A combination of transformative and authentic assessment through ICT in Physical Education
Combinando una evaluación auténtica y transformativa a través de las TIC en Educación Física

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Abstract. This work analyses the results of an authentic assessment (AA) and transformative assessment (TA) experience and use of information and communication technology (ICT) in Physical Education (PE) classes in high school. The experience involves the use of the Plickers application, and the participation of the students in the assessment (self-assessment and peer assessment processes). This study was carried out in a high school from Spain, as part of a didactic dance unit, with 38 students (15th years old). The AA and TA task was for small groups of students to create a video tutorial of salsa steps as a final product of a dance teaching unit; were self-assessed and peer-assessed using Plickers. Experience was also evaluated. Results: the use of AA and TA processes in PE in high school based on the use of ICT has been a very positive experience. For the students the video tutorial is a good method of learning and assessment and they value positively the peer-assessment and self-assessment processes they carried out, as well as the use of the Plickers. This study can be interesting to PE teachers interested in using AA, TA and ICT. Further research about this topic may be need.
Keywords. Transformative Assessment, Authentic Assessment, Formative Assessment, Self-assessment, Peer assessment.

Resumen. Este trabajo analiza los resultados de una experiencia de evaluación auténtica (EA) y evaluación transformativa (ET) que utiliza las Tecnologías de la Información y la Comunicación (TIC) en Educación Física (EF) en Educación Secundaria. La experiencia implica la utilización de la aplicación «Plickers» y la participación del alumnado en la evaluación (procesos de autoevaluación y de evaluación entre iguales). El estudio se desarrolla en un instituto de educación secundaria español, como parte de una unidad didáica de danza, con 38 alumnos de 15 años. Las actividades de EA y ET se realizaron en pequeños grupos, que crearon un video-tutorial de pasos de salsa como producto final de la unidad didáctica, el cual fue autoevaluado y coevaluado utilizando la aplicación «Plickers». Se evaluó también toda la experiencia. Los resultados muestran que la utilización de procesos de EA y ET a través de las TIC en EF en secundaria ha sido una experiencia muy positiva. Los alumnos lo consideran un buen método de aprendizaje y evaluación y valoran positivamente los procesos de evaluación entre iguales y autoevaluación utilizados, así como el uso de «Plickers». El estudio puede ser de interés para el profesorado de EF interesado en utilizar EA, ET y TIC. Parece necesario realizar más investigación sobre la temática.
Palabras–clave. Evaluación Transformativa, Evaluación Auténtica, Evaluación Formativa, Autoevalución, Evaluación entre iguales.

Introduction

Throughout the introduction it is explained the fundamental methodological characteristics on which our experience of transformative and authentic assessment through ICT is based.

Student assessment involvement in PE

López-Pastor et al. (2013) provides a review of the proposals for student involvement in the assessment processes in PE. Furthermore, other publications contain research, studies and arguments about the advantages of encouraging student participation in the assessment processes in PE (Butler & Hodge, 2001; Herranz & López, 2014; López-Pastor, Monjas & Manrique, 2011; MacPhail & Halbert, 2010; Tolgfors, 2018; Ward & Lee, 2005). Butler & Hodge (2001) undertook a review of various studies on the use of peer-assessment in PE, identifying several advantages: more feedback is provided to the students, it improves learning, it generates greater sociability and improved relationships among peers. Similar results are indicated in Melograno (1997). In another study, Ward & Lee (2005) carry out a review of eight studies on peer-assessment in PE published in international journals, identifying that; there is a high positive correlation between the ratings of high school students and researchers when they have been well trained for it (correlations of 0.70-0.96 between students and researchers), which indicate a

high degree of reliability. López-Pastor et al. (2011) highlight the work carried out by a research-action group to develop formative and learning-oriented assessment processes in PE in primary, secondary schools and initial teacher education. Their results show that it improves learning as well as student involvement in the learning process and their self-regulation and, consequently, generates high levels of student satisfaction and good academic results. Subsequently, Herranz & López-Pastor (2014) demonstrate that it is feasible to carry out self-assessment and shared assessment processes in PE in the primary education stage, generating positive results in the classroom climate as well as in the students' learning and academic performance.

Authentic Assessment in PE

In recent decades there has been considerable interest in the use of systems and processes of «authentic assessment» (AA) in the practice of PE (Calatayud, 2019; López-Pastor et al., 2013; Mintah, 2003; Richard & Goudbout, 2000; Zhu, 2007; Georgakis, Wilson & Evans, 2015; Lorente-Catalan & Kirk, 2015). Hay & Penney (2010) point out the importance of the inclusion of a primary focus on assessment for learning, authentic and integrated assessment.

In the studies conducted by Mintah (2003, 2017) it was found that authentic assessment is widely used in PE within public schools. Teacher observation, self-observation, checklists, peer observation and event tasks were the most frequently used techniques for authentic assessment. The PE teachers that participated in this study perceived that the use of authentic assessment positively improved the self-concept, motivation and skills development of their students.

Frey, Schmitt and Allen (2012) support authentic assessment as a more valid and productive approach towards student evaluation, as alternatives to «traditional» paper-and-pencil testing or standardized large scale assessment; whereas Mohnsen (1997) relates authentic assessment in PE to the use of electronic portfolios, using them in PE classes to monitor the student's physical fitness, sports skills, and other performance standards, as well as allowing students to make notes. And MacPhail & Halbert (2010) published a study on the development of authentic assessment systems in PE as well as its implementation and improvement by a group of PE teachers, using approaches aimed at student learning.

The main characteristic of AA is that the techniques, instruments and assessment activities are clearly applied in real situations, activities and learning contexts. It is the opposite, therefore, to specific and artificial assessment situations (López-Pastor, et al, 2013). Desrosiers et al (1997) consider that authentic assessment has three characteristics: (1) it is integrated into the teaching-learning process; (2) it shares the assessment process with the students and (3) it gives greater importance to assessment with a clear formative emphasis. These three characteristics are clearly aligned with the proposal called «formative and shared assessment» (López-Pastor, et al, 2011), which refers to any assessment process whose main purpose is to improve student learning and the teaching-learning processes that take place, as well as to involve students in the assessment processes.

There are different perspectives and ways of understanding AA in PE which López-Pastor et al. (2013) have attempted to synthesize. According to them, the main characteristics of AA in PE are: (1) it refers to the use of multiple techniques and instruments to assess different capacities and competences in situations that are as authentic as possible or that can be transferred to real life outside the classroom; (2) it focuses on the assessment of learning applicable to real life, in how knowledge is perceived and used in real situations, instead of being limited to the simple measurement of the level of knowledge acquired; (3) it gives greater importance to an assessment with a clear formative emphasis, which is why it is integrated into the teaching-learning process on a day-to-day basis in the classroom; and, (4) it involves the students in the assessment and learning processes, giving them the opportunity to share responsibility for the assessment, so it is important that the students know how it will be assessed, in order to increase their interest and motivation in their learning.

From an alternative perspective, the main drawbacks seem to be related to the fact that it may be necessary to spend more time planning and carrying out AA than is required to carry out a more traditional assessment. Assessment generates both fear and reticence among teachers to the point that it is one of the areas in which it is most difficult to implement change and innovation (Slingerland, et al., 2017). This leads some PE teachers to avoid it, believing that it generates an excessive workload. On the contrary, the use of appropriate tools allows the implementation of AA processes to be simple and fast, assuming a lower workload for the teacher and allowing more time to be dedicated to learning than with the more traditional assessment models in PE. Thus, AA now represent an alternative way to hold

students and teachers accountable for acquiring competence in the subject (Lund, 2012).

Transformative assessment in PE

From critical pedagogy, a type of evaluation called «Transformative assessment» is proposed (Tolgfors, 2018). This paper focuses on transformative assessment as a critical pedagogical approach that has the potential to challenge traditional PE practice and the predominant accountability culture of today's education, based on Torrance´s previous studies (2011, 2017). Tolgfors (2018) shows the necessity to approach «Transformative Assesment in PE». To the author, this assessment model implies three aspects to carry out with the students: Responsibilisation, Subjectification and Collaboration. In order to check if teachers produce this three phases with our pupils, it would be convenient to answer the following questions: (1) Responsibilization: How are the learning intentions clarified and shared between teacher and students?; (2) Subjectification: How are the students activated as owners of their own learning?; (3) Collaboration: How are the students activated as learning resources for one another? There are close relationships between critical pedagogy and different authors who defend the participation of students in the evaluation in PE, although part of these works are carried out by the PE Teacher Education (Fernández-Balboa, 2006; Fernández-Balboa and Marshall, 1994; Lorente & Kirk, 2014; LópezPastor, et al., 2012; Sicilia, 2011).

ICT in education and PE

The increasing use of ICT within the context of education is leading to modifications in course content, teaching methodology, student/teacher relationships and the role of the teacher (Erixon, 2010; Cabrera, 2019), improve teachers' observation of students' performance, or the (self) monitoring of students' own progress over time.

Weir & Sean (2009) analyze in one study the use of digital video in three aspects of PE: teaching, learning and assessment. The authors highlight the improvement in the reflection of the students thanks to the feedback provided by the video. Similarly, Leijen et al. (2008) emphasize that the digital video tool is appropriate for dance classes and should focus on facilitating the pedagogy of student reflection. Palao et al. (2015) evaluate the effectiveness of the use of feedback through video and/ or feedback without the use of video on student learning in the subject of PE. The combined use of «video and teacher feedback» provided the best results. However,

the authors point out that the teacher felt overwhelmed by the demands of the technology, both in the time commitment required and in their own technological competence; while Guillén & Perrino (2019) research the importance of technological competence in PE teacher education. A review carried out by Hitchcock (2003) indicates that the creation of videos by students is an effective means to improve their abilities and academic results.

TA, AA and ICT in PE

Among other functions, ICT tools used in PE allow students to: recognize movement patterns and their relationships with motor behaviors; model the practice, predict performance and formulate hypotheses; evaluate the accuracy of the practice; review executions and improve their quality; communicate with others and provide information and improve work efficiency (Grigore, et al., 2007). All these functions make ICT a good tool for delivering authentic assessment (Fraile, et al., 2021).

Cassady, Clarke & Latham (2004) report on a study of self- and peer-assessment in a didactic unit of dance in high school, analyzing the impressions and feelings of the students about the assessment, both when assessing and when being assessed. The students recognize that the assessment system helps them to improve and progress and that it would be beneficial to watch video recordings of the performances more often, to learn more. They also consider it positive to carry out peer-assessment because it helps them see other ideas and to improve their own performance, as well as being able to compare their own work with others'. But the students also indicate some negative aspects, as two types of difficulties arise: (a) the technical difficulty of accurately assessing the work of other colleagues and giving feedback to classmates using appropriate words and without offending them; (b) the negative feelings about the fact of assessing their peers and being assessed by them, which generate anxiety and tension. The authors consider that it would be interesting to produce an assessment system that allows the assessment to be undertaken confidentially and competently and use the information to improve performance in dance teaching units.

The use of ICT is crucial in developing the creativity, communication, collaboration and critical thinking, and with understanding how learning takes place. However, simply using technology does not guarantee that learning will occur. The use of technology needs to align and

adapt with our knowledge of learning to operate in a transformative space (Keane, Keane and Blicblau, 2016). To Chng and Gurvitch (2018) the challenge is to help teachers find an easier, cost-effective, and time-effective way to assess their students' performance and they suggest introduce the use of Plickers, a formative and/or summative assessment tool that can help in assessing the cognitive and affective domains performance of students in health and PE settings.

Taking in consideration the TA´s basis and AA´s characteristics it is consider that both notions have points in common:

(a)-Responsibilization (How are the learning intentions clarified and shared between teacher and students?). The AA is integrated into the teaching-learning process.

(b)-Subjectification (How are the students activated as owners of their own learning?). The AA gives greater importance to assessment with a clear formative emphasis, use multiple techniques and instruments to assess different capacities and competences in situations that are as authentic as possible or that can be transferred to real life outside the classroom, and focuses on the assessment of learning applicable to real life, in how knowledge is perceived and used in real situations, instead of being limited to the simple measurement of the level of knowledge acquired.

(c)-Collaboration (How are the students activated as learning resources for one another?). The AA involves the students when they work in groups or in a collaborative way, giving them the opportunity to share responsibility in the learning process.

Good practices are being carried out using several of these techniques in PE in high school (transformative assessment, ICT, etc.). We believe that it is interesting to investigate to what extent they fulfill the conditions set by the specialized literature and what results they obtain. In this paper it is explored and evaluated «good practice» in PE, using an approach referred to as «Involvement student assessment», «Authentic Assessment», «Transformative assessment» and «ICT».

Taking the above into account, the objectives of this study are:

1-To analyse the results of using authentic and transformative assessment processes in PE in high schools, relying on the use of ICT.

2-To ascertain whether the use of the Plickers application facilitates the development of self- and peer-assessment processes in high school PE.

3-To assess the degree of student satisfaction with undertaking authentic and transformative assessment processes in PE using the Plickers application.

Methodology

The pedagogical experience

It has been carried out a good practice within a teaching unit of Latin dances (salsa). The authentic assessment task consisted of the creation of videos tutorials on salsa steps worked on in class by groups of students. The assessment of the videos was carried out through self-assessment and peer-assessment procedures, using the software tool Plickers (https://plickers.com/). The Plickers application is a tool that allows you to obtain answers quickly and anonymously for students through the scanning of QR codes with a mobile device or tablet.

The use of video tutorials as an authentic assessment instrument is consistent with the basic characteristics indicated above: they are integrated into the teaching-learning process, their assessment is carried out in a shared manner between students and teachers and they have a predominantly formative character. In addition, the final product created by the students (a video tutorial to teach salsa steps) has transferability outside the classroom, since it can be used to teach the steps to other students, teachers, friends and family, since some videos are in the course «Dropbox», which students can access with their «user» and «password» data.

What is more, the production of the videos enables the students to develop skills and also be assessed in their digital competence and the use of ICT.

Participants and context

This study was carried out in a Secondary Education High School from Spain, as part of a didactic dance unit, implemented during the second trimester of academic year, with a total of 38 students from 2 groups (3rd year compulsory education, equivalent to 15 years), as shown in Table 1.

Table 1
Groups and number of students participating in the study

Groups	3rd Year Compulsory Ed - A	3rd Year Compulsory Ed - B	Totals
Female	8	11	19
Male	10	9	19
Totals	18	20	38

Techniques for analysis and data collection

Three data collection instruments were used: (a) a descriptive scale (rubric) for the assessment of the salsa video tutorial; (b) a verbal scale for the assessment of the experience and the assessment system, (c) a teacher

«field notebook». Tables 2 and 3 show the assessment instruments: a) Descriptive scale (rubric) for the self-assessment and peer-assessment of the salsa video tutorial, b) Verbal scale for the evaluation of good practice in assessment.

A-For the self-assessment and peer-assessment processes of the video tutorial a rubric of 5 items was used, with 4 different levels for each item. The assessment was carried out individually and anonymously. Table 2 shows the instrument used.

Table 2
Descriptive scale (rubric) for the self-assessment and peer-assessment of the salsa video tutorial

	A	B	C	D
1 Participation of all members of the group in the video tutorial	Only 1 team member actively participates.	Half of the team participate actively but the others are scarcely involved.	Almost all the team participate actively.	The whole team participate actively.
2 Is there a presentation at the beginning of the video tutorial to introduce the content?	No	A short, not very clear presentation is given.	A presentation is given but it is incomplete.	Yes, very clearly.
3 Is the audience told the aim of the video tutorial?	No	It is mentioned at some point in the video.	Yes, but not in a very clear or concise way.	Yes, very clearly.
4 Are the dance steps explained clearly avoiding any doubt for the viewer?	No.	Explained but not very clearly.	Explained with reasonable clarity but still some doubt.	Yes, very clearly.
5 Do you think the salsa steps covered can be performed correctly after watching this video?	No, not at all.	Possibly not.	Yes.	Yes, definitely.

B-For the assessment of the experience and the assessment system, a Likert verbal scale with 4 options (no, some, quite a lot and a lot) and 5 items was used. The assessment was also carried out individually and anonymously. Table 3 presents the instrument used.

Table 3
Verbal scale for the evaluation of good practice in assessment

	A	B	C	D
1 Do you think producing the tutorial has helped you learn the steps better?	No	Some	Quite a lot	A lot
2 Assessing my own and other groups' tutorials made me reflect on the work done and how it could be improved?	No	Some	Quite a lot	A lot
3 Using the Plickers application QR Codes is useful as a system to assess the tutorials?	No	Some	Quite a lot	A lot
4 Would you like to use this tool again in other situations?	No	Some	Quite a lot	A lot
5 Has using the Plickers application proved easy and straightforward?	No	Some	Quite a lot	A lot

The questions on the assessment instruments are entered on the Plickers application website prior to session 8, so that in the session dedicated to the assessment students can read the questions and assessment answers on the digital screen. The process followed with each item is as follows: (1) the teacher presents the question on the screen; (2) students respond in real time to each of the questions by orienting their QR code as explained (Figure 3); (3) the teacher scans the QR codes with their mobile device; (4) the results are recorded on the Plickers website for subsequent export to «Excel» format and the statistical analysis of the data with the «SPSS 20.0» program. Figure 1 shows an example of a screen with the results of two items recorded in the Plickers App.

Figure 1. *Screen capture of the results filed in the Plickers application*

C-The teacher keeps a «field notebook» where they record in a non-systematic way any reflections derived from the delivery of the didactic unit, either at the end of each session or at the end of the teaching day, inside or outside the school. When literal quotations taken from the notebook are shown in the text, they are accompanied by their acronym and the data collection date; for example: «CP, 23-2-18».

Data Analysis

As explained above, the results for each item are recorded on the Plickers website for later export into Excel format. The descriptive and verbal scales used were converted into numerical scales using the following codes: A (no) = 1, B (some) = 2, C (quite a lot) = 3, D (a lot) = 4. In addition to the descriptive values of central tendency and dispersion, for the comparison of the possible differences in the assessment of the experience in function of the year group or between boys and girls, for the inferential analysis of possible differences between groups it has been used non-parametric statistics, given the absence of normality of our distributions. Specifically, it has been used the Kruskal-Wallis H since, in order to contrast these differences, it has been worked with grouping variables of two or more categories. This consists of a non-parametric test equivalent to the ANOVA of a Factor between the parametric tests. In all contrasts, a confidence level of 1% will be assumed. All statistical analyses, both descriptive and inferential, were carried out using the SPSS 24.0 program.

Results

Analysis of the study

Table 4 shows the mean and standard deviation of each of the assessment questions that the students responded to regarding the formative and shared assessment experience through the Plickers application.

As illustrated by the data the students consider that the production of the video tutorial has contributed to a greater learning of the salsa steps explained in class, with high valuations from both groups and only small

Table 4
Results of the students answers of the formative assessment experience by groups

	3rd Comp Ed A		3rd Comp Ed B	
	Mean	Std dev.	Mean	Std dev.
1 Do you think producing the tutorial has helped you learn the steps better?	3,00	1,08	3,50	0,61
2 Assessing my own and other groups' tutorials made me reflect on the work done and how it could be improved?	3,00	1,08	2,80	1,28
3 Using the Plickers application QR Codes is useful as a system to assess the tutorials?	3,17	0,92	3,55	0,76
4 Would you like to use this tool again in other situations?	3,06	1,06	3,60	0,82
5 Has using the Plickers application proved easy and straightforward?	3,50	0,92	3,65	0,67

differences between them. This latter fact is corroborated by the absence of significant differences in the 5 items according (Table 5).

Likewise, both groups of students present very high ratings in the items that refer to the use of the Plickers application as a tool to assess the tutorials, both in terms of its usefulness (3.2-3.6), its simplicity (3.5-3.7) or if they would like to use it again on other occasions (3.1-3.6). It has also been found high scores in the questions that refer to whether the process of self-assessment and peer-assessment of the tutorials has made them reflect on the work done and its possible improvements.

Table 5
Results of the evaluation of the experience of good practice - by educational groups (Kruskal-Wallis Contrast)

	Year Grp	N	Average range	Chi-squared	Asympt . Sig.
1 Do you think producing the tutorial has helped you learn the steps better?	3rd Comp Ed A	18	17.17	1.79	.18
	3rd Comp Ed B	20	21.60		
2 Assessing my own and other groups' tutorials made me reflect on the work done and how it could be improved?	3rd Comp Ed A	18	42.06	.16	.69
	3rd Comp Ed B	20	39.38		
3 Using the Plickers application QR Codes is useful as a system to assess the tutorials?	3rd Comp Ed A	18	23.81	2.12	.15
	3rd Comp Ed B	20	30.93		
4 Would you like to use this tool again in other situations?	3rd Comp Ed A	18	34.61	3.62	.06
	3rd Comp Ed B	20	48.13		
5 Has using the Plickers application proved easy and straightforward?	3rd Comp Ed A	18	41.00	.10	.75
	3rd Comp Ed B	20	42.95		

In addition, the mean values of the 5 items were calculated according to the students' gender. These results are summarized in Table 6. As in the previous case, the ratings are high in both groups and with little difference between them.

Table 6
Results of the evaluation of good practice experience (by gender)

	Male		Female	
	Mean	Std dev.	Mean	Std Dev.
1 Do you think producing the tutorial has helped you learn the steps better?	3.26	1.04	3.26	0.73
2 Assessing my own and other groups' tutorials made me reflect on the work done and how it could be improved?	2.68	1.29	3.10	1.05
3 Using the Plickers application QR Codes is useful as a system to assess the tutorials?	3.26	0.87	3.47	0.84
4 Would you like to use this tool again in other situations?	3.32	1.00	3.37	0.96
5 Has using the Plickers application proved easy and straightforward?	3.63	0.83	3.52	0.77

Table 7
Results of the evaluation of good practice experience - by gender (Kruskal-Wallis contrast)

	Gender	N	Average range	Chi-squared	Asymp t. Sig.
1 Do you think producing the tutorial has helped you learn the steps better?	Male	19	20.32	.24	.62
	Female	19	18.68		
2 Assessing my own and other groups' tutorials made me reflect on the work done and how it could be improved?	Male	19	17,89	.89	.35
	Female	19	21,11		
3 Using the Plickers application QR Codes is useful as a system to assess the tutorials?	Male	19	18,00	.86	.35
	Female	19	21,00		
4 Would you like to use this tool again in other situations?	Male	19	19,16	.05	.83
	Female	19	19,84		
5 Has using the Plickers application proved easy and straightforward?	Male	19	20,42	.44	.51
	Female	19	18,58		

As it can be seen in Table 7, and as expected, the analysis of the differences between these two groups presents not significant values for the different questions.

Regarding the didactic aspects of the development of this study, it has been observed that the systematic undertaking of self-assessment and peer-assessment processes after the viewing of each video tires out the students as the session progresses. For this reason, the teacher of the unit considers that for this type of process it is not appropriate to use scales of more than 5 items (field notebook):

«The process of co- and self-assessment tires out them a lot despite being brief. That's why I do not recommend doing more than 5 questions «(CP, 21-02-2018).

In addition, the teacher also indicates in their notebook that they invested more time than planned in the teaching-learning process of the basic salsa steps and has explained fewer steps than expected:

«The basic steps took me more classes than expected. I have explained only 3 more steps» (CP, 01-31-2018.

This shows that the production of the didactic video tutorial by the students requires time and commitment, so it affects the planned learning process, which must be restructured on an ad hoc basis.

Regarding the data collection the teacher indicates the ease and speed in obtaining them, although they point out that it is necessary to have a good internet connection to be saved:

«The scanning of student responses is quite fast, and the application saves them automatically. Internet connection is vital» (CP, 02-14-2018).

In this section it will be answered the previous questions in order to check if we apply «Transformative Assessment» (see figure 2).
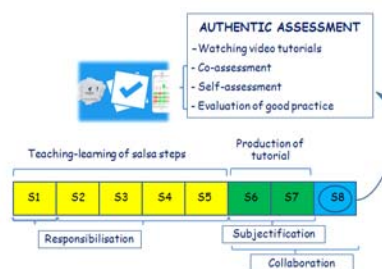

Figure 2. *Relationship between the structure of the didactic unit and the phases of transformative assessment*

1-Responsibilisation: How are the learning intentions clarified and shared between teacher and students?

The learning objectives of the UD were explained to the students in the first session and were remembered throughout the didactic unit. In addition, the main assessment criteria were also explained in the first session and again before proceeding to the assessment

process. The students know the specific questions through which the assessment process is carried out since the beginning of the UD. They also know that there will be peer-assessment, self-assessment and teacher assessment.

- *«Today I presented the UD. Emphasizing that the objective of the tutorial is that everyone can see the step that is explained»* (CP, session 1).

- *«Then I have given them a sheet with the assessment questions that will be used in the last session. I have indicated that the same questions will be used in the processes of: peer-assessment, self- assessment and teacher assessment. The sheet with the questions was uploaded to the drop-box of the subject»* (CP, session 1).

2-Subjectification: How are the students activated as owners of their own learning?

In sessions 6 and 7 students work in small collaborative groups to prepare the video tutorial. It is an autonomous work in which the teacher answers doubts. During this process, the teacher reminds the groups of the assessment criteria that will be used in session 8.

- *«Today we started to assemble the tutorial in groups. At the beginning of the session they have invested a lot of time in the internal organization of the group, giving the impression that there was no progress»* (CP, session 6).

- *«I have been going through the groups resolving doubts about the steps and contributing ideas to accelerate the process»* (CP, session 6-7).

- *«If I detect errors in the preparation of the tutorial, I remind you of the assessment criteria»* (CP, session 6-7).

3-Collaboration: How are the students activated as learning resources for one another?

At the beginning of session 8, all the video tutorials are viewed. Afterwards, an agile process of self-assessment and peer-assessment will be carried out through the «Plicker» tool, using the «QR codes» and the tablet. The teacher assesses later with the same questions.

- *»It gave us time to assess all the tutorials (4-5 groups) in a single session thanks to the plicker tool»* (CP, session 8).

- *»For the students, the process of answering the same questions several times and also having to hold up the QR codes for a while, has been a bit costly»* (CP, session 8).

- *»After completing the UD, I carried out the assessment of each group and compared my results with the data collected in the plicker automatically. This process is immediate and saves me the dump of data if I had to do it with sheets of paper»* (CP, assessment of the UD).

Discussion

Discussion has been organized into three sections, according to the research objectives.

To analyse the results of using authentic and transformative assessment processes in PE in high schools, relying on the use of ICT

Based on the results of our study, it can safely be stated that the use of authentic assessment processes in PE in secondary school based on the use of ICT has been very positive, in a variety of aspects, whitout differences between groups or gender. The students consider that the production of the video tutorial has helped them to learn the dance steps better and that the process of assessing all the videos helped them reflect on the work done and its possible improvements. These results are related to what was found by Cassady et al. (2004), in a study of self- and peer-assessment in a didactic unit of dance in a secondary school, in which they analyzed the impressions and feelings of the students about the assessment, when assessing and being assessed. The students recognize that the assessment system helps them to improve and progress and that it would be beneficial to watch video recordings of the activities more often, to learn more. They also consider that undertaking peer-assessment is valuable because it helps to see other ideas, to improve their own performance, as well as enabling them to compare their own work with that of their peers. Bores -García et al (2020) also find positive effects on students' motivation towards body language when the formative and shared assessment is properly implemented. On the other hand, studies such as Díaz, Molina-García & Monfort-Pañego (2020) and Guillén & Perrino (2019) find that teacher's digital competence and knowledge and didactic intentionality condition the use of ICT in PE.

To ascertain whether the use of the Plickers application facilitates the development of self- and peer-assessment processes in high school PE

The study carried out has made it possible to verify that the use of the Plickers application makes it much easier to carry out self-assessment and peer assessment processes in PE at secondary level and, in addition, it involves a considerable saving of time compared to completing this type of process with pencil and paper. Similarly, Chng & Gurvitch (2018) defend the use of Plickers in PE, both for formative and summative purposes. As indicated by Álvarez (2005), authentic

assessment can take more time than traditional assessment. In this didactic unit, the final assessment process has taken up one session of a total of 8 (therefore, 12.5% of the total learning time). López-Pastor (2011) show that one of the most serious problems of traditional assessment in PE, by means of fitness and/or motor skill test, is that it takes away a lot of learning time (between 20% and 40% of the teaching hours of each term).

Interestingly, one of the most common criticisms made about processes of formative assessment, assessment for learling, authentic assessment and student participation in assessment is that they require a lot of time and work for teachers (López-Pastor, et al., 2013, MacPhail & Halbert, 2010; Mintah, 2003). Also, Lund & Kirk (2002) state that a good assessment in PE requires a lot of work.

As it has been demonstrated in this study, this is not always true and, in this instance, the opposite happens: the use of the right tools allows the use of AA processes to be simple and fast, creating a lower workload for the teacher, and allowing much more time to be devoted to learning than the more traditional assessment models in PE. Consequently, this study shows that the implementation of AA processes can be much more effective than traditional processes in many aspects (greater internal coherence with learning, more learning, more relevant learning for the students' daily lives, etc.), as well as taking up a lower percentage of time from the total time available for the teaching-learning process. Along the same lines, López-Nieto (2016) and Chng & Gurvitch (2018) describes the Plickers application as a tool developed to facilitate assessment processes. His paper analyzes the use of this application in the assessment of the subject of music in primary schools and concludes that it is easy to operate and its simple and visual interface favor a highly «gamelike» and motivating environment for students. The data shows that our students also consider that the use of the Plickers App is very straightforward.

In their work, Butler & Hodge (2001) suggested a couple of key considerations for teachers who would like to use peer assessment: (a) give out the necessary instructions before the class starts; (b) inform the students of what is expected of them and how to carry out the peer-assessment. As explained in the Methodology section above, these aspects have been adequately addressed in this study. It is proposed a series of recommendations when using the Plickers application for the self- and peer-assessment: (a) to familiarize the students with the use of the application beforehand in order to ensure they correctly position the QR codes; (b) inform students at the beginning of the didactic unit of the instrument of self- and peer-assessment to guide their learning; (c) keep the self- and peer-assessment instrument simple, straightforward and brief (asking specific questions and no more than 5); (d) use a digital whiteboard where students can see the questions in real time, although if one is not available the teacher can read the questions and options aloud; (e) use a smartphone for the scanning of QR codes; (f) the same QR codes can be used for several classes and if they are «plasticised» they should be matt (not shiny).

To assess the degree of student satisfaction with undertaking authentic and transformative assessment processes in PE using the Plickers application.

The results show a high degree of student satisfaction with undertaking authentic and participative assessment processes in their PE class, due to the reflection and learning processes that it generates. They also show very high levels of satisfaction with the use of the Plickers application for these assessment processes. They consider it very useful and simple and agree that they would like to use the tool again on other occasions. These results therefore allow us to overcome the problems identified by Cassady et al. (2004) in the processes of self- and peer-assessment in didactic dance units. In their study, the students indicated two types of difficulties: (a) the technical difficulty of accurately assessing the work of other classmates and of giving feedback to the classmates using appropriate words and without offending them; (b) the negative feelings about the fact of assessing their colleagues and being assessed by them, which generate anxiety and tension. As a result, Cassady et al. (2004) considered that it would be beneficial to produce a system that enables assessment to be carried out confidentially and competently and the information used to improve performance in dance teaching units. It appears these problems have been resolved with the application used, given that the assessment is confidential, explicit criteria are used to facilitate its use and the information is used within an approach aimed at improving the preparation of the final video tutorial.

Results show that this experience fits with the Tolgfors (2018) concept of «Transformative Assesment in PE». Furthermore, that study also analizes an example of Authentic and Transformative Assessment in a didactic intervention where students carry out a dance tutorial

producción.

Conclusions

Based on the results of this study, it can be confirmed that the use of authentic and transformative assessment processes in PE in secondary school based on the use of ICT has been a very positive experience, in many aspects. The students consider that the production of the video tutorial has helped them to learn the dance steps better, and that the assessment processes of all the videos helped them to reflect on the work done and its possible improvements. The use of the Plickers application makes it much easier to carry out self-assessment and peer assessment processes in PE in secondary school and, in addition, it produces a considerable saving of time compared to completing this type of process with pencil and paper. In addition, the results show a high degree of student satisfaction with carrying out authentic and participative assessment processes in PE, as well as the use of the Plickers application for these assessment processes. They consider it very useful and simple and agree that they would like to use this tool again on other occasions.

We believe that this study can be of great interest to PE teachers who are interested in using self-assessment and peer-assessment processes with their students, as well as in developing more authentic and transformative assessment systems and processes in their subject. It could also be of interest to researchers in the subject of assessment in PE, as well as to university tutors specialized in the initial training of PE teachers.

As further research in this area it would be interesting to establish, in future studies, the reliability of the self-assessment and peer-assessment processes with this tool (the Plickers application). It would also be interesting to explore if the use of the tool also generates positive results in other educational stages (primary education, vocational training, higher education).

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