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**Original Article**

# Adaptation and validation of a scale to assess digital teaching competence in soccer coaches

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**Abstract**.
Since 2015, the Union of European Football Associations (UEFA) has held a convention with the aim of updating its technical qualifications for the training of its football coaches. It has proposed widespread changes, but with a particular recommendation for the creation of a subject about New Technologies. This proposal is in line with the natural evolution of today's society and with an increasing digital presence in all professional fields. The overarching concern for quality teaching in digital competences involves, first and foremost, the necessary adoption of these digital competences by their trainers. As a result, the aim of this research is to adapt and validate a scale, previously validated in other training contexts, to assess the digital teaching competence (hereafter, DTC) of soccer coaches. The study sample consists of 612 coaches at different levels who are registered in the Football Federation of the Valencian Community (hereafter, FFCV). The sample contains a higher percentage of men (91.7%) than women (8.3%) and a mean age of 30.88 years. A confirmatory factor analysis was performed, which revealed five factors grouping 31 indicators: Information and Literacy (5 items), Communication and Collaboration (6 items), Digital Content Creation (9 items), Security (6 items) and Problem Solving (5 items). Goodness-of-Fit indicators showed adequate values: (x2 /gl=2.82); RMSA= 0.6 (Confidence Interval= 0.6-0.7); CFI=.91; IFI= .91. Reliability was tested by Composite Reliability, Cronbach's Alpha and Mean Variance Extracted values. The results of the research support the reliability and validity of the questionnaire that was adapted for the purpose of assessing the digital teaching competence of soccer coaches.
**Keywords**: **Digital Competence, Educational, Models, Sports Educator.**

## Introduction

At present, it is difficult to specify a single definition of digital competence, due to the large number of definitions provided in the literature (Esteve and Gisbert, 2013). However, digital competence has been defined as the set of skills, knowledge and attitudes in aspects such as technology, information andcommunication or the totality of multimedia resources that a subject master (Domingo-Coscolla et al., 2020; Krumsvick, 2011). Furthermore,Dornaleteche-Ruíz et al. (2015) indicated that the term itself has been surrounded by terms that are synonymous, and therefore used in different publications such as digital literacy, information competences, technological competences or media competences.

In 2010, a European Commission-driven project involving the *Joint Research Centre* (JRC) was launched with the aim of, on the one hand, identifying the set of knowledge, skills and attitudes that define a digitally competent citizen and, on the other hand, establishing a common European reference framework of these competences. This achievement led to the birthof the DIGCOM project, mentored by the European Commission (2016). The reference framework provided a theoretical basis, which mainly dealt with the management of European digital competence certificates. It consisted of five broad dimensions and 21 competences, which in turn integrated a descriptionand three levels of mastery, organized into an initial level, an intermediate level and an advanced level. The framework was subsequently revised by Vuorikari et al. (2016) and Carretero et al. (2017). It is currently supported bythe European Commission's Directorate-General for Education and Culture (DG EAC) and by the European Union's Directorate-General for Employment, Social Affairs and Inclusion (DG EMPL).

The dimensions and competences belonging to each dimension provided by Carretero et al. (2017) were:

*Information*: identifying, locating, retrieving, storing, organising and analysing digital information by assessing its purpose and relevance. Three categories are integrated: browsing, information evaluation and information storage.

*Communication*: communicating in online digital environments, connecting and collaborating with others through digital tools, interacting and participating in communities and networks, intercultural awareness. It


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integrates six categories: interaction, sharing digital content, online participation, collaboration and management and digital identity.

*Content creation*: creating and editing digital content such as texts or images, integrating previous knowledge and content, realising artistic productions, multimedia content and computer programming, knowing how to apply intellectual property rights and licences for use. In turn, it integrates: developing digital content, reworking content, rights of use and programming.

*Security*: personal protection, data, identity and use. The competences that are integrated are: protection of devices, personal health and the environment.

*Problem solving*: identification of digital needs and resources, decision making in the choice of appropriate digital tools, conceptual problem solvingthrough digital media and creative use. Integrated within this dimension are: solving technical problems, identifying technological needs, innovation and creative use of technology and identifying digital skills gaps.

There are currently a series of basic competences that must be present among all educators and trainers. This is not exclusive to university teaching staff (Agreda et al., 2016; Bocharin et al., 2022; Cabero et al., 2020; Casillas-Alvarado and Ramírez- Martinell, 2019; Casillas-Alvarado; Domingo-Coscolla et al., 2020; Khairul et al., 2022), but should be found among teachers at any educational stage (Esteve and Gisbert, 2013; Fernández et al., 2018; Pozo-Sánchez et al., 2020). Withinthese basic competences are digital teaching competences (DTC), defined as the set of knowledge, skills and strategies specific to the teaching profession that enable educational problems and challenges to be solved (Cabero and Palacios, 2020). The definition provided a pedagogical nuance that also addressed aspects of educational didactics required in the teaching and learning process (Durán et al., 2016).

One of the justifications provided that explained the need for DTC amongall education professionals is due to the fact that present societies are changing(Fuentes et al., 2019; López et al., 2019). On the other hand, more and more continuous training courses are required with the aim of increasing the level of DTC, and because of the increasing technological concerns of the students served (Area, 2014; Fuentes et al., 2019; Menescardy et al., 2021; Prensky, 2001).

This new educational model or paradigm had to assume ICT as one of the load-bearing pillars of the model itself, which was called "E-literacy" by Trujillo et al. (2011). The model has to be agile and fast in order to incorporate ICT in classrooms or educational spaces, which in turn are managed by educational administrations. The existence of a large number of teachers who, although they are familiar with ICT media or resources, do not integrate theminto their teaching work was also indicated (Martínez et al., 2017). However,there did seem to be a certain consensus that suggested the lack of continuous ICT training programmes for teachers (Fernández et al., 2018).

Given the many changes that have taken place, especially in the pedagogical and technological field, there are different organizations that havetried to provide the necessary indicators or standards for the management of this competence. For this reason, the DTC, like digital competence, should have been integrated into an evaluative reference framework. At present, there are different reference frameworks for the management of digital competencein teaching, some of which do not apply to Spain, such as the British Digital Teaching Framework, the ICT Competence Framework for the Professional Development of Teachers in Colombia or the ICT Competences and StandardsFramework for the Teaching Profession in Chile.

Among the evaluation frameworks in Europe, the ISTE (*International Society for Technology in Education*) Standards Framework and the UNESCO ICT Competence Framework for Teachers stood out. Another was the European Digital Competence Framework for Teachers (DIGCOMPEDU), which was designed by the JRC in 2017 and whose central objective was to generate a digital reference framework for all teachers in the European Union(Cabero et al., 2020).

In the case of the national territory, the Spanish Common Framework for Digital Competence in Education (MCECCD), created by a team of specialists in educational technology from different autonomous regions and managed through the National Institute of Educational Technologies and Teacher Training (INTEF), stands out. The first MCECCD was approved in 2017 andrecently in January 2022 it has been revised and updated again, approving a draft DTC in Spain, mainly due to the accelerated technological change that occurred as a result of the Covid-19 pandemic (INTEF, 2017). Based on the aforementioned framework approved in 2017, a DTC assessment questionnaire was designed by Tourón et al. (2018), which has been adopted and used in numerous studies and research on the analysis of DTC acquisition among teachers at different educational levels. This questionnaire assessed the level of teachers' digital competence through 5 dimensions with 54 items, all on a Likert-type scale from 1 to 7, representing the level of competence fromlowest to highest.

As we have seen, there are studies that have analysed the digital competences of teachers in regulated contexts, however, there are few studies in specific educational settings such as companies, academies or sports institutions (Ibáñez-Godoy and Medina-Casaubón, 1999; Moneta, 2019, Rauter, 2018). One question of interest was whether the existing DTC scales could be used with reliability and validity in other educational contexts, suchas in the case of sports coach education. In addition, adapting these scales to the context of educational sport

will also make it possible to analyse whethercoaches are digitally trained, as they are responsible for passing on the knowledge of a particular sport to their players (teachers) on the basis of certain competencies.

According to the last convention of the Union of European Football Associations (UEFA), held in 2015, it was clearly stated that the football coach, especially in the formative or grassroots context, is considered a sports educator, since he/she assumes the responsibility of teaching how to play football (UEFA, 2015). Furthermore, in view of the educational reform that has taken place in the curricula of coaches supervised by the different Federations, the hours allocated to training in subjects for the mastery of ICT and the increase in their professional performance were increased (Ballester- Esteve et al., 2021). It has also been possible to observe a coherent adjustmentbetween the contents of sports educators and university teaching staff in Physical Education (Ibáñez-Godoy and Medina-Casaubón, 1999).

The final purpose of this research was to adapt and validate the scale used in the Digital Competence in Teaching questionnaire by Tourón et al. (2018)for the context of football coach training. Based on the validation of this scale, specifically, the aim was to evaluate and find out the level of DTC of football coaches in the Valencian Community. To adapt the original scale, it was necessary to resort to expert judgement (Delphi method) in order to adjust oreliminate items from the original scale through the required methodological process (Reguant-Álvarez and Torrado-Fonseca, 2016) and subsequently, thefinal scale was administered to the body of football coaches in the ValencianCommunity, all of whom were trained through the FFCV.

Reguant-Álvarez and Torrado-Fonseca (2016), argue that the Delphi method is considered a suitable methodology for tackling different situationsthat can generate problems in research and, specifically, to specify research questions that, in reality, are the items of the scale themselves. Moreover, it is considered a versatile method, which provides *feedback* and ultimately generates increased knowledge about a particular aspect when presented by agroup of experts in the field.

**Material & methods**

*Participants*

The sample consisted of a total of 612 students from the football coaching training courses managed by the FFCV. All the sports coaches who are part of the present proposal have received updated pedagogical training based on the pedagogical changes generated in the convention (UEFA, 2015). The socio-demographic characteristics of the group analysed reported, firstly, thatthe sample presented a greater number of men (91.7%) compared to the group of women (8.3%). Regarding the age of the respondents, the mean age was 30.88 (SD=10.50). With regard to the level of education, 11.9% had primary education, 17% had secondary education, 18.5% had a baccalaureate, 17.5% had higher education and 35% had university studies. Finally, in terms of the level or course of study as coaches, 71.1% have the UEFA C coaching qualification, 4.6% the UEFA B qualification, 6.8% the UEFA A qualificationand 17.5% the UEFA PRO qualification.

*Instruments*

An adaptation of the Digital Competence Questionnaire for Teachers by Tourón et al. (2018) has been carried out. The original questionnaire has fivedimensions and a total of 54 items. The adaptation of the scale involved two different steps. The first one was carried out through the Delphi method, the process to constitute the expert judgement. Authors such as Reguant-Álvarez and Torrado-Fonseca (2016) have suggested a minimum of six experts and a maximum of thirty. On this occasion, nine experts were selected, distributed into: (a) three university professors with more than 10 years of experience, accredited PhDs trained in educational innovation and technology who teach in the Faculty of Teaching and Education Science at the Catholic University of Valencia, (b) three university professors with more than 10 years of experience, accredited PhDs trained in educational innovation and technology who teach in the Faculty of Teaching and Education Science at the Catholic University of Valencia, (c) three university professors with more than 10 years of experience, b) three university professors with more than 10 years of experience, accredited doctors trained in Physical Activity and Sport Sciences, who teach in the same Faculty of the Catholic University of Valencia and c) three coaches from professional football leagues, two of themfrom the professional football league or Liga Santander and one coach from the *Smartbank* League. After subsequent feedback and the relevant meetings, the five dimensionsof the original questionnaire were respected, but the number of items was reduced from 54 in the original scale to 32 in the adapted scale. Another aspectwas the elimination of the *knowledge* section of the scale, leaving only the *use* section. The justification is given by the implicit knowledge of the technologywhen it is used, especially because the use itself denotes knowledge of the resource or application (Martínez et al., 2017).

The second step consisted of administering the adapted scale and carrying out the statistical treatment to establish its validity. Finally, the final questionnaire includes the 5 dimensions present in the original by Tourón et al. (2018), with 32 items, using a Likert-type response scale ordered in a frequency from 1 to 7, in which the value 1 represents the lowest degree and the value 7 the highest.

*Procedure*

Following the exceptional situation caused by the pandemic from COVID-19onwards, all the courses that have been held in the autonomous region, Castellón, Valencia and Alicante, have been taught telematically. For this reason, the relevant authorizations were requested and signed with the territorial management of the Valencian

Federation's coaching school, and the research was subsequently carried out. The process for administering the questionnaires was through an *online* support *(limesurvey*). The questionnaires administered *online* have been kept open on the teaching platform since January 2020 and were closed in July 2020.

*Data Analysis*

To test the validity of the measurement model proposed in this paper, we followed the recommendations of Bollen (1989), dividing the sample randomly into two subsets of data in which confirmatory factor analysis (CFA) was applied. The aim of this paper is to test the validity of a factor structure that has been tested in other studies (Agreda et al., 2016; Fernández et al., 2018; Tourón et al., 2018), in football coaches in the Valencian Community. When there is theoretical evidence on a measurement model, it is recommended to use confirmatory factor analysis to test the validity of the model (Kim and Lee, 2019).

The SPSS v.26 statistical software for social sciences and the EQS v.6.4 programme for structural equation models were used to analyse the data. The SPSS statistical package was used to perform the descriptive analyses of the scale indicators, while the EQS programme was used to perform the CFAs. The CFA was carried out by applying the robust maximum likelihood estimation method in order to correct for the possible absence of multivariate normality. Thus, for the assessment of the overall fit, use was made of different goodness-of-fit indices recommended in the literature (Kline, 2015): S-B $\chi^2$ and $\chi^2$ /gl, with values below three being accepted as optimal; the Comparative Fit Index (CFI) and the Incremental Fit Index (IFI), with values above .90 being recommended; and the root mean square error of approximation (RMSEA) value, with scores below .08 being necessary to consider a good fit.

In assessing the reliability of the scale, three measures were taken into account: Cronbach's alpha, Composite Reliability (CF) and the Extracted Variance Measure (EVA) for each factor (Hair et al., 2006). On the other hand, convergent validity was also tested through the significance of the factor loadings on their respective dimension and the associated t-test values. In addition, discriminant validity, which is concerned with the clear distinction between any pair of constructs, was assessed using the method suggested by Fornell and Larcker (1981). This method admits discriminant validity if the square root of the AVE value of a given factor is greater than the correlation coefficients between the factor and any other factor of the proposed scale. Another criterion to ensure discriminant validity is that the correlations between the various pairs of factors must be less than .85 (Kline, 2015).

**Results**

Table 1 shows the mean, standard deviation, skewness and kurtosis of each indicator for the sample as a whole. Most of the indicators presented values higher than value 4 on the Likert scale, which would indicate a tendency towards agreement in the coaches' perceptions of digital competence.

The highest scores were observed for the Information and Information Literacy factor items, followed by the Communication and Collaboration factor, while the factor with the lowest mean scores was the Information and Information Literacy factor, followed by the Communication and Collaboration factor, while the factor with the lowest mean scores was the Information and Information Literacy factor.

corresponds to Digital Content Creation. Of note were the high mean scores for DIGCOMP1, 2, 6, 9 and 13 with a mean score close to or above 5, indicating a tendency towards agreement in the perception of the use of coaches in these indicators. In contrast, the lowest mean scores were observed for DIGCOMP items 16, 18, 19 and 22, whose values are lower than 3, indicating a tendency towards disagreement in the perception of coaches' use. On the other hand, the skewness and kurtosis values were acceptable as they are less than 3.0 for all items (Chou and Bentler, 1995).

Table 1.

*Item analysis of the DIGCOMP scale for the whole sample (n=612): Mean (M), standard deviation (SD), item-total correlation (rjx), Cronbach's alpha if the item is removed (α-x), skewness (A) and kurtosis (C).*

| | | M | DT | $r_{jx}$ | α-x | A | C |
|---|---|---|---|---|---|---|---|
| Factor 1 | Information and Information Literacy: α= .84 | | | | | | |
| DIGCOMP1 | Internet browsing strategies (searches, filters, search operators, etc.). | 5.21 | 1.54 | .68 | .80 | -.72 | -.10 |
| DIGCOMP2 | Strategies for searching, locating and selecting information in different media or formats (text, video, etc.). | 5.03 | 1.53 | .69 | .80 | -.61 | -.31 |
| DIGCOMP3 | Specific channels for the selection of information in different media or formats (Internet videos. drones. GPS. Cardiofrequency meters. Bioimpedance. Virtual Reality. Strength | 3.72 | 1.83 | .58 | .83 | .14 | -1.06 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Platforms. Contacts ...) | | | | | | |
| DIGCO MP4 | Criteria for assessing the reliability of information sources. data. digital content. etc. | 4.43 | 1.70 | .64 | .81 | -.28 | -.79 |
| DIGCO MP5 | Tools for the storage and management of shared files and content (e.g. Drive, Box, Dropbox, Office 365, etc.). | 5.07 | 1.73 | .66 | .81 | -.69 | -.46 |
| Factor 2 | Communication and Collaboration: α = .84 | | | | | | |
| DIGCO MP6 | Tools for online communication: forums, instant messaging, chats, videoconferences... | 4.94 | 1.72 | .60 | .82 | -.60 | -.54 |
| DIGCO MP7 | Software available in my sports club. Participation control. injury register. match statistics. cards and sanctions control. line-ups. call-ups...) | 3.76 | 2.00 | .52 | .84 | .17 | -1.16 |
| DIGCO MP8 | Spaces to share files. images. work. etc. | 4.75 | 1.84 | .74 | .79 | -.48 | -.78 |
| DIGCO MP9 | Social networks or learning communities to share information and educational content (e.g. Facebook, Twitter, Google+ or others). | 5.21 | 1.73 | .58 | .83 | -.69 | -.52 |
| DIGCO MP10 | Tools for shared or collaborative learning (e.g. blogs. wikis. specific platforms). | 3.88 | 1.78 | .67 | .81 | .03 | -.95 |
| DIGCO MP11 | Basic rules of behaviour and etiquette in online communication in the context of sport. | 4.33 | 1.75 | .64 | .82 | -.22 | -.90 |
| Factor 3 | Digital Content Creation: α = .91 | | | | | | |
| DIGCO MP12 | Tools for creating assessment tests | 3.93 | 1.80 | .69 | .91 | .02 | -.96 |
| DIGCO MP13 | Tools for creating Presentations. Power Point ... | 4.82 | 1.75 | .53 | .91 | -.49 | -.71 |
| DIGCO MP14 | Tools for the creation of tactical content videos. analysis of opponents. offensive and defensive strategy. | 3.83 | 1.80 | .74 | .90 | .09 | -.99 |
| DIGCO MP15 | Tools to facilitate learning such as infographics. concept maps. chronological axes. timelines. ... | 3.59 | 1.85 | .77 | .90 | .27 | -.93 |
| DIGCO MP16 | Tools to produce QR (Quick Response) codes. | 2.82 | 1.86 | .70 | .90 | .73 | -.62 |
| DIGCO MP17 | Tools to create voice recordings (podcast) | 3.27 | 1.92 | .67 | .91 | .43 | -.95 |
| DIGCO MP18 | Tools for content based on augmented reality | 2.64 | 1.74 | .73 | .90 | .79 | -.46 |
| DIGCO MP19 | The Interactive Whiteboard software from the club I belong to | 2.78 | 1.86 | .63 | .91 | .81 | -.47 |
| DIGCO MP20 | Tools to re-elaborate or enrich content in different formats (e.g. texts. tables. audio. images. videos. etc.) | 3.86 | 1.85 | .70 | .90 | .07 | -1.08 |
| DIGCO MP21 | Different types of licences to publish my content (copyright, copyleft and creative commons). | 2.57 | 1.78 | .68 | .91 | .96 | -.16 |
| Factor 4 | Security: α = .91 | | | | | | |
| DIGCO | Protection from virus | 4.33 | 1.93 | .73 | .90 | -.21 | -1.04 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MP22 | threats. malware. etc.. for the devices. | | | | | | |
| DIGCOMP23 | Protection of information (names. images. etc.). relating to people in your immediate environment (teammates. club players. other technicians. ... | 4.29 | 1.93 | .80 | .89 | -.16 | -1.06 |
| DIGCOMP24 | Protection systems for devices or documents (access control. privileges. passwords. etc.). | 4.50 | 1.85 | .78 | .89 | -.20 | -1.04 |
| DIGCOMP25 | Ways to delete data/information. when necessary. for which you are responsible for yourself or that of third parties. | 4.14 | 1.92 | .77 | .89 | -.04 | -1.10 |
| DIGCOMP26 | Ways to control ways of using technology that become distracting. | 3.74 | 1.81 | .74 | .90 | .21 | -.92 |
| DIGCOMP27 | How to maintain a balanced attitude between the use of technology. | 4.31 | 1.77 | .69 | .90 | -.15 | -.86 |
| Factor 5 | Problem Solving: α = .88 | | | | | | |
| DIGCOMP28 | Basic computer maintenance tasks to avoid possible malfunctions (e.g. updates, cache or disk cleaning, etc.). | 4.50 | 1.86 | .65 | .87 | -.31 | -.95 |
| DIGCOMP29 | Basic solutions to technical problems arising from the use of digital devices in the club. | 3.68 | 1.93 | .68 | .86 | .12 | -1.14 |
| DIGCOMP30 | Compatibility of peripherals (microphones. headphones. printers. etc.) and their connectivity requirements. | 4.30 | 1.83 | .73 | .85 | -.21 | -.94 |
| DIGCOMP31 | Solutions for management and storage in the "cloud". file sharing. granting access privileges. etc. (e.g. Drive. Onedrive. Dropbox or others). | 4.54 | 1.86 | .75 | .84 | -.25 | -.99 |
| DIGCOMP32 | Ways to upgrade and incorporate new devices. apps or tools into my work. | 4.29 | 1.88 | .75 | .84 | -.13 | -1.06 |

*Confirmatory Factor Analysis*

After testing the properties of the items, their internal validity was analysed by means of the CFA applied to the two subsets of the sample. As can be seen in Table 2, in both the first subset and the second subset, some goodness-of- fit indices did not reach the recommended values.

From the initial composite model, it was necessary to remove one indicator (DIGCOMP18) in the Digital Content Creation factor because it had high residuals (>.20) with other variables in the two subsets of the sample. After this redesign the model presents adequate fit indices in the two subsetsof the sample.

Table 2.

*Goodness-of-fit indices of the scale models*

| | | S-B $\chi^2$ | $\chi^2$ | Df | $\chi^2$/df | RMSEA (IC) | NNFI | CFI | IFI |
|---|---|---|---|---|---|---|---|---|---|
| IM | A | 1127.90 | 1469.21 | 454 | 3.24 | .07 (.07-.08) | .88 | .89 | .89 |
| | B | 1053.06 | 1362.31 | 454 | 3.00 | .06 (.06-.07) | .89 | .89 | .90 |
| FM | A | 970.38 | 1270.34 | 424 | 2.99 | .06 (.06-.07) | .90 | .90 | .90 |
| | B | 915.64 | 1195.13 | 424 | 2.82 | .06 (.06-.07) | .90 | .91 | .91 |

*Note.* IM=Initial model: 32 items and 5 factors; FM=Final model: 31 items and 5 factors; A=1st sample (n=306); B=2nd sample (n=306);

*Reliability and Construct Validity Analysis*

In order to test construct validity, convergent and discriminant validity were tested. Convergent validity seems adequate as the items of the scales are significantly correlated with the latent variables they were supposed to measure. In all cases the t-values for the variables ranged from 10.30 to 20.97(t>1.96) for the first subset of the sample, and between 9.42 and 20.01 for the second subset of the sample. All items had statistically significant probabilityvalues (p<.05) associated with the latent variable in which they were classified.

Table 3.

*Results of the confirmatory factor analysis with factor loadings, Cronbach's alpha, composite reliability and average variance extracted for the scale in the two subsets of the sample*

| Ítems | Factorial loading | | Alfa de Cronbach | | FC | | AVE | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| Factor 1. Information and Information Literacy | | | .86 | .83 | .86 | .83 | .56 | .50 |
| DIGCOMP1 | .78 | .70 | | | | | | |
| DIGCOMP2 | .77 | .70 | | | | | | |
| DIGCOMP3 | .65 | .67 | | | | | | |
| DIGCOMP4 | .74 | .71 | | | | | | |
| DIGCOMP5 | .80 | .73 | | | | | | |
| Factor 2. Communication and Collaboration | | | .84 | .85 | .85 | .84 | .48 | .51 |
| DIGCOMP6 | .72 | .63 | | | | | | |
| DIGCOMP7 | .58 | .61 | | | | | | |
| DIGCOMP8 | .80 | .81 | | | | | | |
| DIGCOMP9 | .63 | .62 | | | | | | |
| DIGCOMP10 | .71 | .79 | | | | | | |
| DIGCOMP11 | .72 | .72 | | | | | | |
| Factor 3. Digital Content Creation | | | .91 | .90 | .91 | .90 | .53 | .50 |
| DIGCOMP12 | .78 | .73 | | | | | | |
| DIGCOMP13 | .64 | .65 | | | | | | |
| DIGCOMP14 | .82 | .80 | | | | | | |
| DIGCOMP15 | .85 | .80 | | | | | | |
| DIGCOMP16 | .67 | .67 | | | | | | |
| DIGCOMP17 | .70 | .65 | | | | | | |
| DIGCOMP19 | .61 | .61 | | | | | | |
| DIGCOMP20 | .77 | .75 | | | | | | |
| DIGCOMP21 | .65 | .66 | | | | | | |
| Factor 4. Security | | | .91 | .91 | .91 | .91 | .64 | .62 |
| DIGCOMP22 | .79 | .76 | | | | | | |
| DIGCOMP23 | .83 | .85 | | | | | | |
| DIGCOMP24 | .83 | .83 | | | | | | |
| DIGCOMP25 | .82 | .81 | | | | | | |
| DIGCOMP26 | .80 | .75 | | | | | | |
| DIGCOMP27 | .73 | .73 | | | | | | |
| Factor 5. Problem Solving | | | .89 | .86 | .89 | .86 | .63 | .56 |
| DIGCOMP28 | .73 | .68 | | | | | | |
| DIGCOMP29 | .73 | .73 | | | | | | |
| DIGCOMP30 | .78 | .73 | | | | | | |
| DIGCOMP31 | .85 | .81 | | | | | | |
| DIGCOMP32 | .86 | .77 | | | | | | |

*Note*. A=1st sample (n=306); B=2nd sample (n=306); FC=Composite Reliability; AVE=Mean Variance Extracted

To analyse the discriminant validity, it was found that all the correlations between the different factors were lower than .85 (Kline. 2015), fulfilling thiscriterion as can be seen in Table 4. However, in the second sample it was observed that this criterion was not met in the case of the correlation between factor 5 and 4 as the

correlation value (r=.79) is slightly higher than that of the AVE root of factor 5 (√2AVE=.75), and also between factor 1 and 2 (r=.71 and √2AVE=.70).

Finally, the reliability of the final factor structure (see Table 3) showed Cronbach's Alpha coefficients between 0.84 and 0.91 for the first sample and between 0.83 and 0.91 for the second sample; while they were 0.85 and 0.91 and 0.83 and 0.91, respectively, in the case of the composite reliability. These values exceed those recommended by previous literature (>.70; Hair et al., 2006). As for the AVE indicators, they present values above the cut-off point recommended (>.50) by Fornell and Larker (1981) in all the factors of the second sample, ranging between .50 and 62, while in the first sample factor 2 presents a value slightly below the recommended value (AVE=.48). However, according to Hatcher (1999), when construct reliability is acceptable, a marginally low AVE value can be accepted. In this case, the composite reliability values were above .70 (an acceptable value according to the literature) on all dimensions for the two subsets of the sample.

Table 4.

*Interfactorial correlation matrix of the DIGCOMP scale.*

| | F1 | | F2 | | F3 | | F4 | | F5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B | A | B |
| F1 | *.75* | *.70* | | | | | | | | |
| F2. | .68** | .71** | *.70* | *.71* | | | | | | |
| F3 | .62** | .64** | .70** | .71** | *.73* | *.71* | | | | |
| F4 | .60** | .66** | .58** | .64** | .66** | .66** | *.80* | *.79* | | |
| F5 | .68** | .70** | .65** | .63** | .69** | .64** | .71** | .79** | *.79* | *.75* |

*Note*. A=1st sample (n=306); B=2nd sample (n=306); ** Correlations are significant (p<.01). The diagonal shows the square root values of the AVE for each factor.

**Discussion**

From the results obtained, it was shown that the scale for assessing coaches' DTC presented valid psychometric properties for the population under study. The questionnaire also obtained acceptable reliability scores, in line with the results found in previous studies (Agreda et al., 2016; Martínez et al., 2012; Tourón et al., 2018). In any case, the functioning of the questionnaire should be further tested in order to confirm the good performance of the scale to assess the DTC of football coaches.

Secondly, the scale presents a multidimensional, five-factor structure confirming the properties of the original scale, although the number of items has been reduced after the application of the Delphi Method and its subsequent validation. It is confirmed that the scale is also suitable for assessing DTC within the sport context, specifically in football, as well as in other educational contexts, such as the university context, obtained in previous studies such as the original scale (Agreda et al., 2016; Martínez et al., 2012; Tourón et al., 2018).

However, in future reviews of the psychometric properties of the scale, the values of the correlations between the safety and problem-solving factors should be observed, since in the second sample of this study they had high values. Similarly, the correlation between the information and information literacy factor and the communication and collaboration factor showed a correlation value slightly higher than the square root of AVE. Although they meet the parameters recommended by the literature on correlation values (<.85; Kline, 2015), these data suggest the need to test in future work the possibility of integrating these factors into a single dimension.

It is considered appropriate to investigate the results among the football coaching staff, and the DTC scores. This will allow us to compare the results with the levels of DTC obtained among the teaching staff, and to compare the results with the studies on DTC of secondary school and university educators carried out, especially with those used with the original scale by Tourón et al.(2018). It is also considered important, based on previous studies consulted, to analyse possible gender differences in the DTC, as well as to analyse age as a direct variable in the level of DTC of sports coaches.

**Conclusions**

The study of the DTC is crucial to investigate the degree of digital competence of sport educators in today's societies, where levels of digital competence and mastery of emerging technologies are essential to demonstrate high levels of professional competence and performance.

In sport training contexts, the work of coaches and their coaching staff can be assisted by technological resources with the aim of increasing the motor behaviour of football players. Possessing a high level of digital competence means controlling a large part of the key parameters of sport performance. In addition, the football coach's high didactic proficiency helps the teaching- learning process. Nowadays, mastery and control of digital teaching resources are essential to achieve a good professional performance.

It is considered appropriate for future research to compare the DTC values of FFCV football coaches with those obtained with university teachers, especially with Physical Education teachers. It is also of particular interest to check whether there are gender differences and age differences in terms of digital competence in teaching.

Finally, evaluation work in educational and sporting contexts, which are considered performance contexts, are key to improving the quality of the specialist corps. The requirements of UEFA (2015) have been instrumental inraising the standards in the DTC of the football coaching staff.

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