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THE STRATEGIC INFLUENCE OF SCHOOL PRINCIPAL LEADERSHIP IN THE DIGITAL TRANSFORMATION OF SCHOOLS

Abstract

This paper analyzes the key factors for the successful digital transformation of schools through the use of Educational Digital Resources (EDRs), paying special attention to school principals and their leadership from a strategic pedagogical perspective. A model is proposed to determine which aspects of principal leadership influence EDR use, and factor analysis is conducted with all the items included in the model. Partial Least Squares Structural Equation Modeling (PLS-SEM) variance analysis is then used to perform a factor analysis of the resulting dimensions. The model is tested with a sample of 142 Spanish school principals. The results show that how useful school principals perceive EDRs to be is the most influential variable in the digital transformation of schools. Other key factors include school contextual variables, the technical support and service related to the EDRs, and the principal's professional and personal profile. Educational policies for digital transformation should thus integrate principals into their core definition, considering factors such as their age or teaching and leadership experience. They should also consider contextual factors, such as school size and complexity and the school's digital culture. School principals' leadership can facilitate a

digital culture transformation, not through their authority or bureaucratic influence, but rather their capacity to foster an open debate that allows educational communities to see the integration of EDRs into pedagogical models as an opportunity to improve outcomes.

Keywords: digital transformation of schools; educational digital resources (EDRs); digital leadership by principals; digital pedagogical issues

1. INTRODUCTION

The digital transformation of schools has been widely studied. Recent research has examined the influence of adaptive e-learning on learning effectiveness (Hubalovsky et al., 2019), how information-seeking styles influence students' self-efficacy (Shen, 2018), how blended digital video-based feedback environments can improve pre-service teachers' feedback competence (Prilop et al., 2020), the use of e-book systems to assess students' reading fluency (Lin et al., 2019), acceptance of visual programming environments among boys and girls in primary schools (Cheng, 2019), and online and face-to-face multitasking (Alghamdi et al., 2020), among other things.

Over the last decade, information and communication technologies (ICTs) have enabled access to an increasing number of Educational Digital Resources (EDRs), giving rise to a revolutionary opportunity to transform education. The pedagogical potential of digital resources challenges the educational process, fostering its transformation and innovation (Siddiq et al., 2016). But despite the numerous studies on digital education, no consensus has been reached regarding the effects of digital resources on educational processes (Calero & Escardíbul, 2014). Most of the literature regards technology as an opportunity to transform education and pedagogical processes, aligning education with

the demands of a digital society. The shift from traditional textbooks to innovative digital content created with ICTs is a unique opportunity to improve students' personal knowledge-creation processes (Joo et al., 2017), enhance peer cooperation and information sharing in the classroom (Moreno & Mayer, 2007; Nelson et al., 2011), and significantly increase students' motivation and interest in the studied topic (Martín-Laborda, 2005).

Technological developments are driving a social transformation. In this transformational context, the political and economic institutions that define educational strategies stress the need to rethink the role of education and redefine learning processes at schools, seeking out new knowledge-sharing mechanisms (European Commission, 2008, 2010; OECD, 2015; UNESCO, 2015). Spreading knowledge and making educational content accessible to all students are the only strategy to enable students to fully develop their values and abilities and, thus, ensure the progress of society as a whole.

To this end, studies have been conducted from teachers' perspective (Chen, 2019; Gil-Flores et al., 2017), on the use of EDRs by rural teachers (Wang et al., 2019), and on the use of technological school analytics methods by school leadership in decision-making (Sergis et al., 2018). But few have focused on the influence of school principal leadership on digital transformation.

In this context, one might ask where the focus should be placed to ensure that EDRs are successfully integrated. To what extent does the school principal's pedagogical leadership matter in the integration of digital content? What factors influence teachers' decisions to use digital content? The present research seeks to answer these important

questions by analyzing the state of the art, developing and testing a model to identify the current situation, and proposing possible measures to help educational leaders pursue digital transformation at schools more easily and adequately.

2. THEORY

Today's global, digital, intercultural, and changing society poses multiple educational challenges (Tourón et al., 2018). School principals will play a key role in the educational transformation needed to meet them. They are the first movers and main agents promoting and managing the required digital revolution (Martín-Laborda, 2005; Branch et al., 2012). School principals must balance the needs, motivation, and expectations of teachers, students, families, and community, taking into consideration the education system's requirements and the specificities of their particular school environment (Bush & Glover, 2003; Izquierdo-Gómez, 2016; OECD, 2016; Yukl, 2002). "To meet all these demands, school principals manage human and many other resources, communicate and interact in many different roles in many different situations, make decisions based on empirical data, and lead teachers to achieve the educational goals set for students" (MECD, 2016, p. 66). Thus, principals are responsible for integrating ICTs into the educational process, managing the acquisition, design, and development of digital content that adequately addresses students' learning needs (INTEF, 2017).

According to Chiappe (2016), no educational process carried out with ICTs can be done without EDRs. This is because EDRs give structure, meaning, and value to all possible communication actions or situations related to digital learning that happen in the school. EDRs are a very broad concept due to the heterogeneity of their educational and

technological characterization. EDRs can be categorized based on various criteria, such as product type or pricing model (Xie et al., 2018). An EDR can refer to any kind of material or interactive resource integrated into a legible digital format as an iconic, visual, audio, or audiovisual element (e.g., websites, data files, databases, e-books, digital images, digital video, or videogames). EDRs can be created, viewed, distributed, modified, and stored by teachers depending on their teaching needs. EDRs let students explore, develop, and transform information as part of their knowledge-construction process. They allow students to pursue this learning process using digital content in creative, appealing, and collaborative ways (Carretero et al., 2017; ONT SI, 2017). Moving beyond the conceptual debate over the delimitation of EDRs (Cacheiro, 2011; Gértrudix et al., 2007), the present study considers EDRs to refer to any type of digital resource with a clear educational purpose. These resources are used in teaching and learning processes as invaluable tools to support student learning and knowledge construction. To emphasize the educational purpose of EDRs, several authors (Byun et al., 2006; Joo et al., 2017) have stressed their pedagogical potential to streamline the learning process. Digital content also provides emotional support to students (e.g., through the use of animation and 3D visuals) and facilitates cognitive acquisition and encoding processes (e.g., search and browse applications).

Today, it is necessary to accept and facilitate the transformation of the education system required by the emerging 21st-century knowledge society (Siddiq et al., 2016). Digital content integration will play a key role in this transformation process. The factors influencing its proper integration and use at schools must thus be analyzed. According to Vongkulluksn et al. (2018), EDR integration is a challenge that depends, among other

things, on teachers' beliefs and technological knowledge. As the leaders responsible for managing the digital revolution at schools, school principals will thus play a very important role in this process (Leithwood & Louis, 2011; García-Garnica & Caballero, 2015; González, 2017). Studying principals' vision from their leadership role is critical to understanding and improving the educational reality. As the most informed people in the school, principals play a "central role" (Batanaz, 1998). They send and receive information about the expectations, interests, and needs of the entire educational community, becoming the school's "center of gravity." The influence of school principal leadership on learning has been widely studied (Leithwood & Jantzi, 2008; Leithwood et al., 2010; Marks & Printy, 2003; Printy, 2008; Wahlstrom & Louis, 2008), but there is a lack of research analyzing the influence of school principal leadership on the transformative integration of EDRs. Principals may translate their own construction of their role into behaviors (Boies & Fiset, 2018), including EDR integration at their schools. The importance of studying school principals' role in the integration of digital content at schools is thus clearly justified. To analyze their role specifically in the transformative integration of EDRs, this study developed a model based on factors related to the educational process, educational outcomes, and their presage factors.

2.1. Proposed research model

Research about the pedagogical use of ICTs at schools has increased significantly over the last decade, as ICT integration into the educational process has come to be regarded as a fundamental pillar to efficiently meet the educational needs of the 21st century (Area et al., 2016; Yao-Ting et al., 2016; Donnelly et al., 2011; Griffin et al., 2012). Against this backdrop, a consensus has been reached regarding the need to gain

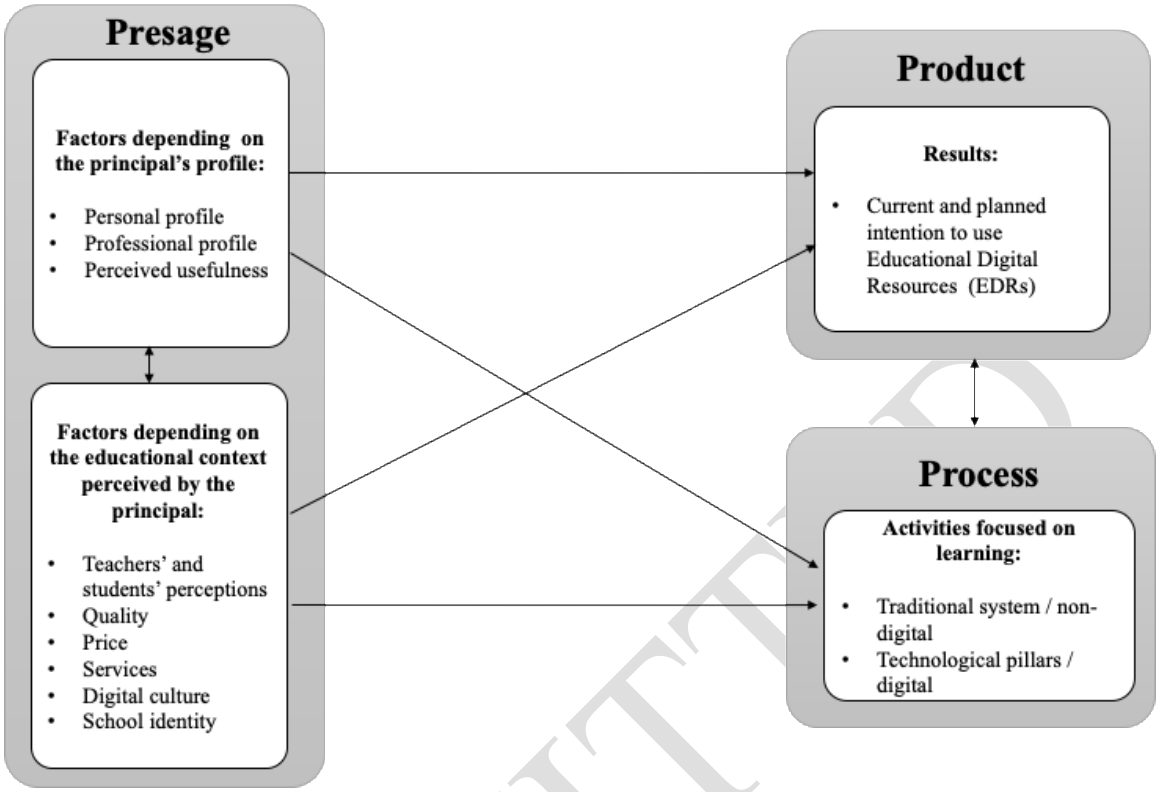
deeper knowledge of how the people responsible for integrating digital competence at schools experience and understand the situation that they are interactively building at their institutions (Area, 2005; Calero & Oriol, 2014; Gómez & Badia, 2016). Digital competence makes it possible to integrate technological resources into learning and teaching processes, improve them, and recognize their pedagogical potential for any school (Brush et al., 2008; Twining et al., 2015).

As pedagogical leaders who influence other people in various positions at their schools, school principals play a fundamental role. Empirical studies are increasingly proving that leadership has a knock-on effect for both student learning and school improvement (Liu & Hallinger, 2018). Principals' leadership approaches affect the practices of the teachers at their schools (Paletta et al., 2019). Their perceptions and ideas about particular school environment conditions, such as community demands or potential opportunities, are an excellent and valuable source of information to efficiently manage the technological transformation required to improve learning (Pont et al., 2008; Centro de Estudios de Políticas y Prácticas en Educación, 2009). Due to their knowledge and influence, their perceptions can be used to explain and predict the intention to use digital content for teaching and learning at schools (Leithwood et al., 2004). Several findings support this idea, explaining that the approach followed in a school's pedagogical strategy is determined more by the perceptions of people involved in the educational process than by the school context (Baeten et al., 2010; Biggs et al., 2001; Lewis & Murphy, 2008; Trigwell & Prosser, 2004). Principal leadership is correlated with school outcomes from the perspectives of both principals and teachers (Zheng et al., 2017). Based on these findings, principals build their interpretation of the school reality into

their interaction with the perceived contextual factors, and their interpretation of that reality significantly influences the behaviors and practices adopted by the people who make up the educational community (Leithwood et al., 2004; Day et al., 2007).

Building on the research model proposed by Dunkin and Biddle (1974), others have also sought to understand the complex process of learning and teaching at schools (Biggs, 1978, 1993, 2005; Entwistle, 2005; Prosser & Trigwell, 1997, 2010; Day et al., 2007). One of the most commonly used models is Biggs's 3P model (Biggs, 2005, p. 38), which offers a flexible framework of analysis, as it can be enriched with the addition of new factors and variables. Based on that model, and in light of the above considerations, the following model is defined to understand how school principal leadership influences the adoption of digital content at schools:

Figure 1. Theoretical adapted 3P model of teaching and learning



Source: The authors based on Biggs (2005, p. 38).

The proposed model is a systemic schema showing structural and organizational factors related to teaching and learning in relation to three dimensions, namely, the 3 Ps: Presage, Process, and Product. Factors included in the Presage dimension make it possible to forecast what the educational process will be like. When they are taken together with the activities occurring in the Process stage, the Product resulting from the process can be established. Interactions among the Presage, Process, and Product dimensions are multiple, can be in any direction, and can vary depending on the version of the model used (Biggs, 1978, 1993, 2005).

The Presage factors in the present model include: (a) factors that depend on the principal, such as his or her age and years of teaching experience; and (b) factors that depend on the educational context (e.g., school culture and values, digital culture, and the needs and interests of teachers, students, and families). The model's Process factors are based on findings that have shown the influence of Presage factors on Product through Process (Fishbein & Ajzen, 1975; Davis, 1989; Bhattacherjee, 2001; Donnelly et al., 2011; Ali et al., 2013). Accordingly, it proposes that principals' perceptions (Presage dimension) influence the current and planned intention to use EDRs at the school (Product dimension). This influence of the Presage dimension on the Product dimension is due to the effects of Process variables such as the activities used in the learning process, learning approaches, or the attitudes of people involved in the educational process, including teachers, students, and their families. All of these Process variables also interact with each other (Leithwood et al., 2006).

Based on the described theoretical framework and findings regarding the analysis of the educational process, the present study aims to identify the factors influencing the integration and intention to use EDRs at Spanish schools, focusing both on principals' perceptions of contextual factors and their pedagogical leadership in the innovative transformation of education. As noted, EDRs will be a key resource for educational transformation in the emerging knowledge society. Understanding principals' role and the factors influencing decisions about the integration of digital content will have important consequences for both education policy and school leadership practices. Based on the previous discussion, the following hypotheses are proposed to explore these areas:

- H1: Presage factors depending on the principal's profile influence the educational process.
- H2: Presage factors perceived by the principal regarding the educational context influence the educational process.
- H3: Presage factors depending on the principal's profile influence the intention to use EDRs.
- H4: Presage factors perceived by the principal regarding the educational context influence the intention to use EDRs.
- H5: The educational process influences the intention to use EDRs.

The proposed conceptual model is summarized in Figure 2:

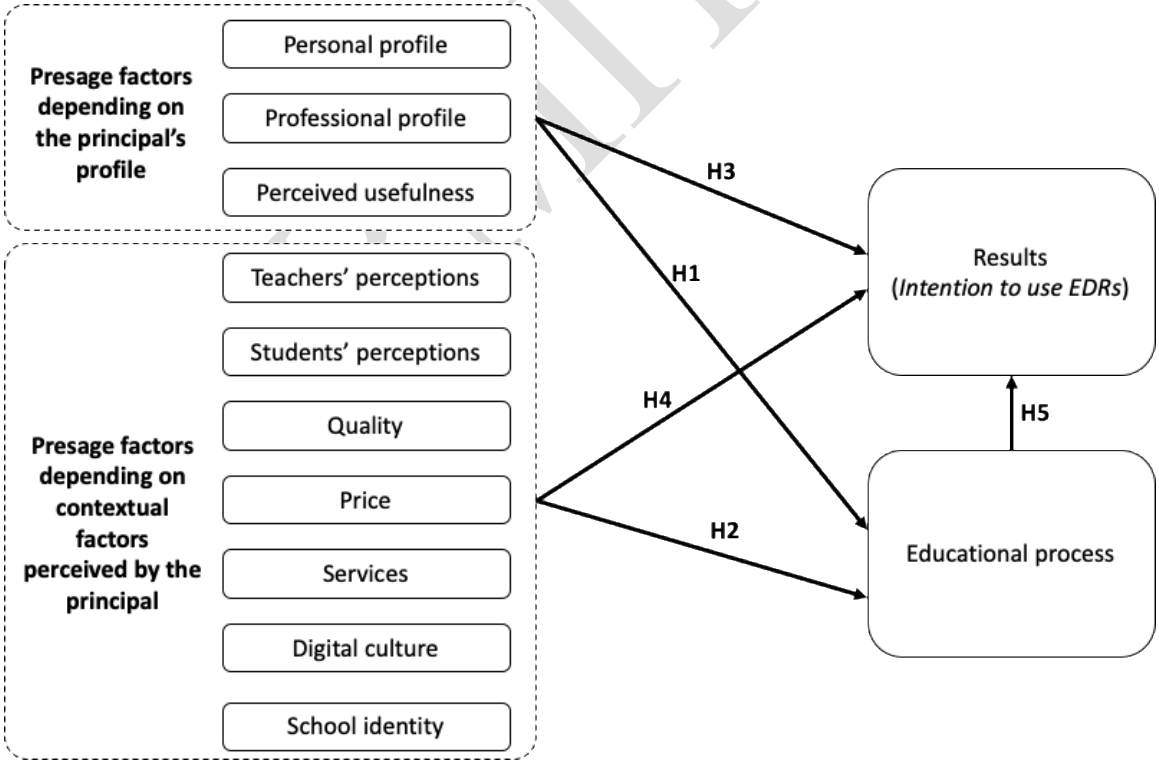


Figure 2. Proposed conceptual research model

A brief description of the dimensions and factors can be found in Appendix 1.

3. METHOD

3.1. Design

To test the hypotheses, a quantitative methodology was used based on quantitative measurements with continuous variables on an interval scale. Data were collected through a survey sent to school principals. The survey was structured in four blocks, on which the model was based: Presage factors regarding school principal leadership, Presage factors related to contextual factors as perceived by principals, the educational process, and the impact on the intention to use EDRs.

3.2. Sample

The final sample consisted of 142 principals from all Spanish regions. With regard to the sample characteristics, 62% of the respondents were men and 38% women. The average age was 43. A total of 92% held a bachelor's degree and 8% a doctorate. The average teaching experience was 12 years, and the average school principal experience was 5 years. The sample design was a semi-probabilistic sampling with a confidence level of 95% and p = q = 0.5, with a sampling error of +/- 6.4% for the whole sample.

3.3. Instrument

The model and questions to test the hypotheses were defined based on Biggs (2005, p. 38). To guarantee both theoretical and content validity (Gómez et al., 2013, p. 204), the survey was given to five experts in educational technologies to judge its structure, dimensions, and items, their fit with the research goals, precision, and legibility, and for any other suggestions to correct or improve it. After the expert assessment, a final version was obtained consisting of 27 questions grouped into four blocks:

1. Presage factors regarding the principal's school leadership: questions about the principal's profile (age and ~~, gender, academic degree,~~teaching experience), professional and leadership profiles (management experience, motivation to become a principal), and perceived usefulness of EDRs (external motivation to integrate and use them at schools).

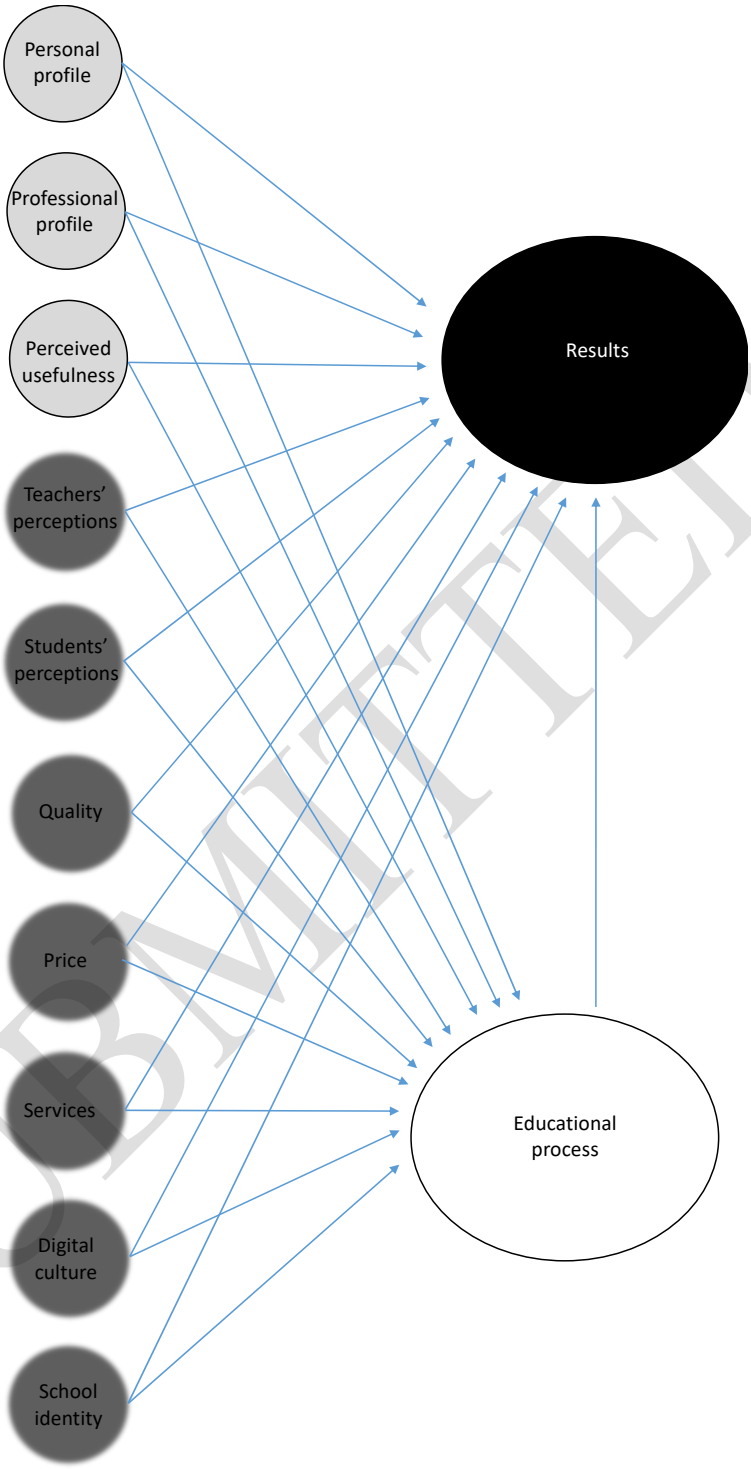
2. Presage factors related to the educational context: school identity (public/private/mixed, size, educational stages offered), school's digital culture (collective values and beliefs regarding availability, uses, attitudes, and habits related to ICTs), preconceived ideas of the steering committee regarding positive and negative aspects of using ICTs (price, quality, service), the principal's perception of the teachers (perceived pedagogical beliefs regarding EDRs), and the principal's perception of the students (perceived pedagogical beliefs regarding EDRs).

3. Process factors related to teaching and learning: educational activity (current use of EDRs in teaching and learning processes at schools).

4. Product factors related to digital content: results regarding the intention to use EDRs and the current approach to digital resources at the school.

The principals were asked to indicate the extent to which they agreed or disagreed with each statement, using a Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). To test the hypotheses, the individual influence of each construct on the Process and Results dimensions and the influence of the Process dimension on the Results dimension were studied with the following analysis model:

Figure 3: Proposed analysis model


Personal profile
Professional profile
Perceived usefulness
Teachers' perceptions
Students' perceptions
Quality
Price
Services
Digital culture
School identity
Results
Educational process

3.4. Data analysis: reliability and validity

Once the data had been tabulated factor analysis was conducted with all the items included in the four blocks defined in the study. Demographic variables were not included in the analysis. Partial Least Squares Structural Equation Modeling (PLS-SEM) variance analysis was then used to perform a factor analysis of those dimensions, and the proposed theoretical model and hypotheses were validated using SmartPLS 3.0.

Convergent validity analyzes the degree of confidence we have that a construct is well measured by its indicators. It is usually assessed using the average variance extracted (AVE) and it shows the amount of variance a construct obtains from its indicators in relation to the amount of variance due to measurement error. Fornell & Larcker (1981) recommend that this mean variance be greater than 0.5, that is, 50% of the variance of the construct be due to its indicators. The reliability and validity of the scale of measurement were assessed with Cronbach's alpha and the composite reliability index and average variance extracted (AVE). The constructs' internal consistency was high, as can be seen in Table 2. The value of Cronbach's alpha was greater than the recommended value of 0.7 (Nunnally & Bernstein, 1994) for all factors except "principal's perception of the teachers," "school identity," "professional profile," and "results." Nevertheless, Cronbach's alpha values below 0.7 can be considered acceptable, given the number of items used in the measuring scale (Hair et al., 1999). The composite reliability results were all over 0.6 (Bagozzi & Yi, 1988), and the AVE was higher than 0.5 (Fornell & Larcker, 1981; Hair et al., 1999).

The significance of the loadings was determined with the bootstrap resampling procedure (5,000 subsamples of the original sample size). All items were significantly related to each of their factors ($p < 0.01$), and all loadings were greater than 0.7 (Hair et al., 1999). The details are shown in Table 1.

TABLE1. Reliability and convergent validity of the measurement instrument

Dimension	Factor	Indicator	Loading	t-value	CA	CR	AVE
Educational process	F.1. Educational process as perceived by the principal	Q20	0.9***	78.0	0.7	0.9	0.8
		Q21	0.8***	14.5			
Principal	F2. Perceived usefulness by the principal	Q19.6	0.7***	8.1	0.9	0.9	0.6
		Q19.9	0.7***	6.1			
		Q19.11	0.8***	9.8			
		Q19.3	0.9***	15.8			
		Q19.4	0.8***	13.6			
		Q19.5	0.8***	11.3			
		Q19.12	0.8***	13.8			
		Q19.8	0.8***	8.2			
		Q19.2	0.9***	18.3			
		Q19.1	0.8***	10.9			
Context	F3. Principal's perception of the teachers	Q18.5	0.7***	2.9	0.5	0.8	0.6
		Q18.1	0.9***	7.3			
Context	F4. Principal's perception of the students	Q17.2	0.8***	16.7	0.9	0.9	0.6
		Q17.3	0.8***	21.0			
		Q17.5	0.7***	8.5			
		Q17.1	0.8***	13.4			
		Q17.4	0.8***	16.4			
Context	F5. Quality perceived by the principal	Q16.6	0.8***	7.9	0.7	0.9	0.7
		Q16.5	0.9***	14.1			
		Q16.4	0.7***	6.8			
Context	F6. Digital culture as perceived by the principal	Q14.2	0.8***	15.4	0.9	0.9	0.6
		Q14.3	0.9***	38.7			
		Q14.1	0.8***	16.2			
		Q14.4	0.8***	18.0			
		Q14.5	0.7***	8.8			
Context	F7. School identity perceived by the principal	Q12	0.7***	3.4	0.5	0.8	0.7
		Q13.1	0.9***	5.3			
Principal	F8. Principal's professional profile	Q8	0.8***	9.5	0.5	0.8	0.7
		Q7	0.8***	5.4			
Principal	F9. Principal's personal profile	Q2	0.9***	19.5	0.9	1.0	0.9
		Q4	0.9***	13.5			
Context	F10. Price as perceived by the principal	Q16.3	0.7***	3.7	0.8	0.9	0.7
		Q16.2	0.9***	5.3			

		Q16.1	0.9***	6.4			
Results	F11. Results as perceived by the principal	Q26	0.8***	15.9	0.6	0.8	0.7
		Q24.1	0.8***	10.5			
Context	F12. Service as perceived by the principal	Q16.8	0.9***	4.7	0.8	0.9	0.7
		Q16.9	0.9***	4.6			
		Q16.7	0.7***	2.7			

Note: CA = Cronbach's alpha; CR= Composite Reliability; AVE= Average Variance Extracted
*** p <0.01

Discriminant validity analysis is intended to ensure that a reflective construct's strongest relationships are with its own indicators (Hair et al., 2017). Discriminant validity was assessed using the Fornell-Larcker criterion and the Heterotrait-Monotrait ratio of correlations (Henseler et al., 2015). As can be seen in Table2, all values of the square root of the AVE were greater than the values of the correlations between the factors, and the Heterotrait-Monotrait ratio had values <0.90. Henseler et al. (2015) propose a threshold value of 0.90: values above 0.90 would suggest that discriminant validity is not present. Based on all these facts, the discriminant validity of the measurement model can be confirmed.

TABLE 2. Discriminant validity

Factor	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
F.1. Educational process as perceived by the principal	0.88	0.18	0.44	0.28	0.25	0.73	0.26	0.39	0.09	0.22	0.79	0.21
F2. Perceived usefulness by the principal	0.17	0.80	0.20	0.63	0.57	0.29	0.09	0.44	0.12	0.31	0.45	0.58
F3. Principal's perception of the teachers	-0.28	0.05	0.80	0.24	0.21	0.17	0.10	0.20	0.09	0.28	0.26	0.29
F4. Principal's perception of the students	0.26	0.58	0.05	0.80	0.54	0.50	0.18	0.70	0.10	0.18	0.63	0.36
F5. Quality perceived by the principal	0.19	0.48	0.58	0.44	0.82	0.46	0.13	0.38	0.28	0.70	0.40	0.76
F6. Digital culture as perceived by the principal	0.62	0.29	0.48	0.42	0.36	0.79	0.20	0.70	0.12	0.17	0.65	0.35
F7. School identity	-0.18	0.03	0.29	0.10	0.06	-0.04	0.82	0.13	0.09	0.09	0.39	0.09

perceived by the principal												
F8. Principal's professional profile	0.26	0.33	0.03	0.48	0.24	0.47	-0.06	0.82	0.23	0.08	0.68	0.21
F9. Principal's personal profile	-0.08	0.01	0.33	0.07	0.22	0.09	0.01	0.01	0.96	0.08	0.19	0.15
F10. Price as perceived by the principal	0.12	0.26	0.01	0.14	0.53	0.13	-0.03	0.04	0.06	0.83	0.31	0.53
F11. Results as perceived by the principal	0.56	0.36	0.26	0.44	0.26	0.47	-0.04	0.37	-0.14	0.20	0.83	0.18
F12. Service as perceived by the principal	0.13	0.49	0.36	0.30	0.58	0.28	0.02	0.14	0.14	0.40	0.08	0.85

Note: Values on the diagonal are the square roots of the AVE; values below the diagonal are the correlations between factors; values over the diagonal are the HTMT ratio.

In order to ensure that no multicollinearity exists, the variance inflation factor (VIF) values were calculated. The results are shown in Table 3.

Table 3
VIF values of the structural model

	Educational process	Results
F6. Digital culture as perceived by the principal	1.5356	2.2285
F1. Educational process as perceived by the principal		1.9525
F2. Perceived usefulness by the principal	1.895	1.8952
F9. Principal's personal profile	1.0783	1.1079
F10. Price as perceived by the principal	1.4887	1.5083
F8. Principal's professional profile	1.5206	1.5386
F5. Quality perceived by the principal	2.2338	2.2338
F7. School identity perceived by the principal	1.0438	1.1086
F12. Service as perceived by the principal	1.7268	1.733
F4. Principal's perception of the students	2.0097	2.0354
F3. Principal's perception of the teachers	1.1156	1.231

As can be seen in Table 3, all VIF values are lower than 3, confirming that no multicollinearity exists.

4. RESULTS AND DISCUSSION

As noted, the structural model was estimated using the bootstrap resampling procedure (5,000 subsamples of the original sample size). The proposed model has explanatory power, as the average variance extracted (R^2) was greater than the required 10% (Falk & Miller, 1992) for both dependent constructs (educational process and results). The Stone-Geisser test was used (Stone, 1974; Geisser, 1975), with the blindfolding procedure, to test the relevance of the predictive analysis. Table shows the details regarding the hypotheses.

TABLE 4.

Hypothesis results

Hypothesis	Standardized beta	t-value (bootstrap)
H1: Perceived usefulness -> Educational process	-0.01	0.16
H1: Professional profile -> Educational process	-0.097	14.1
H1: Personal profile -> Educational process	**-0.124***	**17.49**
H2: Principal's perception of the teachers-> Educational process	**-0.243*****	**26.24**
H2: Principal's perception of the students-> Educational process	0.114	11.28
H2: Quality -> Educational process	0.003	0.03
H2: Digital culture -> Educational process	**0.596*****	**65.19**
H2: School identity -> Educational process	**-0.182****	**22.36**
H2: Price -> Educational process	0.099	12.87
H2: Service -> Educational process	-0.055	0.68
H3: Perceived usefulness -> Results	**0.182***	**18.4**
H3: Leadership profile -> Results	0.097	12.27
H3: Professional profile -> Results	-0.119	15.66
H4: Principal's perception of the teachers-> Results	0.083	10.37
H4: Principal's perception of the students-> Results	**0.171***	**18.22**
H4: Quality -> Results	0.041	0.54
H4: Digital culture -> Results	0.08	0.94
H4: School identity -> Results	0.032	0.51

H4: Price -> Results	0.117	13.79
H4: Service -> Results	**-0.213****	**18.8**
H5: Educational process -> Results	**0.435*****	**38.61**

R^2 (Educational process) = 0.49; R^2 (Results) = 0.48;
*** p < 0.01; * *p < 0.05; *p < 0.1

4.1. Presage factors depending on the principal's profile influence the educational process (H1)

In light of the previous discussion, partial support was found for H1. Only one significant relationship was found between the principal's personal profile and the use of EDRs in classroom educational processes (β = -0.12; p <0.1), while no relationship was found between the principal's professional profile and the perceived usefulness constructs. The older the principal and the more teaching experience he or she had, the less digital educational content was used in the school's teaching and learning activities. These findings are similar to those of other studies, such as Sigalés et al. (2008), who look at secondary schools in Spain, or Area et al. (2016), who show that both age and experience are correlated with ICT use in classroom educational processes. O'Bannon and Thomas (2014) and Scherer et al. (2015) reach the same conclusions, finding a negative relationship between age and teaching experience, on the one hand, and the use of technological resources in teaching and learning activities, on the other.

The successful integration of EDRs was not dependent on the principal's professional profile (β = -0.097; p > 0.1). This may be because the integration of EDRs depends on the principal's own digital competence. One Spanish report on ICTs at schools (IDEA, 2007) notes that digital competence is the key to successful integration. Borko and Putnam (1995) find that school principals' digital competence has a positive effect on the perceived usefulness of digital resources, which are seen as a teaching

resource with potentially positive impacts. Due to these perceptions, the principal's leadership positively influences planned and current use of ICTs in the classroom depending on his or her digital competence (Leithwood & Beatty, 2007).

Perceived usefulness can be defined as the degree to which the use of digital technological resources can increase the quality of the education a school provides (Davis, 1989; Teo, 2011). As can be seen in Table 4, no significant relationship was found between the usefulness perceived by principals and the use of digital content in teaching and learning processes at the school ($\beta = -0.01$; $p > 0.1$).

4.2. Presage factors perceived by the principal regarding the educational context influence the educational process (H2)

The survey included questions related to the principals' perceptions of the educational context. Information was collected on the general context (type of school (public, private, or mixed); educational stages offered; size; digital culture (collective beliefs regarding the availability of digital resources and their use in both online and offline environments; attitudes and habits related to technology-based innovation), principals' perceptions of the teaching staff's ideas regarding factors facilitating and restricting the use of digital resources (price, quality, service); and the pedagogical beliefs of both students and teachers. All the contextual factor analyses led to the analysis of their influence on the integration and use of digital educational content in educational processes at schools.

Partial support was found for H2. The principal's perception of the teachers ($\beta = -0.24$; $p < 0.01$), digital culture ($\beta = 0.60$; $p < 0.01$), and school identity ($\beta = -0.18$; $p < 0.05$)

were found to significantly influence the educational process. The principal's perception of the teachers and school identity had a negative influence on the educational process. The bigger the drawbacks of using EDRs perceived by teachers, the more educational stages offered by the school, and the more teachers at the school, the lower the use of digital content in the educational process. These findings are similar to those of other studies on principals' perceptions of teachers (Ertmer & Ottenbreit-Leftwich, 2010; IDEA, 2007) that identified the following main obstacles to the use of technology in educational processes: (a) teachers' low level of digital competence; (b) teachers' lack of time; and (c) the effort required to ensure the effective curricular integration of educational technologies.

Regarding the principal's perception of students' perceptions , the findings differed from those of previous studies (Joo et al., 2017). They were not found to have any significant influence on the use of technology in educational processes ($\beta = 0.114$; $p > 0.1$). This could be due to the prevalence of traditional teacher-centered learning approaches rather than student-centered ones, as required under new educational trends and policies (European Commission, 2008, 2010; OECD, 2015; UNESCO, 2015).

Digital culture had a positive influence on the educational process ($\beta = 0.596$; $p < 0.01$). The stronger the digital culture as perceived by the principal (shared digital values at the school; digital resource use; and attitudes toward technology-based innovation projects), the more digital content was used. This is consistent with the findings of other studies, which suggest that culture is a key force for the integration of technologies in the educational process (Angers & Machtmes, 2005; Hermans et al., 2008; Windschitl & Sahl, 2002; Ertmer & Ottenbreit-Leftwich, 2010). Somekh (2008) points out that teachers

do not make decisions regarding technology integration entirely freely, but are influenced by their culture and the social context of the schools where they carry out their activities.

4.3. Presage factors depending on the principal's profile influence the intention to use EDRs (H3)

Partial support was found for H3, confirming the influence of the principal's profile on the intention to use digital content. Perceived usefulness was found to significantly influence the intention to use EDRs, as shown in Table 4 ($\beta = 0.18$; $p < 0.1$). Pedagogical benefits perceived by principals positively influenced both current and planned digital content use. Some of the perceived benefits included autonomous student learning, self-pacing depending on students' specific needs, and experimental learning environments. These findings are similar to those of other studies on the influence of the pedagogical benefits of new technologies (Joo et al., 2017).

Neither of the other school principal profile variables (age or teaching experience) was found to significantly influence the intention to use EDRs ($\beta = 0.097$; $p > 0.1$ & β). Similar results (-0.119; $p > 0.1$) were obtained for principals' leadership profiles (management experience and motivation to be principal). These findings are contrary to those of other studies (Clark et al., 2009; Branch et al., 2012), which find that teaching experience and years of experience have a positive influence on schools' educational outcomes.

4.4. Presage factors perceived by the principal regarding the educational context influence the intention to use EDRs (H4)

Based on the results obtained, partial support was found for H4. Two contextual variables in particular had a positive influence on the intention to use EDRs: principals' perceptions of students and of teaching staff.

Principals' perceptions of students have a significant influence on current and planned use of EDRs ($\beta = 0.171$; $p < 0.1$). In light of this influence, the greater the perceived benefits of using EDRs, in the principals' view, in terms of their pedagogical impact (e.g., increased levels of student attention and motivation in the classroom, improved student competence learning, learning-based assessments), the more they will be used. This could be important in the digital transformation of schools required by 21st-century education policies (Law, 2008; Thomas & Knezek, 2008). EDRs can be very helpful in motivating teachers to move toward a student-centered learning approach (Ertmer & Ottenbreit-Leftwich, 2010), facilitating the necessary digital competence that teachers require to work efficiently in a complex and interconnected society (Tourón et al., 2018).

Another influential dimension is principals' perceptions of the teaching staff's opinion of the intention to use EDRs. Factors considered in this category include the price of the EDRs, quality guarantees, and the availability of service and technical support for teachers. The most influential factor was the availability of service and technical support for teachers ($\beta = -0.213$; $p < 0.05$). In other words, whether or not the teaching staff decides to use EDRs will strongly depend on the available technical

support and service. This broad category includes issues such as the reliable provision of EDRs over time and the adaptation thereof to teachers' suggestions and needs. These factors are very influential in the adoption of EDRs. The more concerns about these issues that there are, the lower the intention to use EDRs as both primary and supporting educational resources. Bhattacherjee (2001) stresses the importance of teachers' experience and knowledge as the most determinant factors for the purchase and integration of digital resources at schools.

4.5. The educational process influences the intention to use EDRs (H5)

Based on the results ($\beta = 0.44$; $p < 0.01$), H5 was accepted. The greater the use of any kind of EDR in the educational process, the greater the current or planned intention to use them will be. According to Biggs (2005) and Ertmer and Ottenbreit-Leftwich (2010), digital content cannot be successfully integrated into school curricula based only on its superficial use at a very low cognitive level, as a disconnected resource that is not part of a student-centered learning approach. Successful integration requires a strategic approach geared toward a fully digitalized environment in which EDRs are used by students for a high level of cognitive activity, in a context of shared responsibility and interaction among all educational actors involved in the learning process. Based on these findings, school principals' leadership strongly influences the educational process, including the digital resources used, such as digital content. Any integration of digital content at a school should consider how to digitalize the educational process through the principal's leadership, because of the principal's educational influence on teachers' approaches to learning and teaching (Siddiq et al., 2016).

5. CONCLUSIONS AND PRACTICAL IMPLICATIONS

Schools' digital transformation is an educational priority, and digital content will play a fundamental role in ensuring the success thereof. Both students and teachers will need to develop digital competence, and principals' influence will be decisive in the efficient acceptance and use of specific EDRs that match learning objectives. Principals know the educational context and, through their leadership, can influence the pedagogical approach used at schools, serving as a keystone for the current digital transformation based on the integration of quality digital content. The present study of the situation in Spain yielded new findings regarding principals' views that could be very useful for defining educational policies on digital transformation and the strategic definition of school digitalization based on the efficient integration of digital content. The results of this study offer a diagnosis of the factors that can determine the intention to use both current and planned EDRs from the perspective of school principals. The following findings and their implications for both educational policy design and the strategic definition of schools' digital transformation stand out in particular.

Both the definition of educational policy and the design of schools' strategies for digital transformation and EDR integration should consider principals' professional and personal profiles: (i) Principals' age and years of teaching experience influence their intention to use digital content. The findings of this study demonstrate that older principals with more years of teaching experience are less likely to intend to integrate EDRs at their schools. (ii) Years of school principal experience and motivation to become a principal have no significant influence on the intention to use and integrate EDRs at schools from a school principal leadership perspective. The research results

show that school principal leadership factors have no influence. It can thus be concluded that leadership experience is not a guarantee for the digital transformation of schools. To overcome this issue, educational policies should take these factors into account, defining measures that allow principals with broader experience gained through years of teaching and leading to join training programs on digital transformation. Such training activities would enable principals to improve their digital competence from both the pedagogical and leadership perspective, thereby allowing them to overcome possible gaps due to traditional biases resulting from years of experience with traditional non-digital pedagogical and leadership methods. Priority should be given, in the enrollment in such training programs, to principals with more years of experience. Another possible measure could be to create innovation networks bringing together experienced principals and newcomer teachers with excellent digital competence and know-how regarding the suitable integration of digital content at schools. The creation of such networks at and across schools could play a very valuable role in the transformation process, making it possible to share best practices and compare results.

Some school contextual factors influence digital transformation and EDR integration: The results confirmed the influence of some contextual factors, as perceived by principals, on digital transformation and content integration. (i) School size and complexity (based on factors such as the number of teachers or educational stages offered) negatively influence the intention to use digital content. This finding should be considered in any policy or strategy for a school's digital transformation. Bigger schools should break digital transformation down into more transformational stages than smaller ones. Based on this finding, schools with more teachers and educational stages could try

to achieve the required digital transformation through the use of digital content prototypes in experimental projects. Such projects should focus on a very specific aspect of transformation with a limited scope during this early transformation phase. That could enable more manageable leadership and result in a successful case of digital transformation that can be seen by other teachers and educational stages as positive. This, in turn, would facilitate the subsequent integration of digital content in other educational activities, courses, and stages, according to planned deployment phases. Educational policies should foster this approach, incentivizing this kind of focused innovation project at bigger schools. (ii) The drawbacks of integrating EDRs perceived by teachers from the principal's perspective (based on teachers' lack of digital competence, lack of time to design adequate digital content for integration, or the expected effort of properly integrating digital content into pedagogical practices) negatively influence the intention to use digital content. Based on this finding, training should not only focus on principals, but also teachers. An incentive policy should be implemented to encourage teachers' efforts to foster digital transformation by integrating digital content into the educational process. (iii) The principals' perceptions of students' perceptions of digital content transformation Were not significant. This finding should be considered with caution because it is based on principals' perceptions of students and not directly on students' own perceptions. According to the principals' perceptions, both educational policies and schools' digital transformation strategies should focus on principals and teachers, rather than students. Students play a non-significant passive role in acceptance, depending on the success of the pedagogical approach followed by the principal and teachers. The shift from a teacher-centered approach to a student-centered one based on EDR integration

would thus depend on principals and teachers. Communication and training activities on the benefits of a student-centered pedagogical approach should be considered in educational policies and schools' digital transformation strategies. (iv) Schools' digital culture (preconceived ideas about the use of digital content, current and planned use of both digital and non-digital curricular content, and attitudes toward and habits related to technology-based innovation) as perceived by school principals influences digital transformation through EDR use. In light of this finding, schools should perform a digital culture diagnosis as a previous step for any digital transformation. Depending on the types of cultures detected, the most suitable strategy for introducing digital content at the school could then be determined. Educational policies could encourage schools to gain greater insight into their digital cultures with a cluster analysis resulting in a set of recommended strategies. Each school should analyze its own particular digital culture, moving faster or slower on its digital transformation strategy depending on the degree of penetration of digital values in the school culture.

How useful school principals perceive EDRs to be is the most influential variable in the digital transformation of schools: This finding underscores the importance of perceived usefulness in the acceptance and integration of EDRs. Factors such as autonomous work, self-paced learning based on students' specific needs, or the possibility of generating experimental learning through the use of digital content are key to successful integration because of the benefits that school principals perceive them to offer. The more perceived benefits there are, the greater the current and planned use of EDRs will be, including the shift to a fully digitalized pedagogical approach based on digital resources. Principals' opinions of EDR-integration-based digital transformation

depend on their values, experience, and knowledge, and their opinions are very influential in schools' pedagogical approaches and attitudes toward digital transformation. Any digital transformation policy should thus take school principals into consideration and focus on making the benefits of digital content for transforming schools visible and clear to them. Continuing education programs, communication actions, and innovation networks could all be very valuable tools for showcasing the pedagogical usefulness of digital resources. All these actions should be carried out continuously, due to the constant evolution of digital technologies and EDRs.

Technical support and service are key factors in EDR-based digital transformation: From school principals' perspective, teaching staff greatly value access to technical support and service related to the integration of digital content in their pedagogical strategies. Factors such as real-time customer service, mechanisms enabling teachers to submit suggestions to improve content, the design of EDRs based on teachers' needs, and reliable content provision with guaranteed service over time are important to teachers' acceptance of EDRs. Any educational policy or strategy for a school's digital transformation should consider these aspects to increase the likelihood of acceptance by teachers. In case of institutional purchases of digital content at the local, regional, or national level, technical support and service should be evaluated.

In conclusion, the importance of school principals for the intention to use EDRs within a school's digital transformation strategy must be stressed. Principals have excellent knowledge of contextual factors, as well as both a leadership role within and a pedagogical influence on their educational communities. The core definition of educational policies for digital transformation should thus take principals into account,

considering factors such as their age or teaching and leadership experience. Consideration should also be given to contextual factors, such as school size and complexity (number of students and teachers, educational stages offered) and the school's digital culture. A strategy to deploy EDRs at a school based on the studied significant factors would enable a smoother, faster, and more successful digital transformation process. School principals' leadership can facilitate a digital culture transformation, not through their authority or bureaucratic influence, but rather their capacity to foster an open debate that allows educational communities to see technological innovation and the integration of digital content into pedagogical models as an opportunity to improve outcomes rather than a problem to be overcome. Principals' influence should not be focused only on the process, but also on teachers' and students' values and beliefs.

Regarding limitations and future research, the conclusions of the present study are based on the Spanish context. The situation in other countries should be studied to determine whether it is similar. Likewise, this study focused on principals' profiles and contextual perceptions. Numerous studies have stressed principals' role and influence. Future research could seek to add value by comparing the present findings to those of a study of teachers' and principals' perception of students' . A study of how EDRs are reflected in educational policies could also be useful for determining their suitability according to the findings reported here.

REFERENCES

Alghamdi, A., Karpinski, A. C., Lepp, A., & Barkley, J. (2020). Online and face-to-face classroom multitasking and academic performance: Moderated mediation with self-

efficacy for self-regulated learning and gender. *Computers in Human Behavior*, 102(February 2019), 214–222. https://doi.org/10.1016/j.chb.2019.08.018

Ali, L., Asadi, M., Gasevic D., Jovanovic J., & Hatala, M. (2013). Factors influencing beliefs for adoption of a learning analytics tool: An empirical study. *Computers & Education*, *62*, 130-148. https://doi.org/10.1016/j.compedu.2012.10.023

Angers, J., & Machtmes, K. (2005). An ethnographic-case study of beliefs, context factors, and practices of teachers integrating technology. *The Qualitative Report*, *10*, 771-794. http://nsuworks.nova.edu/tqr/vol10/iss4/8 (accessed 15.10.2018).

Area, M. (2005). Las tecnologías de la información y comunicación en el sistema escolar. Una revisión de las líneas de investigación. *Revista Electrónica de Investigación y Evaluación Educativa*, *11*(1). http://www.uv.es/RELIEVE/v11n1/RELIEVEv11n1_1.htm (accessed 11.01.2011).

Area, M., Hernández, V., & Sosa, J.J. (2016). Models of educational integration of ICTs in the classroom. *Comunicar*, *24*(47), 79-87. http://dx.doi.org/10.3916/C47-2016-08

Baeten, M., Kyndt, E., Struyven, K., & Dochy, F. (2010). Using student-centred learning environments to stimulate deep approaches to learning: Factors encouraging or discouraging their effectiveness. *Educational Research Review*, *5*, 243-260. https://doi.org/10.1016/j.edurev.2010.06.001

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, *16*(1), 74-94. http://dx.doi.org/10.1007/BF02723327

Batanaz, L. (1998). *Organización escolar: bases científicas para el desarrollo de las instituciones educativas*. Córdoba: Servicio de Publicaciones Universidad de Córdoba.

Bhattacherjee, A. (2001). Understanding information systems continuance: An expectation-confirmation model. *MIS Quarterly: Management Information Systems*, *25*(3), 351-370. https://www.jstor.org/stable/3250921

Biggs, J. (1978). Individual and group differences in study processes. *British Journal of Educational Psychology*, *48*, 266-279. https://doi.org/10.1111/j.2044-8279.1978.tb03013.x

Biggs, J. (1993). From theory to practice: A cognitive systems approach. *Higher Education Research and Development*, *12*, 73–85. https://doi.org/10.1080/0729436930120107

Biggs, J. (2005). *Calidad del aprendizaje universitario*. Madrid: Narcea.

Biggs, J.B., Kember, D., & Leung, D. (2001). The revised two-factor Study Process Questionnaire: R-SPQ-2F, *British Journal of Educational Psychology*, *71*, 133-149. http://dx.doi.org/10.1348/000709901158433

Boies, K., & Fiset, J. (2018). I Do as I Think: Exploring the Alignment of Principal Cognitions and Behaviors and Its Effects on Teacher Outcomes. *Educational Administration Quarterly*, 1–28. https://doi.org/10.1177/0013161X18785869

Borko, H., & Putnam, R. T. (1995). Expanding a teacher's knowledge base: A cognitive psychological perspective development. T. R. Guskey, & M. Huberman (Eds.),

Professional development in education: New paradigms and practices (pp. 35–66). New York: Teachers College Press.

Branch, G. F., Hanushek, E. A., Rivkin, S. A. (2012). *Estimating the Effect of Leaders on Public Sector Productivity: The Case of School Principals*. NBER Working Paper, No. 17803. http://www.nber.org/papers/w17803.pdf (accessed 29.01.2018).

Brush, T., Glazewski, K., & Hew, K. (2008). Development of an instrument to measure preservice teachers' technology skills, technology beliefs, and technology barriers. *Computers in the Schools, 25*, 112-125. https://doi.org/10.1080/07380560802157972

Bush, T., & Glover, D. (2003). *School Leadership: Concepts and Evidence*. Nottingham: NCSl.

Byun, H. S., Choi, J. L., & Song, J. S. (2006). Research on the development of electronic textbook prototype. *Journal of Korean Educational Technology*, *22*(4), 1-24

Cacheiro González, M. L. (2011). Recursos educativos TIC de información, colaboración y aprendizaje. *Pixel-Bit. Revista de Medios y Educación*, 39, 69-81. http://www.redalyc.org/articulo.oa?id=36818685007 (accessed 01.02.2018).

Calero, J., & Escardíbul, J. O. (2014). *Recursos escolares y resultados de la educación*. Madrid: Fundación Ramón Areces

Carretero, S., Vuorikari, R., & Punie, Y. (2017). DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use. Luxembourg: Publications Office of the European Union. https://10.2760/38842

Centro de Estudios de Políticas y Prácticas en Educación (CEPPE) (2009). Prácticas de liderazgo directivo y resultados de aprendizaje. Hacia conceptos capaces de guiar la investigación empírica. *Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación*, *7*(3), 19-33. http://www.redalyc.org/articulo.oa?id=55114063003 (accessed 01.02.2018)

Chen, H.-J. (2019). Linking role definition rigidity to elementary school teachers' e-service for in-service teacher development. *Computers in Human Behavior*, (September 2018), 0–1. https://doi.org/10.1016/j.chb.2019.04.014

Cheng, G. (2019). Exploring factors influencing the acceptance of visual programming environment among boys and girls in primary schools. *Computers in Human Behavior*, 92(August 2018), 361–372. https://doi.org/10.1016/j.chb.2018.11.043

Chiappe, A. (2016). Tendencias sobre contenidos educativos digitales en América Latina. Madrid: UNESCO-OEI. http://unesdoc.unesco.org/images/0024/002456/245673s.pdf (accessed 08.01.2018).

Clark, D., Martorell, P., & Rockoff, J. (2009). School Principals and School Performance. *CALDER Working Paper 38*. Urban Institute. Center for Analysis of Longitudinal. Data in Education Research. https://files.eric.ed.gov/fulltext/ED509693.pdf (accessed 01.02.2018).

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319-340. http://www.jstor.org/stable/249008 (accessed 01.02.2018).

Day, C., Sammons, P., Hopkins, D., Harris, A., Leithwood, K., Gu, Q., Penlington, C., Mehta, P., & Kington, A. (2007). *The Impact of School Leadership on Pupil Outcomes.* Interim Report. Nottingham: National College for School Leadership/University of Nottingham.

Donnelly, D., McGarr, O., & O'Reilly, J. (2011). A framework for teachers' integration of ICT into their classroom practice. *Computers & Education, 57*, 1469-1483. doi:10.1016/j.compedu.2011.02.014

Dunking, M., & Biddle, B. (1974). *The Study of Teaching*. New York: Holt, Rinehart and Winston.

Entwistle, N. (2005). Research into student learning and university teaching. Paper presented at the British Journal of Educational Psychology Conference, Edinburgh, May 11. (accessed 01.02.2018).

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher Technology Change: How Knowledge, Confidence, Beliefs, and Culture Intersect. *Journal of Research on Technology in Education*, *42*(3), 255-284. https://doi.org/10.1080/15391523.2010.10782551

European Commission (2008). *Commission staff working document accompanying the communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Improving competences for the 21st century: an Agenda for European Cooperation on Schools*. COM(2008) 425 final.

European Commission (2010). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions: A Digital Agenda for Europe*. COM(2010) 245 final.

Falk, R. F., & Miller, N. B. (1992). *A primer for soft modeling*. Akron, OH: The University of Akron.

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research.* Reading, MA: Addison-Wesley.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50. https://www.jstor.org/stable/3151312

García-Garnica, M., & Caballero, K. (2015). ¿Qué prácticas eficaces desarrollan los directivos andaluces en sus escuelas? *Revista Iberoamericana de Evaluación Educativa, 8*(2), 129-147. http://hdl.handle.net/10481/37993

Geisser, S. (1975). The predictive sample reuse method with applications. *Journal of the American statistical Association*, *70*(350), 320-328. https://www.jstor.org/stable/2285815

Gértrudix, M., Gálvez de la Cuesta, M. C., Álvarez, S., & Galisteo del Valle, A. (2007). Design and development of digital educational content. Institutional proposals and actions. In B. Fernández Manjón (Ed.). *Computers and Education: E-Learning, from Theory to Practice*. Dordrecht (The Netherlands): Springer

Gil-Flores, J., Rodríguez-Santero, J., & Torres-Gordillo, J. J. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure. *Computers in Human Behavior*, 68, 441–449. https://doi.org/10.1016/j.chb.2016.11.057

Gómez, M. A., Rodríguez, G., & Ibarra, Mª S. (2013). COMPES: Autoinforme sobre las competencias básicas relacionadas con la evaluación de los estudiantes universitarios, *Estudios Sobre Educación*, *24*, 197-224. http://hdl.handle.net/10171/29570

Gómez, M., & Badia, A. (2016). Exploring the use of educational technology in primary education: Teachers' perception of mobile technology learning impacts and applications' use in the classroom. *Computers in Human Behavior*, *56*, 21-28. https://doi.org/10.1016/j.chb.2015.11.023

González, M. T. (2017). La dirección del centro escolar y el liderazgo pedagógico. *Revista padres y maestros, 370,* 6-11. https://doi.org/10.14422/pym.i370.y2017.001

Griffin, P., Care, E., & McGaw, B. (2012). The Changing Role of Education and Schools. In P. Griffin, B. McGaw, & E. Care (eds). *Assessment and Teaching of 21st Century Skills*. New York, NY: Springer Science + Business, pp. 1-15. DOI: https://doi.org/10.1007/978-94-007-2324-5_1

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W.C. (1999). *Análisis multivariante*. Prentice-Hall.

Hair Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2017). *Advanced issues in partial least squares structural equation modeling*. Sage publications.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A New Criterion for Assessing Discriminant Validity in Variance-Based Structural Equation Modeling, *Journal of the Academy of Marketing Science*, *43*(1), 115-135. https://doi.org/10.1007/s11747-014-0403-8

Hermans, R., Tondeur, J., van Braak, J., & Valcke, M. (2008). The impact of primary school teachers' educational beliefs on the classroom use of computers. *Computers and Education*, *51*, 1499-1509. DOI: 10.1016/j.compedu.2008.02.001

Hubalovsky, S., Hubalovska, M., & Musilek, M. (2019). Assessment of the influence of adaptive E-learning on learning effectiveness of primary school pupils. *Computers in Human Behavior*, 92(February 2017), 691–705. https://doi.org/10.1016/j.chb.2018.05.033

IDEA (2007). *Las Tecnologías de la Información y de la Comunicación en la Educación. Informe sobre la implantación y el uso de las TIC en los centros docentes de Educación Primaria y Secundaria (Curso 2005-2006.* Madrid: Ministerio de Educación y Ciencia.

INTEF (2017). *Marco común de competencia digital*. Madrid: Ministerio de Educación, Cultura y Deporte. https://bit.ly/2jqkssz

Izquierdo-Gómez, D. (2016) ¿Qué hacen los directores de centros escolares? Las prácticas de dirección en España a partir de los estudios internacionales PISA y TALIS. *Revista Complutense de Educación*, *27*(3), 1193-1209. https://doi.org/10.5209/rev_RCED.2016.v27.n3.47610

Joo, Y., Park, S., & Shin, E. K. (2017). Students' expectation, satisfaction, and continuance intention to use digital textbooks. *Computers in Human Behavior*, *69*(2), 83-90. https://doi.org/10.1016/j.chb.2016.12.025.

Law, N. (2008). Teacher learning beyond knowledge for pedagogical innovations with ICT. In J. Voogt & G. Knezek (Eds), *International handbook of information technology in primary and secondary education* (pp. 425–434). New York: Springer.

Leithwood, K. A., & Jantzi, D. (2008). Linking leadership to student learning: The contributions of leader efficacy. *Educational Administration Quarterly*, 44, 496-528. https://doi.org/10.1177%2F0013161X08321501

Leithwood, K. A., Patten, S., & Jantzi, D. (2010). Testing a conception of how school leadership influences student learning. *Educational Administration Quarterly*, 46, 671-706. https://doi.org/10.1177%2F0013161X10377347

Leithwood, K., & Beatty, B. (2007). *Leading with Teacher Emotions in Mind*. San Francisco: Corwin Press.

Leithwood, K., & Louis, K.S. (2011). *Leadership and learning. The critical connection. Linking leadership to student learning.* San Francisco: Jossey-Bass.

Leithwood, K., Day, C., Sammons, P., Harris, A., & Hopkins, D. (2006). *Successful School Leadership: What it Is and How it Influences Pupil Learning*. Nottingham: National College for School Leadership/University of Nottingham.

Leithwood, K., Sammons, P., Anderson, S., & Wahlstrom, K. (2004). *How Leadership Influences Student Learning*. The Wallace Foundation. Ontario: Center for Applied Research an Educational Improvement/Ontario Institute for School Leadership.

Lewis, P., & Murphy, R. (2008). New Directions in School Leadership. *School Leadership and Management, 28*(2). https://doi.org/10.1080/13632430801969807

Lin, P.-H., Su, Y.-N., & Huang, Y.-M. (2019). Evaluating reading fluency behavior via reading rates of elementary school students reading e-books. *Computers in Human Behavior*, 100(September 2018), 258–265. https://doi.org/10.1016/j.chb.2018.10.004

Liu, S., & Hallinger, P. (2018). Principal Instructional Leadership, Teacher Self-Efficacy, and Teacher Professional Learning in China: Testing a Mediated-Effects Model. *Educational Administration Quarterly*, 1–28. https://doi.org/10.1177/0013161X18769048

Marks, H. M., & Printy, S. M. (2003). Principal leadership and school performance: An integration of transformational and instructional leadership. *Educational Administration Quarterly*, 39, 370-397. https://doi.org/10.1177%2F0013161X03253412

Martín-Laborda, R. (2005). *Las nuevas tecnologías en la educación*. Madrid: Fundación AUNA.

MECD (2016). *Panorama de la educación. Indicadores de la OCDE 2016. Informe español*. Madrid: Instituto Nacional de Evaluación Educativa-Ministerio de Educación, Cultura y Deporte.

Moreno, R., & Mayer, R. (2007). Interactive multimodal learning environments. *Educational Psychology Review, 19*(3), 309-326. https://doi.org/10.1007/s10648-007-9047-2

Nelson, L. L., Arthur, E. J., Jensen, W. R., & Van Horn., G. (2011). Trading textbooks for technology: New opportunities for learning. *Phi Delta Kappan, 92*(7), 46-50.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory*. New York, NY: McGraw Hill.

O'Bannon, B. W., & Thomas, K. (2014). Teacher perceptions of using mobile phones in the classroom: Age matters! *Computers & Education, 74*, 15-25. DOI: 10.1016/j.compedu.2014.01.006

OECD (2015). *Students, Computers and Learning: Making the Connection, PISA*. OECD Publishing. http://dx.doi.org/10.1787/9789264239555-en (accessed 01.02.2018).

OECD (2016). *School Leadership for Learning: Insights from TALIS 2013*. OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264258341-en

ONT SI (2017). *Informe anual del sector de los contenidos digitales en España (Edición 2017).* Ministerio de Energía, Turismo y Agenda Digital. http://www.ontsi.red.es/ontsi/es/content/informe-anual-del-sector-de-los-contenidos-digitales-en-espa%C3%B1a-edici%C3%B3n-2017 (accessed 01.02.2018).

Paletta, A., Ferrari, E. B., & Alimehmeti, G. (2019). How Principals Use a New Accountability System to Promote Change in Teacher Practices: Evidence From

Italy. *Educational Administration Quarterly*, 1–51. https://doi.org/10.1177/0013161X19840398

Pont, B., Nusche, D., & Moorman, H. (2008). *Improving school leadership*. Paris, OCDE. http://www.oecd.org/edu/schoolleadership (accessed 01.02.2018).

Printy, S. M. (2008). Leadership for teacher learning: A community of practice perspective. *Educational Administration Quarterly*, 44, 187-226.

Prilop, C. N., Weber, K. E., & Kleinknecht, M. (2020). Effects of digital video-based feedback environments on pre-service teachers' feedback competence. *Computers in Human Behavior*, 102(October 2018), 120–131. https://doi.org/10.1016/j.chb.2019.08.011

Prosser, M., & Trigwell, K. (1997). Relations between perceptions of the teaching environment and approaches to teaching. *British Journal of Educational Psychology*, *67*, 25-35. https://doi.org/10.1111/j.2044-8279.1997.tb01224.x

Prosser, M., & Trigwell, K. (2010). Confirmatory factor analysis of the Approaches to Teaching Inventory. *British Journal of Educational Psychology*, *76*(2), 405-419. https://doi.org/10.1348/000709905X43571

Sergis, S., Sampson, D. G., & Giannakos, M. N. (2018). Supporting school leadership decision making with holistic school analytics: Bridging the qualitative-quantitative divide using fuzzy-set qualitative comparative analysis. *Computers in Human Behavior*, 89(June), 355–366. https://doi.org/10.1016/j.chb.2018.06.016

Scherer, R., Siddiq, F., & Teo, T. (2015). Becoming more specific: Measuring and modeling teachers' perceived usefulness of ICT in the context of teaching and learning. *Computers & Education, 88,* 202-214. DOI: 10.1016/j.compedu.2015.05.005

Shen, C. X. (2018). Does school-related Internet Information seeking improve academic self-efficacy? The moderating role of internet information seeking styles. *Computers in Human Behavior,* 86, 91–98. https://doi.org/10.1016/j.chb.2018.04.035

Siddiq, F., Scherer, R., & Tondeur, J. (2016). Teachers' emphasis on developing students' digital information and communication skills (TEDDICS): A new construct in 21st century education. *Computers & Education, 92-93,* 1-14, Consultado 18/12/2017 en: http://doi.org/10.1016/j.compedu.2015.10.006

Sigalés, C., Mominó, J. M., Meneses, J., & Badía, A. (2008). *La integración de internet en la educación escolar española: situación actual y perspectivas de futuro*. *Informe de Investigación*. Barcelona: Fundación Telefónica. https://www.uoc.edu/in3/integracion_internet_educacion_escolar

Somekh, B. (2008). Factors affecting teachers' pedagogical adoption of ICT. In J. Voogt & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education* (pp. 449–460). New York: Springer.

Stone, M. (1974). Cross-validatory choice and assessment of statistical predictions. *Journal of the Royal Statistical Society*. Series B (Methodological), 111-147.

Teo, T. (2011). Factors influencing teachers' intention to use technology: model development and test. *Computers & Education, 57*, 2432-2440. DOI: 10.1016/j.compedu.2011.06.008

Thomas, L. G., & Knezek, D. G. (2008). Information, communications, and educational technology standards for students, teachers, and school leaders. In J. Voogt & G. Knezek (Eds), *International handbook of information technology in primary and secondary education* (pp. 333–348). New York: Springer.

Tourón, J., Martín, D., Navarro, E., Pradas, S., & Íñigo, V. (2018). Validación de constructo de un instrumento para medir la competencia digital docente de los profesores (CDD). *Revista Española de Pedagogía*, *76*(269), 25-54. Doi: 10.22550/REP76-1-2018-02

Trigwell, K., & Prosser, M. (2004). Development and Use of the Approaches to Teaching Inventory. *Educational Psychology Review, 16,* 409-424. https://doi.org/10.1007/s10648-004-0007-9

Twining, P., Davis, N. E., & Charania, A. (2015). *Developing new indicators to describe digital technology infrastructure in primary and secondary education*. http://www.uis.unesco.org/StatisticalCapacityBuilding/Workshop%20Documents/Communication%20workshop%20dox/Paris%202014/ICT-infrastructure-schools-EN.pdf (accessed 01.02.2018).

UNESCO (2015). *Rethinking Education. Towards a global common good?* Paris: UNESCO.

Vongkulluksn, V. W., Xie, K., & Bowman, M. A. (2018). The role of value on teachers' internalization of external barriers and externalization of personal beliefs for classroom technology integration. *Computers & Education*, 118, 70-81. https://doi.org/10.1016/j.compedu.2017.11.009Wahlstrom, K. L., & Louis, K. S. (2008). How teachers experience principal leader- ship: The roles of professional community, trust, efficacy, and shared responsibility. *Educational Administration Quarterly*, 44, 458-495. https://doi.org/10.1177%2F0013161X08321502

Wang, J., Tigelaar, D. E. H., & Admiraal, W. (2019). Connecting rural schools to quality education: Rural teachers' use of digital educational resources. *Computers in Human Behavior*, 101(July), 68–76. https://doi.org/10.1016/j.chb.2019.07.009

Windschitl, M., & Sahl, K. (2002). Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture. *American Educational Research Journal, 39*, 165-205. https://doi.org/10.3102%2F00028312039001165

Witziers, B., Bosker, R., & Kruger, M. (2003). Educational leadership and student achievement: The elusive search for an association. *Educational Administration Quarterly*, 39, 398-425. https://doi.org/10.1177%2F0013161X03253411

Xie, K., Di Tosto, G., Chen, S.-B., & Vongkulluksn, V. W. (2018). A systematic review of design and technology components of educational digital resources, *Computers & Education*, *127*, 90-106. doi:10.1016/j.compedu.2018.08.011

Yao-Ting, S., Kuo-En, Ch., & Tzu-Chien, L. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-

analysis and research synthesis. *Computers & Education*, *19*, 252-275. https://doi.org/10.1016/j.compedu.2015.11.008

Yukl, G. A. (2002). *Leadership in Organizations*. Upper Saddle River, NJ: Prentice-Hall.

Zheng, Q., Li, L., Chen, H., & Loeb, S. (2017). What Aspects of Principal Leadership Are Most Highly Correlated with School Outcomes in China? *Educational Administration Quarterly*, 53(3), 409–447. https://doi.org/10.1177%2F0013161X17706152

Appendix 1

Please, answer the following questions about your school and profile:

Block	**Factor**	**Questions**
Context	F7. School identity	- Number of stages offered - Number of teachers
Principal	F9. Principal's personal profile	- Age - Teaching experience (in years)

Please indicate the extent to which you agree or disagree with the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree).

Block	**Factor**	**Questions**
Educational process	F.1. Educational process as perceived by the principal	- The educational process at my school makes intensive use of digital infrastructure - The educational process at my school makes intensive use of EDRs
Principal	F2. Perceived usefulness by the principal	- EDRs improve our curricular content - EDRs improve diversity in teaching activities - EDRs improve evaluation - EDRs improve students' autonomous learning - EDRs improve adaptation to each student's specific learning needs - EDRs improve learning-centered teaching - EDRs improve learning contextualization - EDRs improve competency-based learning

		- EDRs improve task-based work
Context	F3. Principal's perception of the teachers	- Teachers perceive the school's digital infrastructure to be good enough. - Teachers perceive the use of EDRs as positive.
Context	F4. Principal's perception of the students	- EDRs improve student attention - EDRs improve acquisition and development of skills - EDRs improve tailored learning for students - EDRs improve students' affective-emotional welfare - EDRs improve student satisfaction
Context	F5. Quality perceived by the principal	- EDRs improve fairness and equal opportunity for all students - EDRs improve continuous improvement and innovation - EDRs improve the quality of the curricular content
Context	F6. Digital culture as perceived by the principal	- The use of EDRs in face-to-face activities is perceived as positive - The use of EDRs in entirely digital activities is perceived as positive - EDRs are perceived as easy to use - EDRs are used frequently - Participation in calls for digital innovation is perceived as positive
Principal	F8. Principal's professional profile	- My digital competence is excellent - My school's teaching project includes goals for EDR use
Context	F10. Price as perceived by the principal	- The EDR offer is excellent - The school's financial situation allows us to invest in EDRs - EDRs have a good quality-price ratio
Outcomes	F11. Results as perceived by the principal	- Intensive use of EDRs improves learning outcomes - EDRs improve the efficiency of the learning process
Context	F12. Service as perceived by the principal	- EDR support and follow-up are excellent - I trust the EDR service