



1 8 7 2 7 2 0 2 3

Open and Interdisciplinary
Journal of Technology,
Culture and Education

Editor

M. Beatrice Ligorio (University of Bari "Aldo Moro")

Coeditors

Stefano Cacciamani (University of Valle d'Aosta)

Donatella Cesareni (University of Rome "Sapienza")

Valentina Grion (University of Padua)

Associate Editors

Carl Bereiter (University of Toronto)

Michael Cole (University of San Diego)

Kristine Lund (CNRS)

Roger Salijo (University of Gothenburg)

Nadia Sansone (Unitelma Sapienza)

Marlene Scardamalia (University of Toronto)

Scientific Committee

Sanne Akkerman (University of Utrecht)

Ottavia Albanese (University of Milan – Bicocca)

Susanna Annesi (University of Bari "Aldo Moro")

Alessandro Antonietti (University of Milan – Cattolica)

Pietro Boscolo (University of Padua)

Sefa Bulut (Ibn Haldun University)

Lorenzo Cantoni (University of Lugano)

Felice Carugati (University of Bologna – Alma Mater)

Cristiano Castelfranchi (ISTC-CNR)

Montserrat Castelló Badia (University Ramon Llull, Barcelona)

Alberto Cattaneo (SFIVET, Lugano)

Graziano Cecchinato (University of Padua)

Carol Chan (University of Hong Kong)

Cesare Cornoldi (University of Padua)

Crina Damsa (University of Oslo)

Frank De Jong (Aeres Wageningen Applied University)

Ola Erstad (University of Oslo)

Paolo Ferri (University of Milan – Bicocca)

Alberto Fornasari (University of Bari "Aldo Moro")

Carlo Galimberti (University of Milan – Cattolica)

Begona Gros (University of Barcelona)

Kai Hakkarainen (University of Helsinki)

Vincent Hevern (Le Moyne College)

Jim Hewitt (University of Toronto)

Antonio Iannaccone (University of Neuchâtel)

Liisa Ilomaki (University of Helsinki)

Sanna Jarvela (University of Oulu)

Richard Joiner (University of Bath)

Kristina Kumpulainen (University of Helsinki)

Minna Lakkala (University of Helsinki)

Mary Lamon (University of Toronto)

Leila Lax (University of Toronto)

Marcia Linn (University of Berkeley)

Kristine Lund (CNRS)

Anne-Nelly Perret-Clermont (University of Neuchâtel)

Donatella Persico (ITD-CNR, Genoa)

Peter Renshaw (University of Queensland)

Giuseppe Ritella (University of Helsinki)

Vittorio Scarano (University of Salerno)

Neil Schwartz (California State University of Chico)

Pirita Seitamaa-Hakkarainen (University of Joensuu)

Patrizia Selleri (University of Bologna)

Robert-Jan Simons (IVLOS)

Andrea Smorti (University of Florence)

Luca Tateo (University of Oslo)

Jean Underwood (Nottingham Trent University)

Jaan Valsiner (University of Aalborg)

Jan van Aalst (University of Hong Kong)

Rupert Wegerif (University of Exeter)

Allan Yuen (University of Hong Kong)

Cristina Zucchermaglio (University of Rome "Sapienza")

Editorial Staff

Ilaria Bortolotti – Chief Editor

Sarah Buglass, Kevin Fuchs, Lorella Giannandrea,

Francesca Grataini, Hanna Järvenoja,

Mariella Luciani, Louis Maritaud,

Katherine Frances McLay, Giuseppe Ritella

Web Responsible

Nadia Sansone



Publisher

Progedit, via De Cesare, 15

70122, Bari (Italy)

tel. 080.5230627

fax 080.5237648

info@progedit.com

www.progedit.com

qwerty.ckbg@gmail.com

www.ckbg.org/qwerty

Registrazione del Tribunale di Bari

n. 29 del 18/7/2005

© 2020 by Progedit

ISSN 2240-2950

Indice

Editorial

- You, me and the digital. The triangle of technology-mediated relationships after the Covid-19 pandemic* 5
Daniela Di Donato

INVITED ARTICLE

- Neuroscience of distance learning: The impact of technology on neurobiological learning mechanisms* 14
Giuseppe Riva

ARTICLES

- Students' emotional reactions when interacting with information and communication technologies. A key element in improving assimilation* 33
Mercedes Llorent-Vaquero, Juan De Pablos-Pons
- Couples' relationship satisfaction and problematic internet use. A dyadic response surface analysis* 50
Francesca Cuzzocrea, Maria Cristina Gugliandolo, Sebastiano Costa, Daria J. Kuss, Francesca Liga
- Remote teaching and learning in the Covid Era: Empirical evidence from three universities in Thailand* 67
Kevin Fuchs, Keerati Fangpong



<i>About or with teachers? A systematic review of learning analytics interventions to support teacher professional development</i> Elena Gabbi	88
<i>Il ruolo della formazione sulla gratificazione professionale dei docenti di sostegno: Uno studio esplorativo</i> Ilaria Bortolotti, Irene Stanzione	110



Students' emotional reactions when interacting with information and communication technologies. A key element in improving assimilation


Mercedes Llorent-Vaquero*, Juan De Pablos-Pons**

DOI: 10.30557/QW000061

Abstract

The aim of this work is to gain a better understanding of the relationship between the emotions that ICTs evoke in students and their assimilation of these technologies. To this end, a quantitative and descriptive methodology based on a student questionnaire was designed for data collection. The results show that ICTs evoked strong positive emotions in the students interacting with them, whose assimilation of these technologies was high. There were positive correlations between the level of assimilation of ICTs and all the emotions experienced by the students. There were also differences in the assimilation of ICTs in terms of the emotions analyzed. Therefore, research on students' emotional reactions when interacting with ICTs is essential for improving their assimilation.

Keywords: ICT, Emotions, Assimilation, Students, School

* University of Jaen, Spain,  0000-0002-1379-4749.

** University of Seville, Spain,  0000-0001-9147-5965.

Corresponding author: mllorent@ujaen.es

Introduction

The integration of information and communication technologies (ICTs) in schools has a number of benefits including, broadly speaking, improving the quality of the teaching-learning process (Moreira-Fontan et al., 2019; Tang, 2021; Uvarov, 2019). Different studies defend the relationship between ICTs and the academic performance of students. In the analysis of the findings of the PISA report, for instance, positive correlations were detected between the frequency of use of ICTs and academic performance (Petko et al., 2017). By the same token, at a professional level ICTs provide students with the additional skills required in a future work environment (Pacheco et al., 2016) and in the new setting to which all workers will have to adapt in the future (Inzunza-Mejía, 2018; Oberländer et al., 2019).

In this connection, the assimilation of ICTs is crucial for the development of competencies that enhance academic and professional performance. The concept of assimilation (along with that of accommodation) has been studied in many areas by the authors of modern classics such as Baldwin, Piaget and Freud. However, its greatest exponent was Vygotski, who understood it as the internal assimilation and construction of an external operation (Álvarez & Sebastián, 2018), contending that all the higher mental functions were social operations that had been assimilated (Becco, n.d.).

In relation to the assimilation of ICTs, the digital gap among students is a relevant issue, as many studies have demonstrated (Bartikowski et al., 2018; Freiman et al., 2018; Jerman & Blažič, 2020; Pérez-Escoda et al., 2016; Schroeder, 2018; Zilka, 2019). So, schools should bear in mind the situation of each student in an attempt to remedy the shortcomings or differences that may arise in the digital environment. Thus, it is essential to raise the awareness of the education community as a whole about the existing barriers, as well as the benefits of ICT assimilation in academic and social contexts, alike (Cabezas et al., 2016; Iglesias et al., 2017).

Emotional reactions when using ICTs

Education, as an interpersonal process, involves the emotions of the stakeholders. Emotions are relevant given that they guide the learning process per se, orientating it towards different content and educational goals. Ergo, they are crucial in education because of the influence that they have on cognitive processes (Du et al., 2019; Lu & Song, 2020; Reid et al., 2016) and their relationship with academic performance (Hinojo-Lucena et al., 2020; Mathrani et al., 2016).

Motivation is a basic element in ICT assimilation associated with the emotional reactions of students. According to Nolasco and Ojeda (2016), motivation is the first step towards digital literacy and a determining factor in accessing technology and interacting with it. In this sense, there is a negative relationship between the feeling of anxiety when using ICTs and motivation, the latter being lower in those students who feel apprehensive when interacting with technology (Zylka et al., 2015). Conversely, those students who experience positive emotions when interacting with ICTs will be more motivated to acquire knowledge or to develop skills (Huertas & Pantoja, 2016; Kim et al., 2014; Zylka et al., 2015).

Self-confidence is one of the most relevant emotions in relation to performance. Confidence in the use of ICTs, namely, an individual's belief that he or she has the ability to perform tasks requiring their use, is related to a better performance in mathematics and a higher level of scientific literacy, a view endorsed by Zhang and Liu (2016).

Likewise, satisfaction is key to the development of quality learning experiences insofar as it serves as an ideal setting for involving the different stakeholders (Fernández-Pascual et al., 2013). On the one hand, student satisfaction is related to engagement and dropping out of school in digital education contexts such as e-learning (Hernández-Chérrez & Tayo, 2017). And, on the other, students who experience greater satisfaction when using ICTs reach higher proficiency levels (Kim et al., 2014).

In relation to the foregoing, another concept studied in the educational context in general is that of emotional or subjective well-being, which is a determining factor in developing active digi-

tal citizenship (Jiménez-Cortés, 2016). Subjective well-being is thus associated with students' perceptions of their own digital skills (De Pablos et al., 2017).

Lastly, it is important to note the relationship between enjoyment and learning. Many learning theories defend the role of games as a key element in the learning process, above all in the childhood stage (García-Puchades & Chiva-Bartoll, 2018). The level of interest in the teaching-learning process is related to the level of gratification that it produces (Mathrani et al., 2016). Accordingly, in the ICT environment there are different experiences involving the so-called "serious games", which include a fun factor in the education process (Barinaga, 2016; Gutierrez et al., 2018; Tseklevs et al., 2016; Whalen et al., 2018).

Materials and methods

The aim of this study is to gain further insights into the relationship between the emotions that ICTs evoke in students at Andalusian primary and secondary schools, with a long track record in implementing best practices in ICT use, and their assimilation of these technologies. It should be noted that when technology is indicated, reference is made to the main ICT available to students, especially computers, Tablets and smartphones. This study is part of a project that analysed more dimensions¹. In this sense, other publications on the subject can be consulted for further information on the frequency of use of these technologies and their possible impact on the learning process (Llorent-Vaquero, 2020; Rodríguez-López & Llorent-Vaquero, 2015).

To meet the research objectives, a quantitative and descriptive methodology based on an ad hoc student questionnaire or survey

¹ This article shows the partial results of the doctoral thesis *Las políticas educativas TIC en el plano autonómico: El caso de Andalucía* funded by the teacher training grants of the Ministry of Education, Culture and Sport of the Government of Spain. Call 2013.

was designed for data collection. Specifically, the following objectives were established:

- To describe the emotions felt by students when interacting with ICTs.
- To determine the students' level of assimilation of ICTs.
- To discern whether or not there is any relationship between the students' level of assimilation of ICTs and the different emotions resulting from their interaction with them.
- To identify whether or not there are any statistically significant differences between the students' level of assimilation of ICTs and the different emotions that they experience when interacting with them.

Sample characteristics

In line with the study's general objective, non-probability and purposive sampling (Bisquerra, 2004) was employed, the units of analysis being the schools making up the study sample. To this end, two teachers' centres in the province of Seville and one in the province of Cadiz were approached to request their collaboration in the selection of the schools according to the following criteria: A long track record in the use of ICTs and the development of best practices in this regard. Following the selection process, the sample included a total of 18 schools (N = 18), which are summarised in Table 1.

Table 1.

Description of the study sample

	Total	Preschool centres and primary schools	Secondary schools
No. of schools	18	11	7
No. of students	1,882	880	1,002

The average age of the students participating in the study was 12.31 (S = 2,305), with a minimum and maximum age of seven and 20, respectively. As to the respondents' sex, 50.8 per cent were boys and 49.2 per cent girls, thus achieving a relatively equal sampling distribution. Likewise, there was a certain degree of parity between the

number of primary school (46.8 per cent) and secondary school students (53.2 per cent).

Data collection tool

The questionnaire employed for data collection had two sections: The first including the respondents' personal data (sex, age, the school's educational level, etc.) and the second the two measurement scales on which this study focuses. These were five-point (1-5) Likert scales in which the frequency with which the respondents felt particular emotions when using ICTs or performed specific actions relating to the assimilation of their use was determined.

Both scales were developed with the help of a specifications table for the purpose of substantiating the validity of their content. Moreover, reliability and construct validity analyses were performed using Cronbach's alpha and the factor analysis technique in order to assess the quality of the measurement scales.

Table 2.
Reliability and validity of the measurement scales

Scale	Reliability	Construct validity
Emotions evoked by ICTs (in the students) (eight items)	0.812	Factor 1 explains the 43.6% variance All the elements saturate the factor over 0.60
ICT assimilation (11 items)	0.840	Factor 1 explains the 38.8% variance All the elements saturate the factor over 0.53

As can be seen in Table 2, the results for both scale reliability and validity guarantee the quality of the measurement tools.

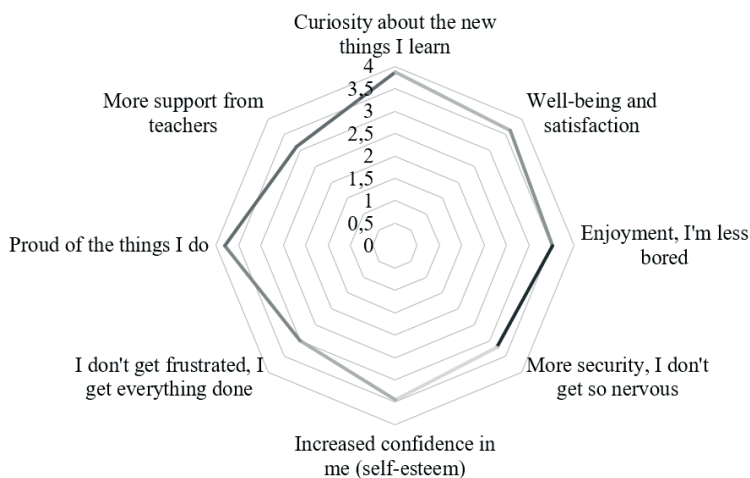
Three statistical analyses were performed on the data: A descriptive one of both measurement scales (measurements and typical deviation); another of correlation between both scales (Spearman); and, lastly, one of contrast so as to determine whether or not there were any statistically significant differences in the level of assimilation of ICTs in terms of the emotions that they elicited (Kruskal-Wallis H test). All the analyses were performed with the SPSS Statistics 24 software package.

Results

At a descriptive level, the scale measuring the emotions felt by the students when interacting with ICTs yielded a value of 3.47 (SD = 0.907), this being considered as a high score inasmuch as the scale ranged from 1 to 5. The scores for all the scale items are shown in Figure 1.

Figure 1.

Average scores for the scale items in regard to ‘Emotions evoked by ICT use’

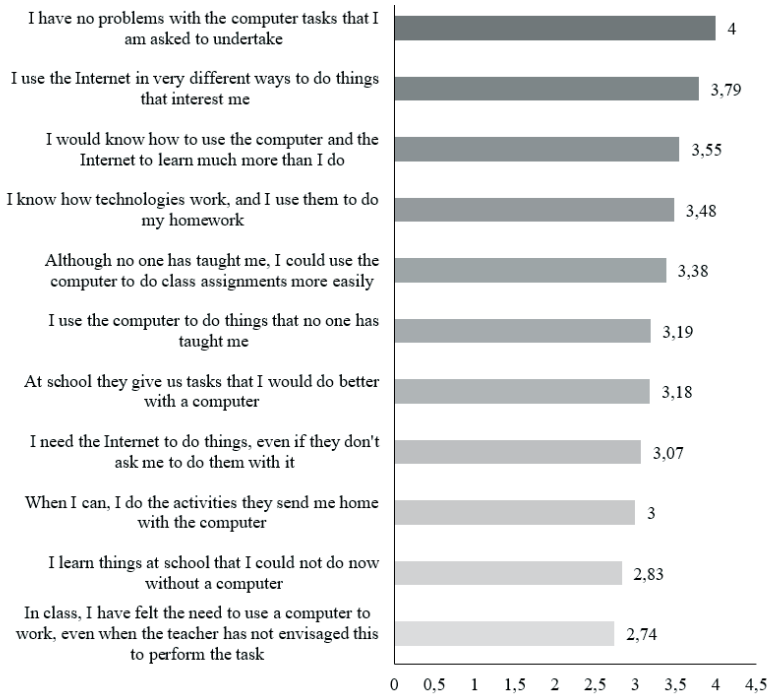


As shown in Figure 2, the emotions that the students most frequently experienced when interacting with ICTs included curiosity, pride, well-being, satisfaction and enjoyment. In contrast, the emotions least present were a lower level of frustration and the feeling of greater support on the part of the teaching staff. However, it is remarkable how all the scale items received average scores higher than the mean (1 to 5).

As to the extent to which the students assimilated the use of ICTs, the scale mean was 3.31 (SD = 0.909), this being regarded as a high value given the range. The averages for all the scale items are shown in Figure 2.

Figure 2.

Average scores for the scale items in regard to 'Assimilation of ICTs'



The items that were scored highest by the students were “I have no problems with the computer tasks that I am asked to undertake” and “I use the Internet in very different ways to do things that interest me”. In contrast, the least valued item was “In class, I have felt the need to use a computer to work, even when the teacher has not envisaged this to perform the task”, followed by “I learn things at school that I could not do now without a computer”. However, as with the previous scale, the scores were fairly high bearing in mind that the scale ranged from 1 to 5. Therefore, it can be assumed that the students' assimilation of ICTs was high.

After creating the unique scale variable, “Assimilation of ICTs”, the relationship between this variable and each one of the items of the scale “Emotions elicited by ICTs” was determined. The results

obtained in the correlation analysis, employing Spearman's rank correlation coefficient, are shown in Table 3.

Table 3.

Results of the correlation analysis using Spearman's rank correlation coefficient

	Assimilation of ICTs	
Curiosity about the new things that I learn	Correlation coefficient	.360**
	Sig. (bilateral)	.000
	N	1,710
More support from my teachers	Correlation coefficient	.250**
	Sig. (bilateral)	.000
	N	1,703
Pride in the things that I do	Correlation coefficient	.389**
	Sig. (bilateral)	.000
	N	1,705
I do not get frustrated, all goes well	Correlation coefficient	.331**
	Sig. (bilateral)	.000
	N	1,699
More self-confidence (self-esteem)	Correlation coefficient	.408**
	Sig. (bilateral)	.000
	N	1,700
More self-assurance, I do not get so nervous	Correlation coefficient	.317**
	Sig. (bilateral)	.000
	N	1,691
Enjoyment, the things that we do bore me less	Correlation coefficient	.338**
	Sig. (bilateral)	.000
	N	1,699
Well-being and satisfaction	Correlation coefficient	.408**
	Sig. (bilateral)	.000
	N	1,690

Note. **. Correlation is significant at the 0.01 level (bilateral).

In light of the results, it can be claimed, with a confidence level of 99 per cent, that there were statistically significant correlations between 'Assimilation of ICTs' and all the variables associated with the emotions evoked by them. Likewise, judging by the coefficient values and significance, the correlation was positive in all cases, albeit moderately so since the values were below 0.5.

Lastly, with respect to possible statistically significant differences in the level of assimilation of ICTs in terms of the different emotions that interaction with them evoked, a contrast analysis was performed using the Kruskal-Wallis H test, whose results are shown in Table 4.

Table 4.

Results of the contrast analysis between the scale 'Assimilation of ICTs' and the emotions elicited by their use

	Assimilation of ICTs
Curiosity about the new things that I learn	.000 ¹
More support from my teachers	.000 ¹
Pride in the things that I do	.000 ¹
I do not get frustrated, all goes well	.000 ¹
More self-confidence (self-esteem)	.000 ¹
More self-assurance, I do not get so nervous	.000 ¹
Enjoyment, the things that we do bore me less	.000 ¹
Well-being and satisfaction	.000 ¹

¹ Employing the Kruskal-Wallis H test.

As can be seen in Table 4, the null hypothesis (H0) of equality of means can be rejected as regards all the items associated with the emotions evoked by ICTs, with a confidence level of 99 per cent. Specifically, the differences in the means of the groups in terms of the analysis variable are as follows:

- Curiosity about the new things that I learn: A higher level of assimilation of ICTs in those who are very curious than in those who are less so.
- More support from my teachers: A higher level of assimilation of ICTs in those who feel that they receive a fair amount of support than in those who believe that they receive none.

- Pride in the things that I do: A higher level of assimilation of ICTs in those who feel very proud than in those who feel quite the opposite.
- I do not get frustrated, all goes well: A higher level of assimilation of ICTs in those who feel much less frustration than in those who feel just as frustrated as before.
- More self-confidence (self-esteem): A higher level of assimilation of ICTs in those who feel much more confident than in those who do not.
- More self-assurance, I do not get so nervous: A higher level of assimilation of ICTs in those who feel very self-assured than in those who feel little self-assurance.
- Enjoyment, the things that we do bore me less: A higher level of assimilation of ICTs in those who really enjoy themselves than in those who find little enjoyment in their use.
- Well-being and satisfaction: A higher level of assimilation of ICTs in those who experience more well-being and satisfaction than in those who experience less.

Discussion and conclusions

We will now present our conclusions in terms of the established research objectives. As regards the first (to describe the emotions felt by students when interacting with ICTs), the student respondents' appraisal was positive, thus showing that they experienced positive emotions when interacting with ICTs. The most frequent emotion was curiosity, followed by pride in the things that they did and well-being and satisfaction. This finding is similar to those of other studies that have underscored the importance of satisfaction in the development of key skills (Fernández-Pascual et al., 2013; Hernández-Chérrez & Tayo, 2017; Kim et al., 2014). Conversely, the least frequent emotions had to do with experiencing little frustration, the support of teachers and self-confidence. These results are in line with the study performed by López-Meneses et al. (2017), in which they note the emotional drawbacks of interacting with ICTs, espe-

cially as regards the stress and anxiety that some students may experience.

Moving on to the second objective (to determine the students' level of assimilation of ICTs), the student respondents' appraisals were also positive, pointing to a high level of assimilation. This was greater in the items relating to the inter-psychological dimension than in those associated with the intra-psychological one. This demonstrates that the inter-psychological dimension is the first step towards assimilation, to wit, students must be proficient in this dimension before going on to tackle the inter-psychological one (Becco, n.d.).

In relation to the third objective (to discern whether or not there is any relationship between the level of the students' assimilation of ICTs and the different emotions resulting from their interaction with them), it is possible to observe statistically significant correlations between the assimilation of ICTs and all the emotions experienced when interacting with them. Albeit moderate, this positive correlation points to a clear association between the assimilation of ICTs and the emotions experienced when using them. Thus, it highlights the different emotions that students feel in their interaction with technology (Crisol-Moya et al., 2021; Huertas & Pantoja, 2016; Kim et al., 2014; Zhang & Liu, 2016).

Lastly, as to the fourth objective (to identify whether or not there are any statistically significant differences between the students' level of assimilation of ICTs and the different emotions that they experience when interacting with them), there were statistically significant differences in the assimilation of ICTs in terms of the emotions analysed. In this sense, a greater positive emotion (pride, well-being and satisfaction, enjoyment, etc.) or a lesser negative emotion (frustration) was associated with a higher level of assimilation of ICTs. This finding is borne out by other studies that associate satisfaction with the development of key skills (Fernández-Pascual et al., 2013; Hernández-Chérrez & Tayo, 2017; Kim et al., 2014).

In sum, the data reflect a clear relationship between the emotions experienced when using ICTs and the level of their assimilation. In other words, students' emotions are essential in their interaction with ICTs in order to achieve a higher level of assimilation. This conclusion

is consistent with those of other studies that defend the importance of emotions for improving educational processes (Hernandez-Cherrez & Tayo, 2017; Mathrani et al., 2016; Neville et al., 2015; Reid et al., 2016; Valverde et al., 2013).

References

- Álvarez, A., & Sebastián, C. S. (2018). El concepto dialéctico de internalización en Vygotski: aproximaciones a un debate. *Psicología, conocimiento y sociedad*, 8(1), 4-29. <https://doi.org/10.26864/pcs.v8.n1.2>
- Barinaga, B. (2016). El videojuego y la tradición del juego. Educación y sombras de la sociedad digital. *Opción*, 32(9), 169-184. <https://www.redalyc.org/pdf/310/31048482009.pdf>
- Bartikowski, B., Laroche, M., Jamal, A., & Yang, Z. (2018). The Type-of-Internet-Access Digital Divide and the Well-Being of Ethnic Minority and Majority Consumers: A Multi-Country Investigation. *Journal of Business Research*, 82, 373-380. <https://doi.org/10.1016/j.jbusres.2017.05.033>
- Becco, G. R. (n.d.). *Vygotski y teorías sobre el aprendizaje*. http://www.libreopinion.com/members/ironcero/docs/VYGOSTSKY_06_BECCO_Vygotsky_y_teorias_sobre_el_aprendizaje.pdf
- Bisquerra, R. (2004). *Metodología de la investigación educativa*. Editorial La Muralla.
- Cabezas, M., Casillas, S., & Hernández, A. (2016). Metodologías de trabajo colaborativo en la educación secundaria obligatoria: un estudio de caso. *RELATEC, Revista latinoamericana de tecnología educativa*, 15(1), 75-85. <https://doi.org/10.17398/1695-288X.15.1.75>
- Crisol-Moya, E., Gámiz-Sánchez, V., & Romero-López, M. A. (2021). University Students' Emotions when Using e-Portfolios in Virtual Education Environments. *Sustainability*, 13(12), 6973. <https://doi.org/10.3390/su13126973>
- De Pablos, J., Colás, P., Conde-Jiménez, J., & Reyes-De-Cózar, S. (2017). La competencia digital de los estudiantes de educación no universitaria: Variables predictivas. *Bordón*, 69(1), 169-185. <https://doi.org/10.13042/Bordon.2016.48594>
- Du, J., Xu, J., Liu, F., Huang, B., & Li, Z. (2019). Factors Influence Kindergarten Teachers' Emotion Management in Information Technology: A Multilevel Analysis. *The Asia-Pacific Education Researcher*, 28, 519-530. <https://doi.org/10.1007/s40299-019-00452-6>

- Fernández-Pascual, M. D., Ferrer-Cascales, R., & Reig-Ferrer, A. (2013). Entornos virtuales: predicción de la satisfacción en contexto universitario. *Pixel-Bit. Revista de medios y educación*, 42, 167-181. <https://doi.org/10.12795/pixelbit.2013.i43.12>
- Freiman, V., Martinovic, D., & Robichaud, X. (2018). New Faces of Digital Divide and how to Bridge It. In M. Khosrowpour (Ed.), *Encyclopedia of Information Science and Technology* (pp. 7248-7258). IGI Global.
- García-Puchades, W., & Chiva-Bartoll, Ó. (2018). El juego como proceso de subjetivación y su justificación en el currículum de educación física. *CCD: Cultura, Ciencia, Deporte*, 13(38), 147-156. <https://doi.org/10.12800/ccd.v13i38.1070>
- Gutiérrez, R. S., Duque, E. T., Chaparro, R. L., & Rojas, N. R. (2018). Aprendizaje de los conceptos básicos de realidad aumentada por medio del juego Pokemon Go y sus posibilidades como herramienta de mediación educativa en Latinoamérica. *Información tecnológica*, 29(1), 49-58. <https://doi.org/10.4067/S0718-07642018000100049>
- Hernández-Chérrez, E. A., & Tayo, E. (2017). La satisfacción de docentes y estudiantes en una experiencia de aprendizaje apoyada en la tecnología. *Revista Publicando*, 12(1), 334-350. <https://revistapublicando.org/revista/index.php/crv/article/view/663>
- Hinojo-Lucena, F., Belmonte, J., Cabrera, A., Torres, J. M., & Sánchez, S. (2020). Academic Effects of the Use of Flipped Learning in Physical Education. *International Journal of Environmental Research and Public Health*, 17(1), 276. <https://doi.org/10.3390/ijerph17010276>
- Huertas, A., & Pantoja, A. (2016). Efectos de un programa educativo basado en el uso de las TIC sobre el rendimiento académico y la motivación del alumnado en la asignatura de tecnología de educación secundaria. *Educación XX1*, 19(2), 229-250. <https://doi.org/10.5944/educxx1.16464>
- Iglesias, A., García, B., & Sánchez, M. C. (2017). Collaborative Learning and Mobile Devices: An Educational Experience in Primary Education. *Computers in Human Behavior*, 72, 664-677. <https://doi.org/10.1016/j.chb.2016.07.019>
- Inzunza-Mejía, P. C. (2018). Amenazas y oportunidades de la economía digital en el mercado laboral de México. *Revista facultad de ciencias económicas: Investigación y reflexión*, 26(2), 45-60. <https://doi.org/10.18359/rfce.2926>
- Jerman, B., & Blažič, A. (2020). Overcoming the Digital Divide with a Modern Approach to Learning Digital Skills for the Elderly Adults. *Education and Information Technologies*, 25(1), 259-279. <http://doi.org/10.1007/s10639-019-09961-9>

- Jiménez-Cortés, R. (2016). Ciudadanía digital y bienestar de las mujeres rurales en las redes sociales. *RELATEC, Revista latinoamericana de tecnología educativa*, 15(2), 81-94. <https://doi.org/10.17398/1695-288X.15.2.81>
- Kim, H., Kil, H., & Shin, A. (2014). An Analysis of Variables Affecting the ICT Literacy Level of Korean Elementary School Students. *Computers & Education*, 77, 29-38. <https://doi.org/10.1016/j.compedu.2014.04.009>
- Llorent-Vaquero, M. (2020). El uso de las TIC en menores. La importancia de la colaboración entre familia, escuela y sociedad. In C. Naval, A. Bernal, G. Jover, J. L. Fuentes, & R. Rudela-Cárdenas (Eds.), *Reflexiones desde la filosofía de la educación* (pp. 517-524). Dykinson.
- López-Meneses, E., Llorent-García, V. J., & Medina-Ferrer, B. (2017). Análisis diacrónico de las ventajas e inconvenientes del uso de las TIC en el ámbito educativo a través de mapas conceptuales multimedia. *TE & ET, Revista iberoamericana de Tecnología en Educación y Educación en Tecnología*, 19, 34-40. http://www.scielo.org.ar/scielo.php?pid=S1850-99592017000100005&script=sci_abstract
- Lu, Y., & Song, H. (2020). The Effect of Educational Technology on College Students' Labor Market Performance. *Journal of Population Economics*, 33, 1101-1126. <https://doi.org/10.1007/s00148-019-00756-3>
- Mathrani, A., Christian, S., & Ponder-Sutton, A. (2016). PlayIT: Game-Based Learning Approach for Teaching Programming Concepts. *Educational Technology & Society*, 19(2), 5-17. <https://www.jstor.org/stable/jeductechsoci.19.2.5>
- Moreira-Fontán, E., García-Señorán, M., Conde, A., & González, A. (2019). Teachers' ICT-Related Self-Efficacy, Job Resources, and Positive Emotions: Their Structural Relations with Autonomous Motivation and Work Engagement. *Computers & Education*, 134, 63-77. <https://doi.org/10.1016/j.compedu.2019.02.007>
- Neville, V., Lam, M., & Gordon, C. J. (2015). The Impact of eLearning on Health Professional Educators' Attitudes to Information and Communication Technology. *Journal of Multidisciplinary Healthcare*, 8, 75-81. <https://doi.org/10.2147/JMDH.S74974>
- Nolasco, P., & Ojeda, M. M. (2016). La evaluación de la integración de las TIC en la educación superior: fundamento para una metodología. *RED, Revista de educación a distancia*, 48(9). <https://doi.org/10.6018/red/48/9>
- Oberländer, M., Beinicke, A., & Bipp, T. (2019). Digital Competencies: A Review of the Literature and Applications in the Workplace. *Computers & Education*, 146. <https://doi.org/10.1016/j.compedu.2019.103752>

- Pacheco, F., Villacís, P., & Álvarez, P. (2016). Las TIC como herramientas en el proceso de enseñanza-aprendizaje para optimizar el rendimiento académico. *Revista ciencias pedagógicas e innovación*, 3(1), 56-62. <http://doi.org/10.26423/rcpi.v3i1.13>
- Pérez-Escoda, A., Castro-Zubizarreta, A., & Fandos-Igado, M. (2016). La competencia digital de la generación Z: claves para su introducción curricular en la Educación Primaria. *Comunicar*, 24(49), 71-79. <https://doi.org/10.3916/C49-2016-07>
- Petko, D., Cantieni, A., & Prasse, D. (2017). Perceived Quality of Educational Technology Matters: A Secondary Analysis of Students' ICT Use, ICT-Related Attitudes, and PISA 2012 Test Scores. *Journal of Educational Computing Research*, 54(8), 1070-1091. <https://doi.org/10.1177/0735633116649373>
- Reid, H. J., Thomson, C., & McGlade, K. J. (2016). Content and Discontent: A Qualitative Exploration of Obstacles to eLearning Engagement in Medical Students. *BMC Medical Education*, 16(188). <https://doi.org/10.1186/s12909-016-0710-5>
- Rodríguez-López, M., & Llorent-Vaquero, M. (2015). El uso de herramientas TIC por el alumnado de los centros de primaria y secundaria andaluces tras la supresión del plan escuela TIC 2.0. In P. Guíérrez, M. L. Hernández, & F. De Paula (Eds.), *XXIII Jornadas Universitarias de Tecnología Educativa JUTE 2015* (pp. 760-770). Red Universitaria de Tecnología Educativa https://knowledgesociety.usal.es/system/files/JUTE_actas_2015.pdf
- Schroeder, R. (2018). Towards a Theory of Digital Media. *Information, Communication & Society*, 21(3), 1-17. <https://doi.org/10.1080/1369118X.2017.1289231>
- Tang, Y. (2021). Does Information and Communication Technology (ICT) Empower Teacher Innovativeness: A Multilevel, Multisite Analysis. *Educational Technology Research and Development*, 69(6), 1-20. <https://doi.org/10.1007/s11423-021-10052-1>
- Tseklevs, E., Cosmas, J., & Aggoun, A. (2016). Benefits, Barriers and Guideline Recommendations for the Implementation of Serious Games in Education for Stakeholders and Policymakers. *British Journal of Educational Technology*, 47(1), 164-183. <https://doi.org/10.1111/bjet.12223>
- Valverde, J., Fernández, M. R., & Revuelta, F. I. (2013). El bienestar subjetivo ante las buenas prácticas educativas con TIC: su influencia en profesorado innovador. *Educación XX1*, 16(1), 255-280. <https://doi.org/10.5944/educxx1.16.1.726>

- Whalen, K. A., Berlin, C., Ekberg, J., Barletta, I., & Hammersberg, P. (2018). "All They Do Is Win": Lessons Learned from Use of a Serious Game for Circular Economy Education. *Resources, Conservation and Recycling*, 135, 335-345. <https://doi.org/10.1016/j.resconrec.2017.06.021>
- Zhang, D., & Liu, L. (2016). How Does ICT Use Influence Students' Achievements in Math and Science over Time? Evidence from PISA 2000 to 2012. *Eurasia Journal of Mathematics, Science & Technology Education*, 12(9), 2431-2449. <https://doi.org/10.12973/eurasia.2016.1297a>
- Zilka, G. (2019). The Digital Divide: Implications for the eSafety of Children and Adolescents. *International Journal of Technology Enhanced Learning*, 1, 20-35. <https://doi.org/10.1504/IJTEL.2019.10017225>
- Zylka, J., Christoph, G., Kroehne, U., Hartig, J., & Goldhammer, F. (2015). Moving beyond Cognitive Elements of ICT Literacy: First Evidence on the Structure of ICT Engagement. *Computers in Human Behavior*, 53, 149-160. <https://doi.org/10.1016/j.chb.2015.07.008>
- Uvarov, A. Y. (2019). Harnessing ICT to Enhance Provision of School Education: The Policy Recommendations. *Computer Science and Education/ Информатика и образование*, 2, 5-12. <http://doi.org/10.32517/0234-0453-2019-34-2-5-12>