in the methodology worked on, so that the student does not see discrepancies (g5, 57 years old, male). ● Knowing how to prepare learning sessions (t2, 45 years old, male). ● Carefully plan the development of the sessions, always hand in hand with the contents and without neglecting the link with professional practice: how this will help the student to be able to later apply it in their professional work (O1, 42 years old, female). ● To also be a good manager of his/her resources and adequately plan activities so that these have the desired impact (O1, 42 years old, female). ● Mastery of the pedagogical processes to capture the attention of the kids and generate the optimal and meaningful learning that they deserve (C1, 31 years old, male).
Didactics (use of methodology, strategies, design of material)	● To have the right methodology to be able to get to the student and achieve the learning that is required (T5, 32 years old, male). ● To have a certain level of creativity to be able to adapt and vary the presentation of content since there will be students with different learning styles in the classroom. It is necessary to generate guidelines that are participatory, that are attractive to the student and that allow everyone to learn: those who are perhaps a little out of date, those who require some levelling, as well as those who are intrinsically motivated and who can manage their own learning (O1, 42 years old, female). ● To handle active learning tools, for example, through case resolution, projects, inverted or collaborative classroom (O1, 42 years old, female). ● It is necessary to build didactic strategies to approach the students. Develop research activities that help to complement the work, the information that we are giving them. Try to adjust the level as well, the student's possibilities to all this information (C6, 45 years old, female).
Knowing how to teach (knowing how to use examples/exposition)	● The teacher must think that the student is going through a training process and must have the patience to repeat as many times as necessary so that the student can understand and comprehend what he/she wants to teach, because the teacher may have a lot of capacity, but the strategies he/she is using may not be the ones that correspond to the student (t4, 53 years old, female). ● To know how to link theory with practice, having examples for each area (L5, 34 years old, male). ● Ask questions, I ask for feedback, I come back, they ask me for examples, I give another example (O4, 48 years old, female).
To generate attention, motivation, and commitment in students	● To have the ability or capacity to keep the group active, engaged (L4, 46 years old, female). ● Being funny, having a good sense of humour, because this also makes it easier to break down the gaps. Enter a little bit into the world, into the students' perspective, so that they can feel more identified and have more interest in their learning (O1, 42 years old, female). ● Encourage interaction, so that the student participates, so that he/she is convinced that he/she is inside a virtual classroom and is not just another spectator (O2, 53 years old, male). ● To be motivating, to be able to generate energy, always as the one who guides or leads the class has to transmit more energy so that it can be assimilated by the students and also generate motivation and energy (O1, 42 years old, female).

(*continued on next page*)

Table 1 (*continued*)

Categorisation	Sample of speech fragments
	● Being dynamic and active during class sessions. Not monotonous teaching, but having that ability to change roles, tones, to transmit his/her ideas (C4, 46 years old, female).
Group management (discipline)	● Having leadership to be able to lead the group (L4, 46 years old, female). ● Being able to impart discipline and to generate a question of living together between students and teacher (L3, 55 years old, male). ● Leadership ability so that with it one is able to have an order, a matter perhaps that allows one to perform all classes in the best way (L3, 55 years old, male). ● Demand with warmth, not under a punitive aspect that may generate that the student has an aversion for that subject, that curricular experience and hinder their learning (O1, 42 years old, female). ● Teachers should be disciplined people, to be able to project discipline and exercise it also in the classroom, whether face-to-face or virtual (O4, 48 years old, female). ● Being a leader, also because you have to deal with the group and that implies having the ability to deal with different types of characters in the classroom (C6, 45 years old, female).
Communication	● Establish effective communication or a communication channel with the students, which allows them to attract their attention (L3, 55 years old, male). ● Communication is also important because virtuality has its own rules, which is what is known as netiquette, which is the way of communicating within the digital space (O5, 44 years old, male). ● Communication is very important. A teacher must have good diction, a good vocabulary to be able to express himself/herself in a correct way. That we can use and teach them some technicalities of the career and the profession so that they feel more identified with the profession they are studying, and also with what they are learning throughout the cycles (O4, 48 years old, female). ● Encourage dialogue, which motivates student participation. One that inspires learning (C2, 50 years old, female). ● At the classroom level, I believe that a teacher should be one who first has a good ability to express his or her ideas. Those communicative skills, that gift of speech, of convincing (C4, 46 years old, female). ● To be a little assertive also in terms of listening to the student regarding the justifications that he may have, perhaps, in the development of his/her activities (C5, 32 years old, male).
Empathy	● We must be empathetic to each other's reality (L4, 46 years old, female). ● Empathetic capacity because for "a" or "b" reasons there are situations that arise and you have to be sympathetic to a certain extent understanding that there are difficulties or limitations regarding access to technology and that implies that the teacher has the capacity to understand the circumstances (L3, 55 years old, male). ● Listening skills because hearing is easy, but listening is very complicated (L6, 35 years old, female). ● I think you must have a good level of empathy because you have to put yourself in different situations, know how to understand that for example if they do not participate, it is not because they are not interested, perhaps there is a greater background situation that leads to them not feeling at that level or in that willingness to participate (O1, 42 years old, female). ● The possibility of empathy must also be increased today because you have to understand that not everyone has the same equipment, or the same facilities, or the same access to networks (O3, 45 years old, male). ● To be very empathetic in the classroom towards the students, to be very understanding with the students (O6, 47 years old, male).
Respect and tolerance	● Tolerance in a virtual environment because we have students who lose the internet, enter late, who tell the teacher to explain again, some enter from a cell phone (t3, 38 years old, male). ● The teacher must be respectful, kind to the students, but without losing the rectitude and demand (O1, 42 years old, female). ● To be a mediator, know how to handle situations to avoid "crossfire" when certain topics are touched upon (C1, 36 years old, male). ● Being tolerant of the different personalities of the students. Patient, too, even for the different situations that may arise (C4, 46 years old, female). ● Tolerance for children who may sometimes have difficulties during the development of virtual classes (C5, 32 years old, male). ● First, respect for the student, for his possibilities, consideration as a person (C6, 45 years old, female).
Cognitive flexibility	● To have an open attitude, flexible to change that must adapt to different circumstances, a person who considers herself on the road to the daily construction of her practice, who recognises that she is on the road to the very construction of her knowledge because this will allow her to project herself to her students (t1, 43 years old, female). ● Being flexible to change because it allows us to modify the didactic scheme for learning (L1, 39 years old, female). ● That flexible capacity, that capacity to adapt, that capacity also to solve problems (L6, 35 years old, female). ● To be open to change so that it can incorporate all this that, in one way or another, to a greater or lesser extent, is new and different for teachers, but that is a reality that will be maintained, that will surely be adapted in the future (O1, 42 years old, female). ● The first thing is the ability to adapt. It is definitely not the same to teach in face-to-face environments as in virtual ones. You have to learn to adapt and look for strategies that allow, virtually speaking, to continue to be close to the student (O3, 45 years old, male). ● The ability to adapt that a teacher must have. One, because we must understand that it is very different to arrive in person than virtually, so the ability to adapt will quickly allow you to include digital tools that are important (O5, 44 years old, male).

Table 2
Conceptual structure and definition of the indicators of the hypothetical model competences of university teaching self-efficacy in virtual environments.

Dimension	Indicator	Argument for inclusion	Items
Self-efficacy in *digital competences*. Confidence in one's own ability to use and guide the use of basic technological resources, gamification, and security in virtual teaching-learning sessions	**Gamification** Confidence in the ability to use virtual recreational resources in a timely and varied manner to encourage students' participation, interaction, and attention	Category obtained (Table 1), based on the responses of 26 interviewees	**As a university teacher in virtual environments, I AM CONFIDENT THAT I CAN …** Use different digital tools (Kahoot, Quizz, Mentimeter, etc.) to maintain participation during the session. Use interactive tools (Genially, Socrative, Mentimeter, etc.) to facilitate students' understanding of a particular topic. Design playful activities to dynamise class sessions. Use interactive tools to strengthen collaborative work among students during learning activities.
	Basic technological skills Confidence in the ability to use platforms and programmes that enable the development of teaching-learning activities	Category obtained (Table 1), based on the responses of 26 interviewees	Develop creative presentations using a variety of virtual tools. Design audiovisual resources (PPTs, videos, audio clips, podcasts, etc.), using various programmes and/or virtual tools. Use office automation packages to implement, publish and share materials (videos, documents, spreadsheets, etc.). Selecting from the Internet, free access programmes, audiovisuals, databases, etc., for the development of the sessions.
	Safety in virtual classes Confidence in the ability to apply security measures to ensure the protection of the students' data and evaluations, as well as to prevent the intrusion of outsiders (hackers) that alter the development of classes.	Category derived from theoretical information [78]	Recognise the risks found on the Internet (hackers, spyware, viruses, etc.) that can affect the implementation and development of my classes. Implement actions (waiting rooms, login, password) to protect my class sessions. Execute measures to block intrusions (suspend participants) during the development of the sessions. Configure the evaluations to keep them hidden. Set up exclusive student access to their work material.
	Ethical and legal aspects Confidence in the ability to design inclusive pedagogical resources, according to the characteristics of the students; in addition, to promote respect for copyright in the production of academic content.	Category derived from theoretical information [78,79]	Facilitate accessible conditions for learning of students with disabilities. Publish digital resources that contain citations of the sources from which information was extracted. Review material produced by students with anti-plagiarism software. Use each student's information for academic purposes only.
	Guidance and/or assessment in the use of technological resources. Confidence in the ability to inform and train students in the use of technological resources (platforms, programmes, and tools).	Category derived from theoretical information [75] Only six teachers considered this category	Develop tutorials to guide students in the use of digital platforms or tools. Respond to students' doubts regarding the management of digital platforms or tools. Guide to the solution of technological problems presented by students during the sessions. ● Develop guides or instructions for the optimal use of digital platforms, tools, or programmes.
Self-efficacy in *pedagogical competences*. Confidence in one's own ability to plan and implement didactic strategies, with mastery of subject matter, constant updating, and group management, as well as to design evaluation and feedback methods.	**Planning** Confidence in the ability to design learning processes (sessions, material, digital tools), according to the capabilities and competences of an educational model.	Category obtained (Table 1), based on the responses of 13 interviewees.	Design didactic sequences that promote the inclusion of students with disabilities within the classroom Design didactic sequences that mobilise skills according to the competence of the course. Evaluate the syllabus of an assigned course, according to the curricular plan and the expected professional competence. Prepare updated material, according to the

(*continued on next page*)

Table 2 (*continued*)

Dimension	Indicator	Argument for inclusion	Items
			purpose of the sessions and course competence. ● Adapt, if necessary, methodological strategies according to the learning needs and interests of the students, the demands of the environment, and the competence of the course.
	Didactics Confidence in the ability to implement methodologies that facilitate teaching-learning and promote attention, motivation, commitment, and autonomy in students, based on a purpose.	Category obtained (Table 1), based on the responses of 17 interviewees.	Dynamise the learning space (active pauses, dynamics, narrative of experiences, etc.) to facilitate the teaching-learning process. Apply strategies to gather knowledge and generate new learning, according to the purpose of the session and competence of the course. Use strategies that promote student reflection regarding the learning process. Provide precise instructions (information search, processes, and expected outcome) aimed at achieving academic products.
	Group management Confidence in the ability to lead students during the development of the sessions in a climate of mutual respect.	Category obtained (Table 1), based on the responses of 10 interviewees.	Handle conflicts that arise between students during sessions. Guide students in meeting the goals of the session. Involve all students in learning activities. Remain calm in the face of tense situations generated by the students' behaviour. ● Establish collaborative relationships for student learning.
	Mastery of the subject matter Confidence in one's own knowledge and experience of the subject matter to be taught.	Category obtained (Table 1), based on the responses of 18 interviewees.	Manage up-to-date information on the subject to be taught. Conduct training on the area (or speciality) related to the subject I teach. Participate as an expert or consultant in the area (or speciality) related to the subject I teach. Carry out research related to the contents of the subject I teach. ● Write newspaper notes or articles on topics in my area of expertise.
	Evaluation and feedback Confidence in the ability to design instruments, collection, and assessment processes, as well as to provide timely information, based on a learning purpose.	Category derived from theoretical information [75,81] Only six teachers considered this category.	Develop instruments to assess student learning. Use a variety of techniques and/or methods to assess students' expected learning. Systematise student assessment results for appropriate decision-making. Adapt evaluation instruments according to the characteristics of the students and the academic product. Inform students of their progress on assessment results. Guide the student to overcome difficulties encountered in the assessment of their abilities.

active, dynamic, and innovative technological learning strategies [97,102]. This is a challenge in virtual education because creativity is required to maintain students' attention and motivation [103]. During the COVID-19 pandemic, difficulty in motivating students to actively participate in the sessions was reported [69].

In the process of structuring self-efficacy towards digital competences, dimensions linked to safety and ethical-legal aspects were also included [78]. The use of virtual environments involves the exposure of personal information (name, ID, and phone number) and interactions with strangers, requiring the mastery of skills to prevent risks and protect users [104]. Additionally, virtual education provides students with more freedom [99], thus teachers must promote ethical behaviour, prevent plagiarism and fraud, and maintain control over the content [105]. Finally, within digital competence, the dimension of guidance and/or advice on the use of technological resources was incorporated. This dimension is associated with teachers' ability to facilitate learning through technological skills in their students [70].

Pedagogical competence refers to the teacher's mastery of mesh theory and practice, giving meaning to what they teach and creating conditions for learning in an equitable and reflective sense [106]. This is coherent with an educational model that determines the graduate profile of competent professionals [76]. Five competence dimensions were identified. The first is planning, which sets the

course of the formative task, involves the designing of the teaching-learning process, and is essential for achieving the expected results [107,108]. The second dimension is didactics, encompassing the ability to select, adapt, or create specific, pertinent, and innovative strategies to optimise teachers' teaching and students' learning [108–110].

The third dimension, group management, is an important element in maintaining an adequate classroom climate according to the teachers interviewed. Compliance with orientations, prevention of conflicts, and establishing clear expectations reduce distractions and help focus on learning purposes [108,111]. The fourth dimension is mastery of the subject, which entails possessing disciplinary expertise, and staying updated and trained in coherence with the subject being taught [112], which allows the teacher to impart solid and quality knowledge. Finally, the fifth dimension of pedagogical competence is evaluation and feedback, which involves designing processes to assess learning [76], employing effective teaching methods or strategies [113], making relevant decisions, and providing educational quality.

Identifying emerging categories of teaching self-efficacy in virtual environments is relevant because it serves as a basis for instrumental studies by deepening and reaffirming theories. In addition, considering the perspective of the target population overcomes researchers' biases in the process of constructing the instrument. This categorisation reveals elements that could inform teacher training programmes according to the competences expected of teachers in the digital era.

3. Study 2

After constructing the preliminary version of the instrument, based on the emerging dimensions and theory, it was necessary to obtain scientific evidence of the correspondence between the content of the scale and the construct of teaching self-efficacy in virtual environments, which it is intended to measure. For this purpose, it was considered propitious to obtain evidence of content validity through expert judgement to determine the representativeness of the items, the relevance of each part of the test in relation to the construct [114], and diversity, clarity, and comprehensibility of the items [115]. In addition, scientific evidence indicates the importance of assessing the clarity of a test by the people to whom the instrument will be addressed [116]. Therefore, the objective is to obtain evidence of content validity of the SSUTVE. For this purpose, it is considered relevant not only from the perspective of the judges but also that of the target population of the test in the Peruvian context.

3.1. Materials and methods

3.1.1. Participants

Ten judges, selected by non-probabilistic convenience sampling, participated in evaluating the content of the instrument and were contacted by the researchers via email. The inclusion criterion was that they had experience in virtual teaching, prior to the COVID-19 pandemic. The majority were psychologists with doctoral degrees (70 %), and males and females (50 % each). Fifty percent were university teachers at the undergraduate level, 40 % at both undergraduate and graduate levels, and 10 % at the postgraduate level. Their minimum university teaching experience was five years (M = 12.4, SD = 6.54), with three years of experience in virtual environments (M = 5.8, SD = 1.81), synchronous and asynchronous. Most of them worked in private universities (80 %, 8). Judges evaluated the items according to the criteria of coherence, relevance and clarity, on a scale from 1 (not at all coherent/relevant/clear) to 5 (fully coherent/relevant/clear). In addition, the judges responded, by dimension, to the question whether the number of items was sufficient to represent the dimension and had the option to suggest the inclusion of any missing items or content. Participation was anonymous, voluntary and without compensation of any kind.

In addition, 10 university teachers, who were part of the target population of the study, rated the clarity of the items, because the assessment of the examinees does not necessarily coincide with that of the judges [116]. Participants were selected by non-probabilistic convenience sampling and their participation was voluntary, anonymous and without compensation for their time. Between the ages of 35 and 61 (M = 47.1; SD = 10.24) 70 % of whom were women. The participants had been teaching in virtual environments, in the synchronous mode, since the pandemic; however, they had previous experience of working in university teaching.

3.1.2. Instrument

The guidelines established by Bandura [7] for constructing self-efficacy scales were followed. In addition, the emerging categories identified after qualitative analysis were considered, and the instrument was designed considering Bandura's social cognitive theory [9,42].

A scale was designed in a template that allows evaluation based on coherence, clarity, and sufficiency. The instructions are detailed below.

"On behalf of our research team, I cordially welcome you. In the context of the pandemic, teachers were faced with the need to develop the competences to carry out their work in virtual environments. Therefore, considering that self-efficacy is an important predictor of performance, we are constructing an instrument that measures self-efficacy for virtual teaching in university teachers.

Therefore, we ask you to please evaluate the items in terms of their consistency with the dimension and clarity, highlighting the assessment you consider most relevant. You will find each dimension in a different tab, in this same [Excel] file. Likewise, if you consider it necessary, you could point out any comments in this same format, as well as the suggestion of potential items that you could kindly suggest to us."

For each item, the judges checked a box between 1 (Not at all coherent/not at all clear) and 5 (Totally coherent/totally clear). The participating teachers had only the option to rate items according to the criterion of clarity. In addition, the judges could comment on

the instructions and response alternatives of the scale.

3.1.3. Procedure

As mentioned above, the project obtained the approval of the Ethics Committee of the School of Psychology of the Universidad César Vallejo (DICTAMEN 131-CEI-EP-UCV-2022).

An e-mail containing the scoring template of the instrument was sent to the judges. Prior to this, they were informed about the research objectives, the estimated time required to complete the scale, and the anonymous, confidential, and voluntary nature of their participation. The researchers' e-mail addresses were also provided, enabling participants to seek clarification if needed.

Subsequently, university teachers (the potential study population) were requested to qualitatively and quantitatively evaluate the items based on their clarity.

The judges' comments were considered, and redundant items were eliminated to ensure the diversity of item content.

3.1.4. Data analysis

Aiken's V [117] and confidence intervals [118] were applied to process the judges' ratings. Items with a lower limit of the confidence interval >.70 were accepted [119].

3.2. Results

The findings on the coherence and clarity of the items obtained adequate values for the dimensions of self-efficacy in digital competences (Min. V = .88 [.89, .99]), and self-efficacy in pedagogical competences (Min. V = .88 [.89, .99]). Despite this, 12 were eliminated, 8 were modified, and 25 items were maintained in response to the observations of the judges and target population evaluated (Table 3).

3.3. Discussion

Prior to the COVID-19 pandemic, university teaching primarily occurred face-to-face. Therefore, it would be expected that self-efficacy is linked to pedagogical competences. However, the new social demands driven by the health emergency required the development of digital competences in teachers. In this context, the content domain of the SSUTVE was constructed and specified based on emerging categories found through qualitative methodology, derived from the perceptions of Peruvian university teachers, as reported in Study 1. Thus, the objective was to obtain evidence of the content validity of the SSUTVE through expert judgement.

The qualitative and quantitative analyses applied in Studies 1 and 2 are recommended for constructing psychological tests [114,115]. This approach enabled the identification of 10 factors and 33 items that constituted the initial structure of the SSUTVE. These factors and items were accepted by both the judges for their theoretical coherence and clarity, and by the target population for their clarity. The factors included gamification, basic technological skills, safety in virtual classes, ethical-legal aspects, guidance, and/or advice in the use of technological resources (related to self-efficacy in digital competences), and planning, didactics, group management, subject mastery, and evaluation and feedback (related to self-efficacy in pedagogical competences).

In this study, the perceptions of both the judges [114] and the target population [116] regarding item clarity were similar, given the similarity in the characteristics of both groups. Previous studies have found that the assessment of item clarity by the target population does not always coincide with that of judges [82,116]. Therefore, the agreement observed in this report enhances the robustness of the instrument. The assessment of item wording and test format complemented the evaluation of the SSUTVE content [114].

4. Study 3

To ensure the quality of psychological assessment instruments, it is necessary to guarantee that the interpretations derived from them are valid, enabling their use as intended [114]. Thus, with the SSUTVE, which has been approved by the judges and target population, it is necessary to empirically test the instrument to determine its internal structure [114,115]. Therefore, the objectives are to determine the evidence of validity based on the internal structure of the SSUTVE and to determine its reliability.

4.1. Materials and methods

4.1.1. Participants

The sample, selected through non-probabilistic intentional sampling, consisted of 554 Peruvian university teachers who taught in the virtual mode due to the COVID-19 pandemic or the design of their academic programme. Sixty-two percent (342) were male, aged between 25 and 75 years (M = 49.4; SD = 10), and 87 % taught at the undergraduate level (482). In total, 83.57 % (463) worked at a private university, 2.53 % (14) at a state university, and 13.9 % (77) at both. The teachers belonged to the field of education (22 %), followed by economics (18 %), technological sciences (16 %), psychology (12 %), among others (Table 4). The average teaching experience was 10.2 years (SD = 7.87) and 3.21 years (SD = 2.76) in virtual environments. Participation was voluntary, anonymous and without compensation of any kind.

4.1.2. Instrument

The SSUTVE was administered after being corrected based on evaluation by judges and the target population (Study 2). The

Table 3
Valuation of items with Aiken's V.

Indicator	Original items	V of Aiken (95%CI)		Decision	Items (version for evaluation)
		Coherence	Clarity		
Self-efficacy in DIGITAL COMPETENCES					
Gamification	• Use different digital tools (Kahoot, Quizz, Mentimeter, etc.) to maintain participation during the session.	.98 [.89, .99][a]	.93 [.82, .97][a] .95 [.85, .98][b]	It is maintained	1. Use different digital tools (Kahoot, Quizz, Mentimeter, etc.) to maintain participation during the session.
	• Use interactive tools (Genially, Socrative, Mentimeter, etc.) to facilitate students' understanding of a particular topic.	.95 [.85, .98][a]	.95 [.85, .98][a]	Deleted to avoid redundancy	
	● Design playful activities to energise class sessions.	.98 [.89, .99][a]	.95 [.85, .98][a] 1 [.93, .99][b]	It is maintained	2. Design playful activities to energise class sessions.
	● Use interactive tools to strengthen collaborative work among students during learning activities.	1 [.93, .99][a]	1 [.93, .99][a] .90 [.79, .96][b]	Deleted to avoid redundancy	
Basic technological skills	● Develop creative presentations using a variety of virtual tools.	.98 [.89, .99][a]	.98 [.89, .99][a] 1 [.93, .99][b]	It is maintained	3. Develop creative presentations using a variety of virtual tools.
	● Design audiovisual resources (PPTs, videos, audio clips, podcasts, etc.), using various programmes and/or virtual tools.	.98 [.89,.99][a]	.98 [.89, .99][a] .98 [.89, .99][b]	It is maintained	4. Design audiovisual resources (PPTs, videos, audio clips, podcasts, etc.), using various programmes and/or virtual tools.
	● Use office automation packages to implement, publish, and share materials (videos, documents, spreadsheets, etc.).	1 [.93, .99]a	1 [.93, .99][a] 1 [.93, .99][b]	It is maintained	5. Use office automation packages to implement, publish, and share materials (videos, documents, spreadsheets, etc.).
	● Select from the Internet free access programmes, audiovisuals, databases, etc., for the development of the sessions.	.95 [.85, .98]a	.98 [.89, .99][a] .98 [.89, .99][b]	It is maintained	6. Select from the Internet free access programmes, audiovisuals, databases, etc., for the development of the sessions.
Safety in virtual classrooms	● Recognise the risks found on the Internet (hackers, spyware, viruses, etc.) that can affect the implementation and development of my classes.	1 [.93, .99][a]	1 [.93, .99][a] 1 [.93, .99][b]	It is maintained	7. Recognise the risks found on the Internet (hackers, spyware, viruses, etc.) that can affect the implementation and development of my classes.
	● Implement actions (waiting rooms, login, password) to protect my class sessions.	.95 [.85, .98][a]	.98 [.89, .99][a] 1 [.93, .99][b]	It is maintained	8 Implement actions (waiting rooms, login, password) to protect my class sessions.
	● Execute measures to block intrusions (suspend participants) during the development of the sessions.	.95 [.85, .98][a]	.98 [.89, .99][a] 1.93, .99][b]	It is maintained	9. Execute measures to block intrusions (suspend participants) during the development of the sessions
	● Configure the evaluations to keep them hidden.	.88 [.89, .99][a]	.88 [.89, .99][a]	Deleted for not representing the dimension	
	● Set up exclusive student access to their work material.	.90 [.79, .96][a]	.90 [.79, .96][a]	Deleted because, the action is included in item 2	
Ethical and legal aspects	● Facilitate accessible conditions in which students with disabilities can learn.	.93 [.82, .97][a]	.93 [.82, .97][a] .93	Deleted for not representing the dimension	

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Table 3 (*continued*)

Indicator	Original items	V of Aiken (95%CI)		Decision	Items (version for evaluation)
		Coherence	Clarity		
			[.82, .97][b]		
	● Publish digital resources that contain citations of the sources from which information was extracted.	1 [.93, .99][a]	1 [.93, .99][a] 1 [.93, .99][b]	It is maintained	10. Publish digital resources that contain citations of the sources from which information was extracted.
	● Review material produced by students with anti-plagiarism software	.98 [.89, .99][a]	.98 [.89, .99][a] 1 [.93, .99][b]	It is maintained	11. Review material produced by students with anti-plagiarism software
	● Use each student's information for academic purposes only.	1 [.93, .99][a]	1 [.93, .99][a]	Deleted for not representing the dimension	
Guidance and/or advice on the use of technological resources	● Develop tutorials to guide students in the use of digital platforms or tools.	1 [.93, .99][a]	1 [.93, .99][a]	Deleted for little relevance	
	● Respond to students' doubts regarding the management of digital platforms or tools.	1 [.93, .99][a]	1 [.93, .99][a] 1 [.93, .99][b]	Modified	12. Respond to students' doubts regarding the use of digital platforms or tools, within the deadlines established by the institution.
	● Guide to the solution of technological problems presented by the students, during the sessions.	1 [.93, .99][a]	1 [.93, .99][a] 1 [.93, .99][b]	It is maintained	13. Guide to the solution of technological problems presented by the students, during the sessions.
	● Develop guides or instructions for the optimal use of digital platforms, tools, or programmes.	1 [.93, .99][a]	1 [.93, .99][a] 1 [.93, .99][b]	It is maintained	14. Develop guides or instructions for the optimal use of digital platforms, tools, or programmes.
Self-efficacy in PEDAGOGICAL COMPETENCES					
Planning	● Design didactic sequences that promote the inclusion of students with disabilities in the classroom.	1 [.93, .99][a]	.95 [.85, .98][a] 1 [.93, .99][b]	It is maintained	15. Design didactic sequences that promote the inclusion of students with disabilities in the classroom.
	● Design didactic sequences that mobilise skills according to the course competence.	.98 [.89, .99][a]	.98 [.89, .99][a] .98 [.89, .99][b]	It is maintained	16. Design didactic sequences that mobilise skills according to the course competence.
	● Evaluate the syllabus of an assigned course, according to the curricular plan and the expected professional competence.	.90 [.89, .99][a]	1 [.93, .99][a] .98 [.89, .99][b]	Modified	17. Evaluate the syllabus of an assigned course, according to the curricular plan and the expected professional competence.
	● Prepare updated material, according to the purpose of the sessions and course competence.	.98 [.89, .99][a]	.98 [.89, .99][a] .98 [.89, .99][b]	It is maintained	18. Prepare updated material, according to the purpose of the sessions and course competence.
	● Adapt, if necessary, methodological strategies according to the learning needs and interests of the students, the demands of the environment and the competence of the course.	.98 [.89, .99][a]	.93 [.82, .97][a] .98 [.89, .99][b]	It is maintained	19. Adapt, if necessary, methodological strategies according to the learning needs and interests of the students, the demands of the environment and the competence of the course.
Didactics	● Dynamise the learning space (active pauses, dynamics, narration of experiences, etc.) to facilitate the teaching-learning process.	.98 [.89, .99][a]	.98 [.89, .99][a] 1 [.93, .99][b]	It is maintained	20. Dynamise the learning space (active pauses, dynamics, narration of experiences, etc.) to facilitate the teaching-learning process.
	● Apply strategies to gather knowledge and generate new learning, according to the purpose of the session and competence of the course.	.98 [.89, .99][a]	.98 [.89, .99][a] .98	It is maintained	21. Apply strategies to gather knowledge and generate new learning, according to the purpose of the session and competence of the course.

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Table 3 (*continued*)

Indicator	Original items	V of Aiken (95%CI)		Decision	Items (version for evaluation)
		Coherence	Clarity		
			[.89, .99][b]		
	● Use strategies that promote student reflection on the learning process.	.98 [.89, .99][a]	.98 [.89, .99][a] .98 [.89, .99][b]	It is maintained	22. Use strategies that promote student reflection on the learning process.
	● Provide precise instructions (information search, processes and expected outcome) aimed at achieving academic products.	.98 [.89, .99][a]	.98 [.89, .99][a] 1 [.93, .99][b]	It is maintained	23. Provide precise instructions (information search, processes and expected outcome) aimed at achieving academic products.
Group management	● Handle conflicts that arise among students, during the sessions.	.88 [.76, .94][a]	.88 [.76, .94][a] 1 [.93, .99][b]	It is maintained	24. Handle conflicts that arise among students, during the sessions.
	● Direct students in meeting the goals of the session.	1 [.93, .99][a]	1 [.93, .99][a] 1 [.93, .99][b]	Modified. Suggestion of participants.	25. Direct students in meeting the goals of the session.
	● Involve all students in learning activities	1 [.93, .99][a]	1 [.93, .99][a] 1 [.93, .99][b]	It is maintained	26. Involve all students in learning activities
	● Calmly handle tense situations generated by student behaviour	.88 [.76, .94][a]	.95 [.85, .98][a]	Deleted to avoid redundancy	
	● Establish collaborative relationships for student learning.	.95 [.85, .98][a]	.95 [.85, .98][a]	Deleted for not representing the dimension	
Subject- Matter Mastery	● Manage up-to-date information on the subject matter to be taught.	.88 [.76, .94][a]	.88 [.76, .94][a] 1 [.93, .99][b]	Modified. Suggestion of participants.	27. Manage up-to-date information on the subject matter to be taught.
	● Conduct training about the area (or speciality) related to the subject I teach.	.85 [.73, .92][a]	.95 [.85, .98][a]	Deleted for little relevance	
	● Participate as an expert or consultant in the area (or speciality) related to the subject I teach.	.98 [.89, .99][a]	.98 [.89, .99][a] 1 [.93, .99][b]	It is maintained	28. Participate as an expert or consultant in the area (or speciality) related to the subject I teach.
	● Carry out research related to the contents of the subject I teach.	.88 [.76, .94][a]	.98 [.89, .99][a]	Deleted because related to another indicator	
	● Write journalistic notes or articles on topics of my specialty.	.90 [.79, .96][a]	1 [.93, .99][a] 1 [.93, .99][b]	It is maintained	29. Write journalistic notes or articles on topics of my specialty.
Evaluation and feedback	● Develop instruments to assess student learning.	.98 [.89, .99][a]	.98 [.89, .99][a]	Modified	30 Develop instruments to assess student learning.
	● Use a variety of techniques and/ or methods to assess students' expected learning.	.98 [.89, .99][a]	.98 [.89, .99][a]	Deleted for redundancy with previous item	
	● Systematise student assessment results for appropriate decision-making.	.98 [.89, .99][a]	.98 [.89, .99][a]	Deleted because, in the university environment, the systematisation process in virtual teaching is consolidated by the digital platforms to be managed (Canvas, Blackboard, etc.).	
	● Adapt evaluation instruments, according to the characteristics of	.95 [.85, .98][a]	.95 [.85, .98][a]	Modified	31 Adapt evaluation instruments, according to the characteristics of

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Table 3 (*continued*)

Indicator	Original items	V of Aiken (95%CI)		Decision	Items (version for evaluation)
		Coherence	Clarity		
	the students and the academic product.		1 [.93, .99][b]		the students and the academic product.
	● Inform students of their progress on assessment results.	.98 [.89,.99][a]	.98 [.89, .99][a] 1 [.93, .99][b]	Modified	32. Feedback to students on their progress on assessment results.
	● Guide the student to overcome difficulties encountered in the assessment of his or her abilities.	1 [.93, .99][a]	1 [b][.93, .99][a] 1 [.93, .99][b]	Modified	33. Provide personalised feedback to students at academic risk to help them overcome their difficulties.

Note.
[a] Judges' evaluation.
[b] Participating teachers' evaluation.

Table 4
Profession of the study participants.

Science and technology nomenclature.[a]	Profession	f	%
Agricultural sciences	Environmental scientist	1	.18
	Zootechnician	1	.18
Sciences of life	Biologist	7	1.26
	Microbiologist	2	.36
Sciences of arts and humanities	Architect	9	1.62
Economic sciences	Administrator	59	10.65
	Accountant	39	7.04
Juridical sciences and law	Lawyer	51	9.21
Medical sciences	Sports scientist	1	.18
	Nurse	17	3.07
	Medical doctor	19	3.43
	Nutritionist	3	.54
	Obstetrician	2	.36
	Odontologist	4	.72
Technological sciences	Engineer	88	15.88
Physics	Physicist	6	1.08
Mathematics	Economist	24	4.33
	Statistician	4	.72
Pedagogy	Educator	122	22.02
	Translator and interpreter	2	.36
Psychology	Psychologist	69	12.46
Chemistry	Chemist - pharmacist	4	.72
Sociology	Communication scientist	15	2.71
	Social scientist	3	.54
	Tourism professional	2	.36
Total		554	100

[a] The nomenclature corresponds to the United Nations Educational, Scientific and Cultural Organisation. (https://skos.um.es/unesco6/view.php?fmt=1).

instrument consisted of 61 items.

The instructions state: "Below you will find situations that university teachers find difficult when teaching in virtual environments. Indicate how confident (a) you feel about performing each of the following activities, choosing a number between 1 and 10, according to the following scale: 1 'Not at all I can do it', 5 'Moderately confident that I can do it', and 10 'Totally confident that I can do it'.

For example: "As a university teacher in virtual environments, I am confident that I can …

… develop tutorials to guide students in the use of digital platforms."

If a participant feels somewhat confident that they can do it, they would mark the number 3. Conversely, if they feel almost sure that they can do it, they would select the numbers 8 or 9 (See appendix).

4.1.3. Procedure

The study employed an instrumental design [120]. Approval for the project was obtained (DICTAMEN 131-CEI-EP-UCV-2022, Resolution of the Vice-Rectorate for Research No. 457-2022-VI-UCV). Permission was also granted by the Vice-Rectorate for Research of a private Peruvian university with campuses in different cities across the country (Oficio Múltiple No. 169-2022-VI-UCV).

This department managed the dissemination of the survey link by institutional e-mail, allowing willing teachers to participate using a Google form, after providing informed consent. The scale was also disseminated through social networks, WhatsApp messaging, and emails to teachers from other Peruvian universities who agreed to participate.

4.1.4. Data analysis

4.1.4.1. Estimation and software. To analyse the internal structure of the instrument, confirmatory factor analysis (CFA) was used with the weighted least squares method of estimation with mean and variance adjusted (WLSMV), considering the matrix of polychoric correlations. These procedures were performed using the Mplus v. 7 software [121].

4.1.4.2. Evidence of validity in relation to the internal structure. Measurement models. A measurement model of 10 oblique factors was analysed based on a review of the available literature, after which content analysis was carried out (Studies 1 and 2).

Preliminary analysis. Before conducting the CFA, we analysed whether the items had a reasonable approximation to univariate normality, which was assessed according to the magnitude of asymmetry and kurtosis; specifically, if they were between −1.5 and 1.5 [122]. Multivariate normality was analysed using the multivariate kurtosis coefficient (G2) of Mardia [123], expecting values less than 70 [124].

Evaluation of the measurement models. The proposed measurement model was evaluated based on three criteria. First, the magnitude of various fit indexes, such as CFI (>.90 [125]), RMSEA, whose confidence interval (CI) must have an upper bound less than .10 [126], and WRMR (<1 [127]). The second criterion considered the influence of the latent variable on the items, focusing on the magnitude of the factor loadings (>.50 [128]).

The third criterion considered two aspects. First, the average variance extracted per factor (AVE; >.37 [129]) was assessed as an indicator of convergent internal validity. AVE represents the average of the communalities of the items and indicates the factor's presence in the measure. Second, the degree of discriminant internal validity among factors was assessed through the descriptive examination of the interfactor correlations (ϕ). Values greater than .85 indicate a low empirical difference between these dimensions [130]. Finally, to conclude whether factors can be interpreted separately, the AVE of a factor is expected to be greater than the squared interfactor correlation between two factors (ϕ2; shared variance among factors) [131,132].

4.1.5. Reliability

The reliability of the scores was assessed with Cronbach's α coefficient (>.70 [133]). Construct reliability was estimated with the ω coefficient (>.70 [134]).

4.2. Results

4.2.1. Evidence of validity in relation to internal structure

4.2.1.1. Preliminary analysis. In terms of description, although most of the items showed acceptable skewness, the kurtosis significantly exceeded the proposed limits (Table 5). In addition, Mardia's coefficient suggests that the data did not approach multivariate normality (G2 = 930.636).

4.2.1.2. Evaluation of measurement models. The 10-factor oblique model obtained acceptable fit indexes (CFI = .965; RMSEA = .104, CI90 % .100, .107; WRMR = 1.647). However, the interfactor correlation between the first original factor (gamification) and the

Table 5
Descriptive statistics of the items.

	M	DE	g_1	g_2		M	DE	g_1	g_2
Item 1	8.132	2.086	−1.197	.727	Item 18	8.718	1.527	−1.645	3.467
Item 2	7.946	2.078	−1.076	.451	Item 19	8.986	1.261	−1.638	3.565
Item 3	8.338	1.813	−1.303	1.291	Item 20	8.810	1.358	−1.516	2.979
Item 4	8.527	1.669	−1.314	1.358	Item 21	8.865	1.281	−1.410	2.298
Item 5	8.469	1.795	−1.253	1.005	Item 22	8.865	1.302	−1.486	2.814
Item 6	8.606	1.588	−1.293	1.308	Item 23	8.894	1.289	−1.535	3.092
Item 7	8.078	2.034	−1.032	.301	Item 24	8.897	1.255	−1.468	2.585
Item 8	8.747	1.574	−1.486	1.847	Item 25	9.119	1.197	−2.016	5.575
Item 9	8.522	1.726	−1.441	1.879	Item 26	9.199	1.076	−1.792	4.266
Item 10	8.543	1.718	−1.416	1.711	Item 27	9.119	1.083	−1.689	4.041
Item 11	8.294	1.876	−1.170	.783	Item 28	9.186	1.069	−1.740	4.122
Item 12	8.588	1.596	−1.388	1.863	Item 29	8.944	1.346	−1.632	2.947
Item 13	8.415	1.713	−1.279	1.379	Item 30	8.287	1.868	−1.199	.977
Item 14	7.940	2.035	−1.015	.491	Item 31	8.821	1.396	−1.565	3.223
Item 15	7.848	2.110	−1.040	.580	Item 32	8.874	1.380	−1.653	3.620
Item 16	8.457	1.630	−1.318	1.910	Item 33	9.112	1.182	−1.753	3.951

Note: M: Mean; SD: Standard deviation; g1: Asymmetry; g2: Kurtosis.

second (basic technological skills) exceeded unity. Therefore, it was decided to merge them into a factor called basic technological skills. Subsequently, the new nine-factor oblique model obtained favourable fit indexes (CFI = .973; RMSEA = .090, CI 90 % .087, .093; WRMR = 1.433), and factor loadings exceeded expectations in all cases (λrange = .798 - .963) (Table 6).

Regarding convergent internal validity, the AVE exceeded the expected value, with the minimum value almost doubling the minimum acceptable value (.697). On the other hand, for internal discriminant validity, some cases suggested overlap among factors ($\phi > .85$). However, in most cases, the AVE exceeded the ϕ2, providing evidence in favour of the empirical difference among dimensions and allowing for an independent interpretation of each of the scores (Table 7).

4.2.1.3. Reliability. In all cases (except for the ethical-legal aspects factor), the reliability coefficients for both scores and constructs, were excellent (Table 8).

5. Discussion

With a preliminary structure of the SSUTVE established through categorisation obtained from grounded theory and judges' assessments, it was necessary to determine the underlying factors, such as the structure of the test, from the scale scores. The procedure followed adhered to the recommendations for the construction of psychological assessment instruments [114,115], from the theoretical foundation to the evaluation of the items using different methodologies (expert judgment, factor analysis, etc.). Therefore, the objective of this study was to establish evidence of validity based on the internal structure of the SSUTVE and to assess its reliability. To this end, this discussion will integrate the findings of the three studies.

The structure of the SSUTVE in a sample of Peruvian university teachers working in the virtual modality comprised 33 items distributed across nine correlated factors and demonstrated adequate internal structure, convergent validity, and discriminant internal validity. These factors confirmed the theoretical expectations and findings reported in Study 1, which utilised grounded theory methodology. In Study 2, where the judges and target population were involved, some items from the initial set were eliminated due to various reasons (e.g. lack of representativeness), compromising the construct's representativeness. This resulted in dimensions with four, three, or two items. Subsequently (Study 3), the first two dimensions (gamification and basic technological skills) were merged due to high interfactorial correlation. This could be attributed to the current trend of integrating gamification into teaching to address students' learning needs [135], such as maintaining motivation and attention in virtual environments [69,97,102,103]. Therefore, gamification constitutes an element of teachers' basic technological tools.

The SSUTVE factors are based on the teachers' experiences (Study 1) and confirm the theoretical expectations: basic technological skills [76,78,100,103], safety in virtual classes [78], ethical-legal aspects [104,105], guidance and/or advice in the use of technological resources [80], planning [107,108], didactics [108–110], group management [108,111], subject mastery [112], and evaluation and feedback [76,113]. It is important to mention that although the construction of a new scale was reported, it was decided to start with a CFA because the dimensions were theoretically specified in previous studies (Studies 1 and 2), which determined the items belonging to each dimension [136–138].

Table 6
Factorial parameters of the oblique model.

Self-efficacy in digital competences		Self-efficacy in pedagogical competences	
F1		F5	
Item 1	.798	Item 15	.791
Item 2	.807	Item 16	.888
Item 3	.896	Item 17	.869
Item 4	.865	Item 18	.910
Item 5	.849	Item 19	.918
Item 6	.915	F6	
F2		Item 20	.922
Item 7	.812	Item 21	.936
Item 8	.912	Item 22	.935
Item 9	.869	Item 23	.917
F3		F7	
Item 10	.877	Item 24	.916
Item 11	.791	Item 25	.963
F4		Item 26	.939
Item 12	.931	F8	
Item 13	.924	Item 27	.957
Item 14	.882	Item 28	.853
		Item 29	.805
		F9	
		Item 30	.949
		Item 31	.932
		Item 32	.959
		Item 33	.901

Note: F1: Basic technological skills; F2: Safety in virtual classes; F3: Ethical-legal aspects; F4: Guidance and/or advice on the use of technological resources; F5: Planning; F6: Didactics; F7: Group management; F8: Mastery of the subject; F9: Evaluation and feedback.

Table 7
Convergent and discriminant internal validity.

	F1	F2	F3	F4	F5	F6	F7	F8	F9
AVE	.733	.749	.697	.833	.768	.860	.883	.764	.875
F1	1.000	.726	.733	.750	.706	.650	.472	.521	.543
F2	.852	1.000	.857	.780	.733	.663	.552	.552	.546
F3	.856	.926	1.000	.845	.826	.757	.548	.672	.627
F4	.866	.883	.919	1.000	.854	.702	.516	.534	.566
F5	.840	.856	.909	.924	1.000	.885	.701	.764	.755
F6	.806	.814	.870	.838	.941	1.000	.812	.780	.785
F7	.687	.743	.740	.718	.837	.901	1.000	.927	.817
F8	.722	.743	.820	.731	.874	.883	.963	1.000	.837
F9	.737	.739	.792	.752	.869	.886	.904	.915	1.000

Note: F1: Basic technological skills; F2: Safety in virtual classes; F3: Ethical-legal aspects; F4: Guidance and/or advice on the use of technological resources; F5: Planning; F6: Didactics; F7: Group management; F8: Subject mastery; F9: Evaluation and feedback; AVE: average variance extracted; below the diagonal: interfactor correlations (ϕ); above the diagonal: variance shared between factors (ϕ2).

Table 8
Reliability.

	α	ω
F1	.913	.943
F2	.849	.899
F3	.737	.821
F4	.891	.937
F5	.884	.943
F6	.938	.961
F7	.919	.958
F8	.823	.906
F9	.921	.966

Note: F1: Basic technological skills; F2: Safety in virtual classes; F3: Ethical-legal aspects; F4: Guidance and/or advice on the use of technological resources; F5: Planning; F6: Didactics; F7: Group management; F8: Mastery of the subject; F9: Evaluation and feedback.

The factors related to self-efficacy in pedagogical competences of the SSUTVE were similar to those of the Collective Self-efficacy Scale [33]. They coincide with some factors: planning and design of the teaching-learning process, active involvement in student learning, assessment of student learning, and the teaching role. However, the SSUTVE additionally includes group management and subject matter mastery. Conversely, the Collective University Teaching Self-Efficacy Scale contains factors such as interaction and creation of a positive climate in the classroom, department, and faculty, research and publication of scientific knowledge, as well as professional and pedagogical training and updates. We consider that part of the training and updating dimension is immersed in the content of some items of the SSUTVE subject matter mastery factor. However, as previously noted, the Higher Education Research Self-Efficacy Scales require a separate measure.

Regarding the factors of the SSUTVE related to self-efficacy in digital competences, they share similarities with those of a previous instrumental study that measured the ICT competences of future teachers [40]. These dimensions include basic technological skills and guidance and/or advice in the use of technological resources. However, the antecedent study did not include the factors considered in this research, such as safety in virtual classes and ethical-legal aspects, which are indispensable for information protection and for student training in academic integrity.

The reliability of eight of the nine factors of the SSUTVE was excellent (>.85 [133]), and the self-efficacy factor of the ethical-legal aspects was acceptable (>.70 [133]). This result highlights the scale's good internal consistency and low variability due to errors. However, further studies are necessary to conduct test-retest measures to estimate the stability of the scores.

As the SSUTVE is a recently constructed instrument, obtaining new evidence of validity and reliability in populations from other contexts is essential. Additionally, it is necessary to perform other procedures such as measurement invariance, considering factors like sex. Despite the diversity of the professions of the participants in study 3, further research could include the assessment of the content of the Scale by teachers in virtual environments, who belong to professional fields not represented in the sample of study 3, such as: Philosophy, Ethics, History, Astronomy and Astrophysics, Earth and Space Sciences.

Another limitation of this study was its use of non-probabilistic sampling, which restricts external validity. Similarly, regarding internal structure, developing a study that implements hierarchical models could help clarify the nature of the association among the dimensions [139]. On the other hand, diversifying the strategies to provide evidence of validity would be beneficial. Using external measures that assess related or theoretically relevant constructs (e.g. teacher self-efficacy) could be convenient because, although the structural configuration (internal structure) is important, understanding how the assessed construct is related to others is equally important [140].

As a practical implication, the SSUTVE can serve as a diagnostic measure for the design of plans to improve teaching competence in virtual environments, which will contribute to strengthening teacher performance and, therefore, also teacher's self-efficacy. Similar to a previous study [141], a hybrid teaching programme strengthened pre-service teachers' self-efficacy in instructional strategies, classroom management and student participation. Therefore, the teachers' belief of mastery of their performance in the teaching-learning process in virtual environments will allow them to identify what they need to improve in order to support students in achieving academic objectives. This last aspect is relevant because relationships have been documented between self-efficacy, ease of use of technologies, attitude [1], effort and persistence [7,8]. Despite this, it is suggested that the application of the SSUTVE be accompanied by a measurement of teaching competences in virtual environments, which, in addition to providing evidence of convergent validity, will enrich the information collected for planning training.

Finally, strengthening teaching self-efficacy would contribute to the perception of ease of use of technologies, positive attitudes, and the intention to continue using virtual tools [66] in the post-pandemic period. This could facilitate international virtual exchange in higher education, foster the development of intercultural awareness, and promote skills and knowledge of a global ecology [4].

6. Conclusions

The SSUTVE presents a multidimensional structure of nine correlated factors and 33 items that adequately represent the domain of the construct. The content-based evidence obtained from qualitative and quantitative methodologies, as well as the internal structure, convergent and discriminant internal validity, and reported reliability support the theoretical expectations. Thus, the scale constitutes a diagnostic measure for university teachers in virtual environments and contributes to identifying strengths and potential training areas for university systems.

CRediT authorship contribution statement

Gina Chávez-Ventura: Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Tania Polo-López:** Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Investigation, Conceptualization. **Lilia Zegarra-Pereda:** Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Conceptualization. **Orlando Balarezo-Aliaga:** Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Conceptualization. **Candy Calderón-Valderrama:** Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Conceptualization. **Sergio Dominguez-Lara:** Writing – review & editing, Validation, Supervision, Software, Methodology, Formal analysis, Data curation.

Informed consent statement

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

Institutional review board statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Universidad César Vallejo (March 21, 2022) for studies involving humans.

Data availability

The database is available on the Open Science Framework with registration number p468x: [https://osf.io/p468x/?view_only=75ceefc49c16481ca7e0fa2f4669f49a].

Declaration of generative AI in scientific writing

No generative AI was used writing this text.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

ESCALA SSUTVE

(Versión en español).

A continuación, encontrará situaciones que le resultan difíciles a los docentes universitarios durante la enseñanza en entornos virtuales. Indique qué tan seguro (a) se siente usted de realizar cada una de las siguientes actividades, escribiendo el número del 1 al 10, de acuerdo a la siguiente escala:
1De ninguna manera lo puedo hacer
5 Moderadamente seguro(a) de que lo puedo hacer
10 Totalmente seguro que lo puedo hacer

Como docente universitario (a) en entornos virtuales, confío en que puedo …	De ninguna manera lo puedo hacer				Moderada-mente seguro(a) de que lo puedo hacer					Totalmen-te seguro que lo puedo hacer
	1	2	3	4	5	6	7	8	9	10
1. Utilizar distintas herramientas digitales (Kahoot, Quizz, Mentimeter, etc) para mantener la participación durante la sesión.										
2. Diseñar actividades lúdicas para dinamizar las sesiones de clases.										
3. Elaborar presentaciones creativas utilizando diversas herramientas virtuales.										
4. Diseñar recursos audiovisuales (PPTs, videos, audio clips, podcast, etc.), utilizando diversos programas y/o herramientas virtuales.										
5. Utilizar paquetes de ofimática para implementar, publicar y compartir materiales (vídeos, documentos, hojas de cálculo, etc.).										
6. Seleccionar idóneamente de la internet, programas de acceso libre, audiovisuales, base de datos, etc., para el desarrollo de las sesiones.										
7. Reconocer los riesgos que se encuentran en la Internet (hackers, spyware, virus, etc.) que pueden afectar la implementación y desarrollo de mis clases.										
8. Implementar acciones (salas de espera, registro para ingreso, contraseña) para proteger mis sesiones de clase.										
9. Ejecutar medidas para bloquear las intromisiones (suspender a los participantes) durante el desarrollo de las sesiones.										
10. Publicar recursos digitales que contengan las citas de las fuentes de donde se extrajo información.										
11. Revisar el material elaborado por los estudiantes con software antiplagios										
12. Responder a las dudas de los estudiantes respecto al manejo de plataformas o herramientas digitales, en los plazos establecidos por la institución.										
13. Orientar a los estudiantes en la solución de los problemas tecnológicos, durante las sesiones.										
14. Elaborar guías o instructivos para el uso óptimo de las plataformas, herramientas o programas digitales.										
15. Diseñar secuencias didácticas que promuevan la inclusión de estudiantes con necesidades educativas especiales dentro del aula.										
16. Diseñar secuencias didácticas que movilicen capacidades en función a las competencias del curso.										
17. Estructurar el sílabo de un curso asignado, acorde al plan curricular y a la competencia profesional esperada.										
18. Preparar material actualizado, acorde al propósito de las sesiones y competencia del curso.										
19. Adaptar, si es necesario, estrategias metodológicas en función de las necesidades e intereses de aprendizaje										

(*continued on next page*)

(*continued*)

Como docente universitario (a) en entornos virtuales, confío en que puedo …	De ninguna manera lo puedo hacer				Moderada-mente seguro(a) de que lo puedo hacer					Totalmen-te seguro que lo puedo hacer
	1	2	3	4	5	6	7	8	9	10
de los estudiantes, la demanda del entorno y la competencia del curso.										
20. Dinamizar el espacio de aprendizaje (pausas activas, dinámicas, narración de experiencias, etc.) para facilitar el proceso de enseñanza - aprendizaje.										
21. Aplicar estrategias para recoger saberes y generar nuevos aprendizajes, de acuerdo al propósito de la sesión y competencia del curso.										
22. Utilizar estrategias que promuevan en los estudiantes la reflexión del proceso de aprendizaje.										
23. Brindar instrucciones precisas (búsqueda de información, procesos y resultado esperado) encaminadas a la consecución de productos académicos.										
24. Manejar con calma las discusiones/altercados que se presenten entre estudiantes, durante las sesiones.										
25. Orientar a los estudiantes en el cumplimiento de las metas de la sesión										
26. Involucrar a todos los estudiantes en las actividades de aprendizaje										
27. Usar información actualizada de la materia a impartir										
28. Participar como experto o consultor en el área (o especialidad) relacionada a la materia que enseño.										
29. Redactar notas o artículos periodísticos sobre temas de mi especialidad.										
30. Elaborar instrumentos pertinentes para evaluar el aprendizaje de los estudiantes.										
31. Adaptar instrumentos de evaluación, de acuerdo a la naturaleza del curso y del producto académico.										
32. Retroalimentar a los estudiantes sobre sus avances en los resultados de la evaluación.										
33. Retroalimentar de forma personalizada a los estudiantes con riesgo académico para que superen sus dificultades.										

Scale for University Teaching in Virtual Environments, SSUTVE

Below, you will find scenarios that university teachers find difficult when teaching in virtual environments. Indicate how confident you feel about performing each of the following activities by writing a number from 1 to 10, according to the following scale:
1. No way can I do it.
5. Moderately confident that I can do it.
10. Absolutely sure that I can do it.

As a university teacher in virtual environments, I am confident that I can …	No way can I do it				Modera-tely confident that I can do it					Absolutely sure that I can do it
	1	2	3	4	5	6	7	8	9	10
1. Use different digital tools (Kahoot, Quizz, Mentimeter, etc.) to maintain participation during sessions.										
2. Design playful activities to energise class sessions.										
3. Develop creative presentations using a variety of virtual tools.										
4. Design audiovisual resources (PPTs, videos, audio clips, podcasts, etc.), using various programmes and/or virtual tools.										
5. Use office automation packages to implement, publish and share materials (videos, documents).										
6. Select free-access programmes, audiovisuals, databases, etc., from the Internet for session development.										

(*continued on next page*)

(*continued*)

As a university teacher in virtual environments, I am confident that I can …	No way can I do it				Modera-tely confident that I can do it					Absolutely sure that I can do it
	1	2	3	4	5	6	7	8	9	10
7. Recognise risks found on the Internet (hackers, spyware, viruses, etc.) that can affect the implementation and development of my classes.										
8. Implement actions (waiting rooms, login, password) to protect my class sessions.										
9. Execute measures to block intrusions (suspending participants) during the development of the sessions.										
10. Publish digital resources that cite sources from which information was obtained.										
11. Review material produced by students with anti-plagiarism software.										
12. Respond to students' doubts regarding the use of digital platforms or tools, within the deadlines established by the institution.										
13. Guide students in solving technological problems during sessions.										
14. Develop guides or instructions for the optimal use of digital platforms, tools, or programmes.										
15. Design didactic sequences that promote the inclusion of students with disabilities in the classroom.										
16. Design didactic sequences that mobilise skills according to course competences.										
17. Evaluate the syllabus of an assigned course according to the curricular plan and expected professional competences.										
18. Prepare updated material, according to the purpose of the sessions and course competences.										
19. Adapt methodological strategies as necessary, according to the learning needs and interests of the students, the demands of the environment and course competences.										
20. Dynamise the learning space (active pauses, dynamics, narration of experiences, etc.) to facilitate the teaching–learning process.										
21. Apply strategies to consolidate knowledge and generate new learning according to the purpose of the session and course competences.										
22. Use strategies that promote student reflection on the learning process.										
23. Provide precise instructions (information search, processes and expected outcomes) aimed at achieving academic products.										
24. Handle conflicts that arise among students during sessions.										
25. Direct students in achieving the goals of the session.										
26. Engage all students in learning activities.										
27. Manage up-to-date information on the subject matter to be taught.										
28. Participate as an expert or consultant in the area (or speciality) related to the subject I teach.										
29. Write journalistic notes or articles on topics of my specialty.										
30. Develop instruments to assess student learning.										
31. Adapt evaluation instruments according to the characteristics of the students and the academic product.										
32. Provide feedback to students on their progress based on assessment results.										
33. Offer personalised feedback to students at academic risk to help them overcome their difficulties.										

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