



## Training Physical Education Teachers in the Use of Technological Applications

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### Abstract

The inclusion of Information and Communication Technologies (ICT) in the educational setting requires teaching staff to have a sufficient level of digital competence (DC) to be able to teach this technology to students. Paradoxically, the literature shows an emerging trend towards the study of DC whereas the specific use of technology tools is tapering off, particularly in the area of physical education (PE). Therefore, the objective of this paper was to evaluate the actual use of educational applications by future PE teachers. To this end, the CUTDEF (*Cuestionario sobre conocimiento y uso de las TIC por los y las docentes de EF*) [Questionnaire on the Knowledge and Use of ICT by PE Teachers], previously validated by a panel of experts, was administered to 155 students at the University of Valencia. The results showed that few applications are used and are limited to office automation tools (word processor, spreadsheet and presentations) and that all the possibilities provided by the use and the potentialities of other applications or tools available online are not leveraged. It is concluded that trainee PE teachers present an average knowledge and use of information and communication management tools, basically as Google users, while they have made little headway in the creation of generic and specific digital content about PE. An improvement in this area is one of the challenges to be addressed in order to accomplish better development of DC in PE.

**Keywords:** digital competence, technological applications, ICT, physical education, teaching staff

## Introduction

Information and Communication Technologies (ICT) have brought about a change of mindset both in the way that students learn and also how teachers teach based on the appropriation of content, the development of competences and the creation of attractive venues for interaction and knowledge exchange (Castro-Lemus & Gómez, 2016). This is designed to make learning more effective, efficient, innovative and attractive, thereby reducing the school drop-out rate (Calero, 2019; Colas-Bravo et al., 2018). Indeed, some authors suggest that the operative expression should be Learning and Communication Technologies (LCT) (Prat & Camerino, 2012; Lozano, 2011).

Nevertheless, implementing this approach calls for a change in the form of teaching whereby teaching staff transition from knowledge depositories to transmitters of information and designers of learning situations using new materials and multimedia resources that will be made freely accessible to students via the Internet (Prat & Camerino, 2012). This new approach requires teachers to have sufficient digital competence to be able to provide students with the training called for nowadays (Díaz, 2015).

The DC involves the creative, critical and secure use of ICT and therefore requires knowledge related to accessing sources and processing information, content creation, security and problem-solving (*Instituto Nacional de Tecnologías Educativas y de Formación del profesorado*, INTEF, 2017). Student DC is a requirement of Spanish legislation (Royal Decree 126/2014 of February 28, which establishes the basic syllabus for Primary Education, and Royal Decree 1105/2014, of February 24, which establishes the basic syllabus for Compulsory Secondary Education and Baccalaureate) so that they can write, present documents and search for information as well as perform tasks and further their learning. Little research has been done in this area since the enactment of the current education law (*Ley Orgánica 8/2013, de Mejora de la Calidad Educativa* [Organic Law 8/2013 on the Improvement of Educational Quality], LOMCE) since the bulk of the research conducted to date took place while the *Ley Orgánica 3/2006, de Educación* [Organic Law 3/2006 on Education] (LOE) was in force. This affords added value to this paper.

In terms of background, several authors (Suárez-Rodríguez et al., 2012) showed that teachers' technological competence (use of computers, basic computing applications and ICT and communication resources) is the same as a regular or basic user of technological resources such as word processors, basic Internet browsing and spreadsheets. However, it does not cover advanced

features; there are shortcomings in multimedia and presentations and also in creating learning environments which include ICT. The fields of DC in PE teachers have already been analysed (Ferrerres, 2011), while other authors (García-González & Sánchez-Moreno, 2014; Prat & Camerino, 2012; Úbeda-Colomer & Molina, 2016) suggest possible tools or applications (apps) for working on content specific to this area. Previous research used the classifications that best fitted their study objectives to establish the scientific foundations for knowledge of ICT and DC in teaching.

Moreover, Díaz (2015) demonstrated that teachers have advanced skills in office automation tools (word processing and presentations) and are familiar with and use classroom management and control tools and information-sourcing tools (edublogs, databases or e-journals). Likewise, Fernández-Espínola and Ladrón-de-Guevara (2015) demonstrated that PE teachers are conversant with ICT (Word, Excel, PowerPoint, email and search engines) and they think that including these technologies in PE classes has positive outcomes. Nevertheless, only a minority of them use these tools to teach their subject and moreover do so without changing their traditional roles, thus replacing textbooks without contributing anything new. Another study performed by Prat et al. (2013) showed that teachers rated their level of DC skills as intermediate-user, with knowledge of basic software, noting their (somewhat lower) knowledge of multimedia software and working in virtual teaching environments. Despite these results, it appears that in the cases in which teaching staff use ICT (social media, blogs and wikis), they do so only passively, for example as readers of information, but not actively as contributors to the development of this information.

As can be seen, previous papers look at teachers' DC but not about their knowledge of specific educational applications. Hitherto, not a great deal of work has been done on classifying ICT by content and type of activity (García-González & Sánchez-Moreno, 2014; Díaz, 2015). Although some of the efforts made by researchers have focused on ascertaining teachers' DC, the applications used for each activity and what they are used for now needs to be studied. This is especially so in view of the accelerated rate of change in the tools or applications available on the market, as it would make it possible to classify these educational uses in teaching terms. This paper seeks to evaluate the use of applications by future PE teachers (final-year students and future graduates) and based on the results help practising teachers to select the best applications for their lessons.

## Methodology

### Participants

The sample was comprised of 155 participants, 94 men and 61 women, 61 of whom were students on the Secondary Education University Teaching Master and 94 students doing the Physical Education speciality in Teacher Training at the University of Valencia during the 2019-2020 academic year. The students' ages ranged from 18 to 24 years (78.7%), 25 to 35 years (20.6%) and 36 to 45 years (0.6%). The non-probability convenience sampling technique, commonly used in research experiences in educational contexts (McMillan & Schumacher, 2001), was used to recruit the sample. Continuing in the line of previous research, the participants were told about the study and signed the informed consent form for the collection of information, thereby fulfilling the requirements of objectivity, impartiality and confidentiality (Díaz, 2015). They were also told that their participation in the surveys was voluntary and of their right to withdraw whenever they wanted.

### Procedure

The questionnaire was designed by an expert panel based on the Delphi Method (Otero et al., 2012) used extensively in PE (Otero et al., 2012). It is a procedure that pursues consensus and qualitative agreement to achieve the consistency and validation of an instrument (Paixao et al., 2019; Escobar-Pérez & Cuervo-Martínez, 2008; Simón et al., 2017). For this purpose, and following Loevinger (1957), discriminative elaboration performed by experts was used and the first draft was modified based on the ensuing comments: a) answer options were reduced to three by means of discriminant analysis, and b) the number of questions in the "content creation" section was reduced. An expert group was subsequently consulted, following the guidelines proposed by Díaz (2015) and Ferreres (2011), by means of an online questionnaire with Likert-type answers ranging from 1 (strongly agree) to 4 (strongly disagree) and dealing with formal aspects of the questions, a general assessment of the questionnaire or functional aspects and with an open-ended question for adding or suggesting changes. The majority of the experts (85%) awarded a score of 4 (strongly agree) to all the items. The instrument's reliability was determined by test-retest with Cohen's kappa ( $\kappa$ ) and Kendall Tau-b ( $\tau_b$ ) (Escobar-Pérez & Cuervo-Martínez, 2008) statistics following the analysis of the results obtained by a participant who completed the questionnaire for a second time after an interval of 14 days (Díaz, 2015). In this respect, total agreement and optimal values were found ( $\kappa=1$ ;  $\tau_b=1$ ).

Cronbach's  $\alpha$  (consistency) and Intraclass Correlation Coefficient (ICC) were .96 and .52, respectively, for this questionnaire, making it possible to gauge the validity of the content and reliability of the CUTDEF (Questionnaire on the Knowledge and Use of ICT by PE Teachers) created by Menescardi et al. (2019).

### Instruments

A quantitative methodology was used by means of a survey and questionnaire (Ruiz-Bueno, 2009). The previously validated CUTDEF questionnaire (Menescardi et al., 2019) was devised to perform the study.

The questionnaire consisted of two sections: a) personal and professional contextual information and b) the use of educational applications. The first section studies the respondents' characteristics, whereas the second included a DC model developed on the basis of a number of sources (Díaz, 2015; Ferreres, 2011; García-González & Sánchez-Moreno, 2014; INTEF, 2017; Suárez-Rodríguez et al., 2012). This second section was structured in the areas shown in Table 1.

### Data analysis

SPSS v.22 software was used for the descriptive statistics (frequency and percentage) on the use of the applications included.

## Results

### Results in the use of applications related to access to and management of information

The results in the use of this type of applications are displayed in Table 2. Particular mention should be made of the use of Google Chrome as a browser (88.39%) and as a search engine (98.71%), as well as of YouTube as an information-sourcing repository. However, little use is made of applications for class and teaching work management (82.58%).

### Results in the use of communication and collaboration applications

With regard to the use of these tools (Table 3), Gmail is the main email manager used (95.48%), Drive is used for online file management (94.19%), Instagram as a social media site (94.19%), Wikipedia as a wiki (66.45%) and Skype for video-conferencing (64.52%). Similarly, the limited use of blogs and websites (69.68%) and the failure to recognise virtual learning environments (42.58%) should be emphasised.

**Table 1**  
Areas and tools or applications used and included in the CUTDEF.

Areas	Tools or applications
Access to and management of information	Internet browsers, information-sourcing tools, repositories, tools for class and teaching work management
Communication and collaboration	Email managers, online file management and hosting, virtual learning environments, management of websites and blogs, social media, wikis, video and web-conferences
Content creation (generic)	Word processors, spreadsheets, databases, presentations, video creation and edition, creation of collages, infographics, murals or posters, audio and voice recording and edition, augmented reality, immediate feedback questionnaires, writer portfolios and programs
Content creation (PE specific)	Knowledge of the human body, orientation, body expression, physical condition and health and motion analysis on video and sports white-boards

Source: own compilation.

**Table 2**  
Results (frequency and percentage) of the tools or applications used for access to and management of information.

Tools or applications used		Fr.	%
For browsing the Internet	Google Chrome	137	88.39
	Internet Explorer	28	18.06
	Mozilla Firefox	56	36.13
	Others: Safari, Opera, Ecosia	17	10.97
For searching for information on the Internet	Google	153	98.71
	Yahoo	2	1.29
	Others: Google Scholar, WOS, Dialnet, EBSCO	87	56.13
As information-sourcing repositories	Eduweb	33	21.29
	TED	22	14.19
	YouTube	93	60.00
	Others: Dialnet, ERIC, WOS, G.Scholar, SportDiscus, PubMed	24	15.48
	None	22	14.19
For managing classes and teaching work	Additio	3	1.94
	Class dojo	9	5.81
	Idoceo	3	1.94
	Others: Symbaloo, TokApp	3	1.94
	None	128	82.58

Source: own compilation.

**Table 3***Results (frequency and percentage) of the tools or applications used for communication and collaboration.*

Tools or applications used		Fr.	%
For managing email	Gmail	148	95.48
	Hotmail-Outlook	70	45.16
	Yahoo	0	0.00
For online document and file management	Drive	146	94.19
	Dropbox	66	42.58
	iCloud	43	27.74
	Others: Mega, WeTransfer	8	5.16
	None	3	1.94
As virtual learning environments	Edmodo	11	7.10
	Google Classroom	7	4.52
	Moodle	75	48.39
	None	66	42.58
For educational web and blog management	Blogger	16	10.32
	Edublog	6	3.87
	WordPress	26	16.77
	None	108	69.68
As social media	Facebook	117	75.48
	Instagram	146	94.19
	Twitter	78	50.32
	None	6	3.87
For working with wikis	Weebly	1	0.65
	Wikipedia	103	66.45
	Wikispaces	4	2.58
	None	45	29.03
For video- or web-conferencing	Facetime	62	40.00
	Google Hangout	12	7.74
	Skype	100	64.52
	Others: WhatsApp, Discord, Team Speak 3, Duo	11	7.10
	None	41	26.45

Source: own compilation.

**Table 4***Results (frequency and percentage) of the tools or applications used for content creation.*

Tools or applications used		Fr.	%
As a word processor	Document (Google)	69	44.52
	Word	148	95.48
	Open Office	15	9.68
	Other: Pages	1	0.65
	None	1	0.65
For creating spreadsheets	Calc (Open Office)	14	9.03
	Spreadsheet (Google)	25	16.13
	Excel	134	86.45
	None	14	9.03
For creating databases	Access	22	14.19
	Dbase	1	0.65
	Filemaker	1	0.65
	None	127	81.94
For producing presentations	PowerPoint	150	96.77
	Prezi	65	41.94
	Presentations (Google)	36	23.23
	Others: Keynote, Genially	2	1.29
	Gimp	15	9.68
For image creation and edition	Paint	150	96.77
	Photoshop	65	41.94
	Others: Picasa, Picsart, VSCO, HUJI, Instasize, Lightroom, PicsArts, PixelMator, Snapseed, Pixlr Express	36	23.23
	None	2	1.29
For video creation and edition	Imovie	15	9.68
	MovieMaker	77	49.68
	WeVideo	60	38.71
	Others: Filmora, Adobe, Quik, Sony Vegas, VideoPad	12	7.74
	None	41	26.45
For creating collages, infographics, murals or posters	Mural.ly	32	20.65
	PowerPoint	66	42.58
	Padlet	3	1.94
	Others: Canva, Adobe Photoshop, PicsArts, Pixlr Express, Picktochart	14	9.03
	None	34	21.94

Source: own compilation.

**Table 4** (Continuation)

Results (frequency and percentage) of the tools or applications used for content creation.

Tools or applications used		Fr.	%
For sound and voice recording and edition	Audacity	23	14.84
	Voice Notes	115	74.19
	VLC	37	23.87
	Others: Lenso create, Virtual DJ	2	1.29
	None	24	15.48
Augmented reality	Unity 3D	3	1.9
	None	152	98.1
For producing immediate feedback questionnaires	Edpuzzle	3	1.94
	Plickers	33	21.29
	Kahoot	102	65.81
	Others: Google Docs, Google Surveys, Socrative	6	3.87
	None	48	30.97
For creating portfolios	Weebly	1	0.65
	Google Sites	11	7.10
	Pathbrite	0	0.00
	Others: Word	1	0.65
	None	142	91.61
For creating activities	Cuadernia	3	1.94
	Jclíc	6	3.87
	HotPotatoes	1	0.65
	None	145	93.55

Source: own compilation.

### Results in the use of applications for content creation

Table 4 illustrates the use of this type of tools, with Word (95.48%), Excel (86.45%) and PowerPoint (96.77%) as the programs most used for creating documents, spreadsheets and presentations, respectively. PowerPoint is also used to produce collages, infographics, murals and posters (62.58%). The use of Paint is also particularly relevant (49.68%) for image creation and MovieMaker (42.58%) for videos, as well as Voice Notes (74.19%) and Kahoot for producing immediate feedback questionnaires (65.81%). The use of augmented reality applications (98.10%), portfolios

(91.61%), author programs for creating activities (93.55%) and databases (81.94%) was observed.

### Results in the use of applications for the creation of PE-specific content

This type of application is barely used (Table 5), since a large percentage of the respondents said that they did not use them for knowledge of the human body (89.68%), body expression work (92.90%), and motion analysis (86.45%). The majority of the students only claimed that they were familiar with and use applications for orientation work, the best-known one being Google Maps (72.90%).

**Table 5***Results (frequency and percentage) of the specific tools or applications used for PE content creation work.*

Tools or applications used		Fr.	%
For knowledge of the human body	Skeleton 3	4	2.58
	Imuscle 2	2	1.29
	Jump it	6	3.87
	Others: Human Anatomy Atlas, muscle and motion, my jump, powerlift app, lifesum, aceworkout, anatomylearning.com	6	3.87
	None	139	89.68
For orientation work	Brújula [Compass]	30	19.35
	Google Maps	113	72.90
	Wikiloc Outdoor Navigation GPS	11	7.10
	Others: Geocaching, IOs Maps	3	1.94
	None	30	19.35
For body expression and rhythm work	Pro Metronome	2	1.29
	Balance it	8	5.16
	Drama Games	1	0.65
	None	144	92.90
For physical condition and health work	Fitbit	21	13.55
	Runtastic	47	30.32
	Edufit	2	1.29
	Others: Smart Watch, Endomondo, Strava, Garmin, Mi Fit, Polar, Ergdata, myjump	18	11.61
	None	80	51.61
For motion analysis in video and sports whiteboards	Coach Board	7	4.52
	Coach Eye	4	2.58
	Coachmvideo	0	0.00
	Others: Kinovea, Longo match, Hudl Technique, Jes-soft.com, video delay	10	6.45
	None	134	86.45

Source: own compilation.

## Discussion

Hitherto, previous papers have addressed teachers' DC but not their knowledge of specific educational applications, and so research is called for in order to ascertain their actual use. For this purpose, the objective of this study was to evaluate the use of applications by future PE teachers (final-year students and future graduates) to identify their level of DC and to examine, on the basis of their role as trainers, what

needs to be done in order for them to have greater DC and knowledge of the use of tools focusing on PE lessons.

As for applications related to access to and management of information, the results showed, in line with previous research (Pathak et al., 2012), that the applications used to browse the Internet are provided by Google (Google Chrome, 88.39%, and the Google search engine, 98.71%, respectively). Moreover, the most commonly used repository

(digital content storage platform) was YouTube (60%), in line with the findings of DeWitt et al. (2013), in view of its capacity to provide information. The use of search engines, Internet news, databases or e-journals by PE teachers has increased in recent years, eating away at the use of books or hardcopy journals for these tasks (Woods et al., 2008), so teaching staff need to be expert users of these search applications. By contrast, the scant use of applications for the management of classes and teaching work (82.58%) is striking, as was demonstrated by Díaz (2015). Although a certain amount of time has elapsed since the publication of the previous papers (DeWitt et al., 2013; Díaz, 2015), no improvements in DC in the use of these applications by teachers were apparent. Generally speaking, the group studied may be characterised as “standard Google users”. It should be emphasised that ICT allow administrative and management tasks to be performed faster (Cabero & Llorente, 2008), so this type of applications could make for greater efficiency and also increase students’ actual motor activity time, normally short in PE lessons and which teachers sometimes use to take the register or for class management (López-Taveras & Moya-Mata, 2019). In this regard, the literature suggests that teachers should be conversant with and use applications such as ClassDojo or iDoceo (García-González & Sánchez-Moreno, 2014).

Collaboration and communication tools enable social interaction and dialogue among colleagues, expert personnel and teaching staff (DeWitt et al., 2013) and may range from emails, forums, chats and blogs to collaborative wikis. The most commonly used email and document managers are the options provided by Google (Gmail, 95.48%, and Drive, 94.19%) because they are free, deliver substantial sending and storage capacity (Gb) and are also compatible with Google Apps (Rodríguez et al., 2013). These applications make it possible to share and store information and are compatible with the collaborative creation of documents or other files, thus adapting teaching to the Information and Knowledge Society.

With regard to virtual learning environments (VLE), the results showed that the most used platform is Moodle, which is the one used at the university. Although students are familiar with the VLE that they use, all schools should have a VLE since it delivers a broad range of resources and facilities that can be leveraged by teachers and students alike (Prat et al., 2013). In this regard, some schools have their own educational platforms (Google Classroom) which allow networking, resource-sharing, the design of new virtual venues and connection with other professionals, fostering innovation in teaching practices and ultimately improving teaching and learning processes (Calero, 2019).

In turn, most of the respondents said that they do not use applications for work such as blogs and websites, whereas

those who do opt for Blogger and WordPress which can be utilised to source ideas on how other experts (PE teachers) employ activities and proposals in their lessons (DeWitt et al., 2013) or include them in the subject in order to reflect on the performance of physical activity and sports (Úbeda-Colomer & Molina, 2016). As for working on social media, and in line with DeWitt et al. (2013), the most used sites are Facebook (75.48%) and Instagram (94.19%), which allow followers to comment upon their likes and on publications and also share documents, photos and videos. It was found that although university students make extensive use of social media in their daily life, teaching use of social media is limited. Likewise, wikis are hardly used (Wikipedia: 29.03%) and there is poor diversity of video- and web-conferencing applications (Skype: 64.52%). Better use of social media would be a teaching innovation in PE in order to encourage students to participate in out-of-school sports activities (Prat et al., 2013), enabling the collaborative creation of information on websites and curricular materials (Colas-Bravo et al., 2018), thus turning ICT into LCT and encouraging students to learn with technology (Prat et al., 2013). Therefore, it is evident that future teachers are still not leveraging the possibilities of these applications and only use them conventionally.

As far as content creation applications are concerned, previous studies have shown that teachers have a mastery of office automation tools (word processing, spreadsheets and presentations) as well as audio and video edition and creation tools, yet as noted above lack a similar skill level in the use of collaboration and communication tools (Díaz, 2015; Fernández-Espínola & Ladrón-de-Guevara, 2015; Prat et al., 2013). This trend is maintained in this paper, which points to frequent use of Microsoft Office tools (Word: 95.48%; Excel: 86.45% and PowerPoint: 96.77%), perhaps because they are older, although the use of Google Apps is on the increase as they are more economical and can be used without having to download applications onto a computer (Joyanes, 2009). Nevertheless, most teachers are skilled in creating and editing audio and videos (Díaz, 2015) with MovieMaker (42.58%) and Voice Notes (74.19%). Despite this, for the moment there is still little creation of learning environments with ICT, which could account for the fact that most of the participants use PowerPoint to create collages, murals, infographics and posters and are not familiar with other applications such as Padlet, Canva or Mural.ly, etc. Similarly, competence in content creation with augmented reality, writer programs, portfolios, etc. is still poor and the failure of most participants to use these applications is patent.

As can be seen from this paper, the lack of familiarity with specific applications forces future teachers to use more generic ones (Suárez-Guerrero et al., 2016), and it

is clear that a great deal remains to be done for ICT to be integrated in classrooms.

Finally, with regard to applications and tools (apps) for PE content work, the failure to use these applications and tools for knowledge of the human body and psychomotricity and body expression along with motion analysis in video and sports whiteboards is particularly significant. To a lesser extent they are familiar with and use applications for working with orientation and geolocation content as reported by DeWitt et al. (2013), particularly Google Maps, whereas almost half of the participants mentioned the use of physical fitness and health applications (Runtastic, Fitbit). These findings contradict the results of the studies by Woods et al. (2008), which indicate that PE teachers have a developed DC when it comes to using tools for teaching and PE and sports performance management (the use of pedometers, physical performance monitoring devices, etc.), and it is concluded that they use these devices for personal use but not for teaching purposes. With respect to this result, and as Prat and Camerino (2012) show, the introduction of LCT into PE is still very recent and often seen not only as a challenge but also as a threat to the already scarce time available in PE lessons (Corrales, 2009). However, when people understand that using LCT can complement and even broaden knowledge and learning in this area, these tools can be integrated easily. Here applications such as Wikilog (Blanco et al., 2016) and Geocaching (Teles da Mota & Pickering, 2020) have proven their usefulness as a complement to orientation activities in the environment activity block.

Similarly, the use of watches and activity bracelets is becoming increasingly more common for monitoring physical activity time and intensity (Rosenberger et al., 2019), which could be appealing not only for their use in PE classes but also for students to begin using them in their leisure time and thus increase their daily physical activity. It would also be a good idea to consider the introduction of active video games (Cuberos et al., 2016), which besides making physical fitness work easier also provide access to artistic and expressive content through well-known games such as *Just Dance*.

One of the limitations of this paper is that the educational use of these applications by teachers or whether they are used for personal purposes was not taken into consideration, meaning that future research could continue to investigate PE teachers' knowledge or awareness and use of such applications. Despite this limitation, this is one of the first papers to address the knowledge of certain educational and PE-specific applications used by future PE teachers. It is also significant in that it studies a population which hitherto has attracted scant attention in technology-related research, i.e. trainee PE teachers, and because it deals with a topic,

namely the use of technology, which is normally assumed or taken for granted in DC research. Therefore, the results of this paper could constitute a preliminary stage for future studies about DC.

## Conclusions

The results of the study led to the following conclusions: Irrespective of the type of application (access to and management of information, collaboration and communication or content creation), a greater use of Google applications (Gmail, Drive) was found because they are free and compatible with Google Apps, the Office suite tools (Word, Excel and PowerPoint) as well as YouTube and social media sites (Facebook and Instagram).

By contrast, the use of applications for class management and teaching work and the creation of audiovisual material (video and audio) is minimal. Therefore, it may be concluded that teachers use few applications, and the ones that they do use are general and fail to straddle all the possibilities of use and the potentialities offered by the tools available on the market. For this reason, future and current teachers should think about the way ICT are being used in education, putting to one side prejudices and the insecurity involved in using them in the classroom. They should be trained in this area and should transition from a traditional teaching model to a model that embraces active methodologies using ICT.

To this end, teaching staff need to be conversant with these applications (ICT) and how to plan learning environments and build learning communities (LCT) until ICT are fully integrated at the institutional level (EPT, Empowerment and Participation Technologies) (Ferrerres, 2011). Ultimately, a great deal remains to be done in this area and in the use and integration of ICT in classrooms at all educational levels.

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