

## **Scale E-portfolio for Higher Education**

**Carolina Zambrano**  
**University Finis Terrae**

**Dario Rojas**  
**University Finis Terrae**

**Miguel Friz**  
**University of Bio Bio**

*Due to the COVID 19 pandemic, the integration of technologies in education accelerated. In this context, the Digital Portfolio is presented as a tool with characteristics that allow the development of various skills. Thus, the objective of this research was i) Design a scale to measure the usefulness of developing a digital portfolio in Education from the curricular, communicative, and informative aspects. In addition, ii) Validate the proposed scale by applying exploratory factor analysis. The design was instrumental and 271 Higher Education students participated. The scale was designed based on the literature review and validation was carried out by expert judges and cognitive interviews. The results indicate adequate validity and reliability indices; being made up of 22 items represented in 3 factors: 1) Development of Curricular Aspects, 2) Digital Communication, 3) Development of Digital Information. It is concluded that the scale can be useful to measure and make visible the characteristics and pedagogical potential of digital portfolios in Higher Education.*

*Keywords: higher education, technology, educational informatics*

### **INTRODUCTION**

The educational curriculum is the set of objectives, contents, methodologies, and evaluation techniques that guide the academic activity to organize the teaching and learning process. The curriculum can have a critical social approach, a curricular approach to the development of the cognitive process, a curricular approach based on constructivism, among others (Chen & Salas, 2019). In this context, due to the COVID 19 pandemic, the curriculum underwent modifications that seek to promote adjustments and that may be an opportunity to make the necessary innovations for student learning (Díaz & Barrón, 2020).

Likewise, due to the COVID 19 pandemic, Distance Education was accelerated as a scenario for the teaching and learning process in Education. This new scenario requires an active role on the part of students to plan (Zambrano et al., 2021), apply strategies (Zambrano et al., 2018; Zambrano et al., 2020) and show results of their learning (Zambrano, 2016). In this area, information, and communication technologies (ICT) converge with Education and can be transformed into a means for the development of learning

environments if the teacher learns to design these constructivist scenarios for their students that could help reduce the gaps cognitive (Cabero, 2020).

A Digital Portfolio for the educational field is a repository that, according to educational research, could help to demonstrate the learning results of students because they represent a collection of data, information, and knowledge that they elaborate, argue, and reflect on in a virtual community for learning. (Marinho et al., 2021; Syzdykova et al., 2021; Cabero et al., 2013). Also, the Digital Portfolio allows observing the academic development of the student body, related to individual skills, experiences and results derived from the training processes (Vega & Appelgren, 2019), enables interaction between students and teachers, as well as between students. It can promote enriching dialogues, contribute to the feedback of the author of the Digital Portfolio and create an environment for learning (Díaz et al., 2012; Arancibia et al., 2017). In addition, it allows the development of digital communication skills and digital information development skills, which coincides with research related to the development of Educational Blogs (Marín et al., 2016).

The digital portfolio is a pedagogical resource. It allows constructivism to be applied through the creation of one's own knowledge (Buzzetto-More, 2010; Conrad & Openo, 2018). In short, the characteristics of the Digital Portfolio that have been investigated transform it into a means for the development of skills and learning environments. Aspects related to:

- i. Curriculum development: which is associated with the development of curricular content, self-assessment, reflection processes, among others.
- ii. Development of Digital Information: refers to the creation of well-organized digital information through technological tools.
- iii. Digital Communication: from a technological point of view, digital communication is any transmission of an online message from a person or organization through a wide range of online channels, to another(s). In the Portfolio, digital communication can be seen reflected, for example, when creating videos, when making a video call to work as a team on a portfolio, among others (Marinho et al., 2021; Syzdykova et al., 2021; Cabero et al., 2013).

Due to the above background, this research aims to: 1) Design a scale to measure the usefulness of developing a digital portfolio in Education from curricular, communication and information aspects. 2) Validate the proposed scale by applying exploratory factor analysis.

The visibility of the favorable characteristics of the development of Digital Portfolios can support the teaching and learning process with awareness of cognitive, motivational, and socio-constructive processes because each item represents a characteristic that supports the formation of that awareness that answers why? and for what? I use a certain technology in the teaching and learning process.

## **METHOD**

### **Design of the Investigation**

The approach is quantitative and is classified as an instrumental design (Ato et al., 2013).

### **Scale Development**

The procedure carried out for the development of the E-Portfolio scale is shown in Figure 1 and consisted of five stages:

1. Study the contributions of Digital Portfolios: during this stage the contributions of Digital Portfolios were studied according to scientific evidence.
2. Create instrument items: From the study of the scientific evidence, the items of the E-Portfolio Scale were created.
3. Review by expert judgment and cognitive interviews: in this stage experts reviewed the scale and then students participated in cognitive interviews (online) to verify, for example, the understanding of the items.
4. Study 1: the E-Portfolio scale was applied to a group of 134 students from the health area and a first exploratory factor analysis was performed.

5. Study 2: the E-Portfolio scale was applied again to a group of 137 students in education and a second exploratory factor analysis was performed.
6. Integrated Study: an exploratory factorial analysis was applied with all the data, that is, 271 students, to verify the factors and items associated with each factor.

**FIGURE 1**  
**PROCEDURE APPLIED FOR THE DEVELOPMENT OF THE E-PORTFOLIO SCALE**



### Participants

For the selection of the participants, non-probabilistic sampling was considered as a technique because students who were studying education and health at two universities in Chile were intentionally chosen. A total of 271 students, belonging to four careers, participated voluntarily. 24.4% of the participants were men and 75.6% women. The average age of the students is 21.8 years.

In relation to the educational establishment of origin, 64.4% come from private subsidized schools, 6% come from paid private establishments and 29.6% come from public establishments called municipal. It is observed that many of the students belong to a subsidized private establishment, which refers to the segregation of the Chilean educational system (Canales et al. 2016; Valenzuela et al., 2014; Bellei et al., 2020).

## Instruments

The scale designed to measure the usefulness of developing digital portfolios in Education, whose factors are defined below, was applied.

- Factor 1 Development of Aspects of the Curriculum: refers to aspects of the curriculum associated with the content, development of thought, evaluation and reflection that are applied with the development of the digital portfolio.
- Factor 2 Digital Communication: related to the development of digital expression and communication. From a technological point of view, digital communication is all that transmission of an online message from a person or organization through a wide range of online channels, to another (s).
- Factor 3 Development of Digital Information: refers to the development of digital information using technologies, for example, the development of infographics.

## Process

The designed instrument was validated through expert judgment, cognitive interviews, and pilot applications (Smith-Castro & Molina, 2011) to end with an integrated study with all the data. The instrument has polytomous items (Likert type). The applications were carried out during the second semester of the 2020 academic year online. The students answered voluntarily and with informed consent.

## RESULTS

The 22 items of the E-Portfolio instrument that were designed and then validated by expert judgment, cognitive interviews, and pilot applications (Smith-Castro & Molina, 2011) were subjected to two exploratory factor analysis studies whose results showed the existence of 3 factors. Then, when integrating the data, the same three factors that are shown in Table 1 were also observed. The AFE was based on the Principal Axis (PA) extraction method with varimax rotation.

The correlation matrix was close to zero, the Kaiser-Meyer-Olkin (KMO) sample adequacy measure obtained a value of .95 and the Bartlett's sphericity test was calculated at  $X^2 = 3637.6$  with  $p < .001$ , the that corroborated the relevance of carrying out studies with ESAs. To determine the amount of latent factors, a parallel Horn analysis was performed, which recommended keeping 3 components. The factor solution showed that the three factors explain a total variance of 78.67% and all the items revealed factor loads greater than .4. In this way, the factors recommended by the exploratory factor analysis are the following: Factor 1 Development of Aspects of the Curriculum: composed of 12 items. Factor 2 Development of Digital Information: composed of 5 items. Factor 3 Digital Communication: composed of 5 items.

**TABLE 1**  
**ITEM WEIGHTING EXPLORATORY FACTOR ANALYSIS (EFA)**

Items and Factors	Factor 1	Factor 2	Factor 3
<b>Factor 1: Development of Aspects of the Curriculum</b>			
1. The development of a Digital Portfolio encourages creativity	.519		
2. The development of a Digital Portfolio enhances group work	.562		
3. The development of a Digital Portfolio helps to form a critical vision of the contents that I must include in the portfolio	.572		
4. The development of a Digital Portfolio helps to better solve an educational process in distance mode	.599		
5. The development of a Digital Portfolio encourages me as a student to search for information online	.618		

6. The development of a Digital Portfolio allows applying the content taught by the teacher	.639
7. The development of a Digital Portfolio favors working across the curriculum of my degree	.645
8. A Digital Portfolio allows you to expand the content developed by the teacher	.686
9. The development of a Digital Portfolio enhances the processes of reflection in students	.698
10. The contents created in the Digital Portfolio allow me as a student to self-assess my learning process	.708
11. When developing a Digital Portfolio, the curricular contents of my career are linked in a practical way	.725
12. Developing a Digital Portfolio encourages critical thinking	.742
<b>Factor 2: Development of Digital Information</b>	
13. The development of a Digital Portfolio in the educational field encourages the use of technologies for the development of digital information	.457
14. The development of a Digital Portfolio encourages the competence of developing digital information through the creation of graphics	.617
15. The development of a Digital Portfolio allows the creation of well-organized digital information using, for example, infographics.	.662
16. The development of a Digital Portfolio enhances reading comprehension by creating digital texts.	.738
17. The development of a Digital Portfolio enhances written comprehension by creating digital texts	.790
<b>Factor 3: Digital Communication</b>	
18. Digital Portfolios allow the development of digital communication skills	.529
19. The digital communication competence is applied while developing a Digital Portfolio, that is, I make video calls, use email, among others	.543
20. The development of a Digital Portfolio encourages oral communication skills by creating videos of educational content and sharing them in the Portfolio	.629
21. The Digital Portfolio allows developing digital communication competence using different technologies that allow the communication of message(s)	.732
22. Digital Portfolios help communicate ideas and opinions	.751

## DISCUSSION AND CONCLUSIONS

The objectives of this work were i) Design a scale to measure the usefulness of developing a digital portfolio in Education from curricular, communication and information aspects and ii) Validate the proposed scale by applying exploratory factor analysis.

In relation to the first objective, the E-Portfolio scale was designed through a procedure that was evidenced in Figure 1 from the analysis of the literature, the review by expert judgment and cognitive interviews, managing to create the scale according to the criteria and recommended procedures (Matas, 2018). For this reason, the scale provides an instrument that allows measuring and making visible the opportunities offered by the development of a digital portfolio.

Regarding the second objective, through an exploratory factorial analysis it was possible (Costello & Osborne, 2011) to show three factors: factor 1: Development of aspects of the curriculum, factor 2: Digital communication and factor 3: Development of digital information, which allows us to suggest the existence of the three factors that measure the three dimensions proposed in the context of the study. Thus, in relation to other research that proposes the same dimensions as useful factors of a technology in Education, we

agree with Marín et al. (2016), differentiating ourselves in the items that deal with aspects and/or characteristics that can be developed for the student learning through the application of a digital portfolio.

Currently, in the field of Distance Education it is essential that students can learn to develop a digital portfolio through the tutoring and teaching of a teacher that allows them to learn skills such as creativity, reflection, teamwork, and self-assessment that are possible to achieve intentionally using a digital portfolio (Arancibia et al., 2017; Cabero et al., 2013; Conrad & Openo, 2018; Díaz et al., 2012).

It is concluded that the scale can be useful to measure and make visible the characteristics and pedagogical potential of digital portfolios in Education in research contexts and/or for teachers who seek to make visible in their teaching the characteristics, skills and competencies that foster the development of digital portfolios for student learning.

Finally, we point out that it may be interesting to confirm the structure of the scale at the Higher Education level through a confirmatory factor analysis.

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