

Article

Is Reality in Conflict with Perception? The Impact of Technology-Enhanced Active Learning and Formative Assessment on the Formation of Pre-Service Teachers in the Social Sciences

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Abstract: Active learning environments mediated by technologies in which learners assume ownership of their learning and receive daily feedback are gaining in popularity. Nevertheless, variables such as pre-service teachers' learning gains and their perception towards these educational approaches have been little studied in the field of social science teaching. This quantitative study analyses to what extent (if any) an active methodology such as inquiry-based learning (IBL) supported by a Learning Analytics (LA)-based formative assessment process impacts on the academic achievement attained by 240 prospective teachers and their perception of the quality of the teaching–learning process compared to lecture-based teaching. Results show higher pre-service teachers' performance in those lessons in which IBL supported by LA were used. However, the class dynamic and the lecturer's role were rated lower by prospective teachers who used this methodology compared to those who attended lecture-based teaching classes. Results evidence that educational research should not only pay attention to the academic benefits of active methodologies, but also to the necessity of educating (future) teachers about these innovative approaches.

Keywords: social science teaching; pre-service teachers; active learning; learning analytics; inquiry-based learning; formative assessment



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1. Introduction

The presence of information and communication technologies (ICTs) in society reveals the need to integrate digital technology within the educative field [1]. Its integration requires pedagogical and technical knowledge [2]. Therefore, teachers need to adapt their teaching methodologies [3], as the mere introduction of ICTs into schools does not assume innovation [4]. Therefore, the teachers' role, the methodology employed, and the assessment methods must be modified. Thanks to ICTs, not only can new active methodologies be put into practice, but also new ways of formative evaluation can be implemented, too. Related to this, different authors (e.g., [5]) state that one of the technological trends with the best prospects for formative assessment in the short to medium term is learning analytics (hereafter LA).

However, the integration of technology to promote these active learning environments within the social sciences has hardly been investigated in the current literature [6]. Thus, it is important to provide evidence to teachers on the impact (if any) of integrating active learning environments mediated by technologies into the teaching–learning process of social science subjects such as history. For this reason, the current study seeks to find out whether an active methodology, such as inquiry-based learning (IBL) combined with a student response system (SRS) to enable LA-based formative evaluation processes, might influence pre-service teachers' learning performance and attitude in social science learning.

1.1. The Teaching of Social Sciences for the XXI Society

In social science lessons, the role of the teacher is traditionally to present the contents that students receive and usually must memorize [7,8]. The excessive use of textbooks as the main learning resource, and the passive role of students, led to a negative perception and disinterest towards learning [9]. Thus, different studies criticize the teaching methods usually employed to teach social science disciplines such as history [10]. This being said, although the majority of teachers do not like how social sciences subjects are taught in schools, teachers also blame students for their apathy [11].

For this reason, the demands of our new society require a change in the educational perspective. Students not only have to acquire theoretical contents, but they also need to learn how to put them into practice in their daily life [12,13], as well as in the field of history [14]. Students must adopt an active role and be the centre of the teaching–learning process [15]. To achieve this, the teacher’s role must change from being the source of knowledge to being a facilitator of learning. Instead of giving direct instructions, teachers should enhance the development of complex skills, such as historical thinking, through encouraging students to think about questions related to the theoretical content presented [14,16,17]. Thus, through the active role that students acquire, they are able to build their own learning, being able to monitor their progress, and to develop their competence of learning to learn [7].

Moreover, many European countries have highlighted the development of digital competence and ICT skills as crucial components of teacher training [1,2]. In fact, international reports such as the EDUCAUSE Horizon report emphasize the current need for integrating technology, not sporadically, but as an essential instrument throughout their pedagogical practices. This includes both the implementation of active methodologies and the assessment of their students’ progress [18].

Therefore, the subject of inquiry is not only how social sciences are taught, but also the way students’ knowledge is assessed. Authors such as Gómez-Carrasco and Miralles-Martínez [8] emphasise that assessment should be integrated as a daily activity, highlighting the limitations of summative tests in assessing students’ learning process. Technological advancements have enabled the collection of extensive data regarding the ongoing teaching–learning process on a daily basis, thanks to the use of techniques such as LA [5,19,20]. According to these authors, the use of LA allows us to collect data directly linked to students’ academic achievement such as student scores in class activities, as well as to discover other types of variables (e.g., the time spent on an online course, number of interactions performed, or time spent solving a task) which, although they are not closely linked to academic achievement, allow the teacher to have a more complete picture of how the process of learning is developing. However, this information should be used with caution, since it should not be used as a means of over-controlling the process and the people involved in the project, but rather as a way of helping the teacher to know the daily progress of his or her students and to take measures to improve the teaching process.

Related to this, Long et al. [21] define LA as “the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs” (p. 1). The integration of LA is particularly noteworthy in the training of pre-service teachers in the social sciences, where, due to the nature of its contents and the university context, characterized by a large number of students, manual data collection can be a hard, time-intensive endeavour [22–24]. In fact, international frameworks such as the Digital Competence of Educators (DigCompEdu) emphasized the use of LA as one of the techniques for monitoring the teaching–learning process that teachers should acquire as part of their digital competence [25].

Nevertheless, this issue is still a challenge for the teaching community [1,2], and particularly in social science disciplines such as history [26]. The level of teacher training, and the complexities that teachers face when using ICT, place technology far from educative change and innovation [27,28]. As a consequence, traditional teaching based on lecturing, where the teacher is the main source of knowledge, prevails as a dominant methodology [29].

1.2. Student Ownership and Awareness of Their Learning Process through Active Methodologies and Technology

Among the active methodologies that provide an answer to teaching needs, inquiry-based learning (IBL), combined with technology, has been gaining popularity over recent years [30]. With this approach, students are active learners, responsible for constructing their own knowledge through the application of problem-solving skills [31]. IBL enables the development of student curiosity, exploration, and experiential learning. Research questions prompt and guide student exploration and investigation, in an individual or collaborative way with their classmates [32]. Moreover, the steps followed can be compared with historian method skills: formulation, question and problem identification, investigation, data collection and analysis, conclusion development, and the dissemination of results [33].

Thus, IBL may become an active methodology suitable for the development of history awareness, compared to the usual method employed [10]. In fact, there is currently an interest in training students to be competent in the era of post-truth, fake news, and conversational artificial intelligence in which social science knowledge will be important [14,34,35]. Therefore, active learning spaces must be created to enable students to think critically and reflectively, analyse and contrast information, and distinguish reliable technological sources. This can be achieved thanks to IBL.

IBL, LA, and SRS: Rethinking How to Train Pre-Service Teachers in Social Science Teaching

Despite the advantages described above, more research into how to prepare prospective teachers to implement IBL in the social science field is needed [36]. According to Kori et al. [37], the presence of technology within the teaching–learning process boosts inquiry learning as it can be harnessed by pre-service teachers to facilitate their solution-finding processes, awareness, and simultaneously afford lecturers—and educators in general—the capability to closely monitor and assess how the learning process is progressing [18,25]. Something that is aligned with the importance of integrating LA to foster both the students' daily and personalised feedback and their formative assessment [5,19,38].

Among the different learning tools used to implement LA within the teaching–learning process, SRSs such as Kahoot! have become increasingly popular to collect data, as Li and Wong [39] conclude in their literature review. SRSs are useful to induce motivation and learning engagement in tertiary students [40]; develop more active, autonomous learners and increase awareness [41]; and to monitor on a daily basis what the students have learnt [22]. Hence, although initially LA appears to demand costly and unfamiliar tools for (prospective) teachers, this is not the actual scenario.

In the social sciences, teaching with ICT fosters the development of different skills such as autonomy, as well as collaboration among students and between teachers and students [26]. The study carried out by Tirado-Olivares et al. [6] with pre-service teachers studying for a Bachelor's Degree in Primary Education in social sciences showed the influence and usefulness of active learning and LA for both improving students' learning and predicting students' academic achievement. Likewise, Miralles-Martínez et al. [42] observed that the introduction of ICT projects improved both curricular knowledge and competences such as critical thinking when looking for information.

However, although ICT seem to improve the teaching of social science content in the classroom, different authors stated that in most schools, the real implementation of ICT within the teaching–learning process is barely being achieved [27,28]. This is related to the unwillingness that the teaching staff show towards its use. Their lack of training leads firstly to deficiencies in ICT application, which are observed in learning processes, and secondly to scarce improvements in social science education [4].

Related to this, there are few studies that combine new technologies in social science disciplines such as history [43], and there is very little evidence related to how to integrate them into formative student assessment [22]. In fact, different literature reviews concerning the use of LA evidence the higher predominance of their use in scientific–technological

fields with limited evidence in other areas [44–46]. For this reason, and as an alternative to lecture-based methodologies, the aim of this paper is to evaluate the effect of an active methodology, such as IBL, coupled with LA-based formative assessment. Thus, one of the main goals is to make a contribution to the educational community in a way that goes beyond the mere application of active methodologies in the training of social science teachers. It also entails emphasizing how this educational approach opens doors for the integration of formative student assessments facilitated by technology.

Nonetheless, not only is it essential to determine whether there is an academic improvement, but it is also important to understand the perspectives of prospective teachers regarding these educational approaches, as they will be the ones responsible for implementing them in their future teaching practice.

1.3. Students and Teachers' Perceptions Concerning Active Methodologies

With respect to students' perception towards active methodologies, Moya et al. [47] claim that, by and large, students have a positive attitude, especially if they know the aim of the active methods. In this regard, Lumpkin et al. [48] reported in their mixed study that students appreciate participating in engaging activities, showing also that these activities have a positive impact on their learning. In addition, Chiu et al. [49], through the collection of more than 35,000 student surveys, found that students consider active environments as the best context to learn, since they believe that these are the best-designed environment, as well as being ideal to encourage innovation and skills such as creativity. This perception was independent of the learners' academic performance.

However, there is not always a unanimous perception of these methodologies, and the scientific literature reflects this divergence. Although students seem to be more motivated and engaged when using active learning, educators argue that when they employ active methodologies, they are rated lower in the students' end-of-course evaluations [50]. These authors developed a study with undergraduate students to analyse the practices that motivate or discourage students towards active learning. On the one hand, students who supported them stated different reasons. Firstly, they considered that active methodologies increased their learning and interest and also enhanced their creativity to think about the questions, and, moreover, they felt more motivated to better prepare their lessons. In addition, they developed a sense of community learning while negotiating the questions and preparing the answers, and they became more open-minded. Finally, they believed that it was challenging but effective, as it resulted in more functional learning compared to lecture-based teaching. On the other hand, students who showed resistance to active learning considered that it took away time from other learning experiences. They also felt confused about their purpose and unfamiliar with the practices required. Finally, from their point of view, extra effort was required. Therefore, they preferred teacher-centred instruction. Likewise, Welsh [51] stated that undergraduate students' perceptions changed depending on the level: while fourth- and fifth-year students consider active learning as a waste of time, third-year students consider it useful to improve peer–peer interaction, as well as interactions with teachers and their understanding.

With respect to teachers, they are aware that their teaching style needs to change when implementing active methodologies; something that should be complemented by new evaluation processes [52]. These authors compared teachers' and students' perceptions concerning active methodologies. Using the same questionnaire, they concluded that teachers have a better vision than students concerning these methodologies, considering that classrooms have the necessary resources to apply them, while students think that they are designed for traditional lecture-based methodologies. Finally, teachers consider that they are improving in the use of active methodologies in the learning process. In the particular case of IBL, it is essential that teachers feel comfortable with their new role, especially when students work autonomously. In this regard, some studies underline that teachers tend to think that contents are learnt better when they employ a direct methodology

approach (e.g., [53]). These results may explain why only 12% of teachers surveyed in the National Survey of Science and Technology let their students design their own inquiry [50].

Finally, to measure students' perceptions of a teaching methodology, Student Evaluation of Teaching (SET) ratings can be a source of knowledge. These surveys consist of items with a five-point Likert scale ranging from Strongly Disagree to Strongly Agree, where students rate their perceptions of instructors and courses [54]. However, these types of SET ratings should be analysed carefully, as the information gathered can sometimes be biased [54]. Traditionally, it has been thought that students learned more from instructors that achieved high SET ratings. Hence, many teachers considered SET ratings as feedback about their teaching effectiveness [55]. Nevertheless, as stated by Uttl et al. [54], these measures can be influenced by different factors such as student interest and motivation, subject content, instructor gender, class size, class schedule, and class level. Hence, the results from the aforementioned studies suggest that there is no complete agreement concerning the eventual benefits and drawbacks of this methodology and its perception, which would lead to recommending more research in this regard.

The present study seeks to answer the following questions:

1. Do pre-service teachers perform better in social science teaching when using an IBL methodology supported by LA-based formative assessment compared to a traditional expository methodology?
2. Are pre-service teachers' perceptions towards the teaching–learning process affected by the methodology employed (lecture-based learning or IBL and LA-formative assessment)?

2. Materials and Methods

2.1. Participants

The study was conducted with pre-service teachers from a Spanish university. A total of 240 undergraduate students participated in the study. All the participants were taking a subject entitled “Social Sciences II. History and its didactics”. In this subject, students learn about the history contents established in the Spanish curriculum for primary education and how to teach them through considering different methodologies and educational proposals that they can carry out in their future teaching practice. These future teachers came from two different groups. The first group consisted of 111 students (81 females and 30 males). This group was randomly chosen as the control group (hereinafter, CG). A traditional lecture-based methodology was followed with this group. The intervention took place with the second group, made up of 129 prospective teachers (74 females and 55 males) (intervention group or IG). In this IG, the IBL methodology, supported by LA-based formative assessment, was used. Both groups belonged to the same Faculty of Education, were in the same academic year, and were taught by the same lecturer.

2.2. Design

To analyse the established objectives, a quasi-experimental study using a quantitative methodology was carried out. Through this study, we aimed to discover how the implementation of the active inquiry-based learning methodology, and its subsequently continuous assessment mediated by technology, affects pre-service teachers' learning of history content and their perception of this methodology compared to a lecture-based methodology.

2.3. Procedure

The experimental phase consisted of ten sixty-minute sessions. In each CG session, a traditional lecture was conducted. This methodology is based on lecturing; that is, the professor explained the theoretical contents to the students using PowerPoint presentations as visual supports. According to Miller et al. [56], in this classroom setting, the central role of the teaching–learning process is carried out by the lecturer, and the students are passive listeners. So, in this educational context, interactions between students and the acquisition of some abilities, such as reflection, are not promoted during each lesson.

However, the IBL methodology implemented in the IG, using questions to discover what information future teachers needed to find, fostered them not only to learn theoretical contents, but also key competences such as learning to learn and ICT competence, since pre-service teachers had to search for information on the Internet. Finally, at the end of each lesson, the last few minutes of each session were devoted to the completion of a Kahoot activity with different questions about the key concepts worked on during the lesson. Hence, it was during the last few minutes of each session that LA was applied. In that way, not only did pre-service teachers become responsible for their own learning process, adopting an active role by collecting the necessary data to answer the questions posed [57], but a process of continuous monitoring and evaluation of how this learning was taking place was enabled, too [5,19]. During the IG lessons, the lecturer had to oversee the learning process. The procedure followed during the experiment is summarized in Figure 1.

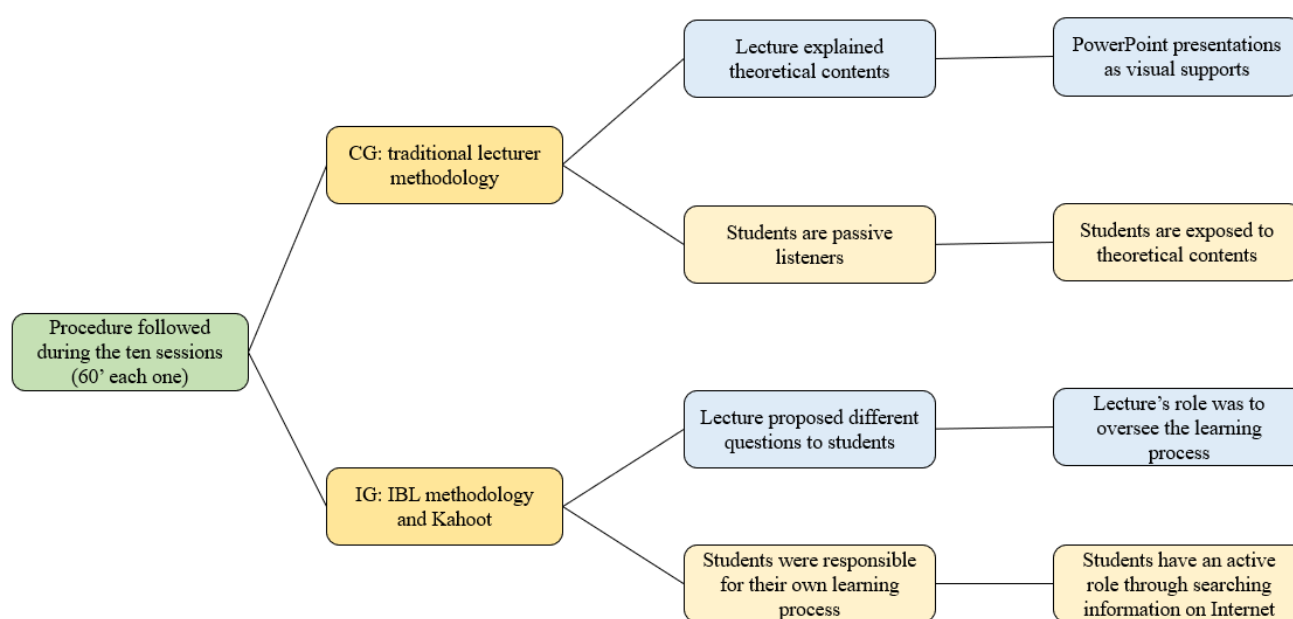


Figure 1. Pedagogical approach implemented in each session in both groups. CG (Control Group), IG (Intervention Group).

Finally, when the intervention finished, both groups took the final exam. In addition, when the students had finished studying the subject, all the participants filled in a survey to discover what they thought about the methodology used and the role of the lecturer.

2.4. Instruments and Measurements

As previously mentioned, student learning was analysed in both groups through a test at the end of the intervention. The comparison of students' scores between groups allowed us to evaluate whether the methodology proposed in the IG promotes higher learning scores in comparison to a lecture-based methodology. The test employed was an ad hoc instrument that consisted of fifteen multiple choice questions to specifically measure the academic achievement attained by the prospective teachers in both groups concerning the history contents worked on.

Related to the second research objective, the survey used by the university to assess the teaching–learning process in the subjects of all its degrees was employed to develop this study. This survey was provided by the Office for Teaching, Evaluation and Academic Quality of the University of Castilla-La Mancha. This questionnaire is used to assess students' perception of the teaching–learning process. In particular, this survey is made up of 18 five-point Likert-scale items—from “Totally disagree” (1) to “Totally agree” (5). These items are divided into three categories: teaching planning and development (items 1–9),

attitude and dedication of the teacher (items 10–17), and a final item devoted to an overall evaluation of the teaching–learning process. All the items are presented in the results section. The institutional gathering process preserved the anonymity of the participants.

2.5. Statistical Analysis

The collected data were exported to a database and analysed using SPSS vs.24 software. Learning scores were standardized on a ten-point scale. In addition, in relation to the institutional survey, for descriptive purposes, the average score obtained in each item was computed, as well as the mean score in each of the three dimensions. Finally, a t-student test was carried out to assess the first research objective. Mann–Whitney U tests were used to analyse the ordinal answers from the survey and answer the second research question. A confidence interval of 95% was used for all the analyses.

3. Results

Below, the results are organised into sections corresponding to each research question. The first analysis was performed to compare the two methodologies implemented in terms of the academic achievement attained in both groups. The second analysis aimed to study the future teachers' perception of the methodologies used.

3.1. Differences in Learning Achievement Based on the Methodology Used

Based on the average scores, students from the IG ($M = 7.69$, $SD = 1.61$) outperformed students from the CG ($M = 6.16$, $SD = 1.87$). An independent sample *t*-test revealed that these differences were statistically significant ($t(238) = -6.8$; $p < 0.001$). To weigh the effect size, Cohen's *d* was used ($d = 0.89$). According to [58], this value corresponds to a large effect. Therefore, we can state that the academic performance of pre-service teachers in the IG is greater compared to the learning achievement by the CG students with a large-sized effect. These results support the efficacy of the use of an IBL supported by LA-based formative assessment with pre-service teachers, as can be seen in Table 1.

Table 1. Descriptive and inferential data analysis based on post-test scores in both groups.

	Group	N	M	SD	t-value	p	d
Post-test	CG	111	6.16	1.87	−6.8	0.001	0.89
	IG	129	7.69	1.61			

Note: Table shows the mean (M) score and standard deviation (SD) obtained in the post-test by students from the CG (control group) and students from the IG (intervention group). Subsequently, the data obtained through inferential analysis carried out using the t-student test and their effect sizes (Cohen's *d*) are presented.

3.2. Perception about Methodology Implemented in Both Groups

In relation to the second objective, scores for each item and dimension were contrasted between both groups using Mann–Whitney U tests. The results obtained can be seen in Table 2. As a measure of the effect size, *r* is reported for all the comparisons. According to [58], values of 0.1, 0.3, and 0.5 can be interpreted as small, medium, and large, respectively.

As can be seen, the Mann–Whitney U test reported statistically significant differences in future teachers' perceptions on all dimensions and for almost all the items. In most cases, as detailed below, when these differences were significant, a medium-large effect was found. Although the scores are high in both groups, the methodology proposed in the CG has wider support from the students. Pre-service teachers consider that teaching planning and development is more effective when a traditional lecture-based methodology is used ($r = 0.26$). In addition, when an active methodology is implemented, the participants consider that the lecturer's attitude and dedication is inferior compared to when the lecturer proposed an expository methodology ($r = 0.25$). Nevertheless, although the inferential analyses report no statistically significant differences in the students' opinion

of the dedication of the lecturer, the effect size in favour of the CG was not negligible ($r = 0.12$).

Table 2. Institutional survey used to check students' perception about the methodology used and the role of the teacher.

	Group				
	CG	IG	<i>U</i>	<i>p</i>	<i>r</i>
I. Teaching planning and development (items 1–9).	3.81 (0.98)	3.15 (1.23)	222,582.5	<0.001	0.26
1. The teacher informs about the competences and contents of the subject.	3.88 (0.79)	3.12 (1.2)	3201	<0.001	0.32
2. The teaching guide of the subject has been useful to me.	3.4 (1.02)	2.89 (1.11)	1669	0.019	0.23
3. The teaching methodology and planning allows the acquisition the foreseen competences.	3.93 (0.88)	3.24 (1.17)	3132	<0.001	0.3
4. The programming contents have been developed during the course.	4.18 (0.68)	3.27 (1.16)	3036	<0.001	0.41
5. The teacher points out and clearly identifies the key concepts of the subject.	3.89 (0.97)	2.82 (1.24)	2996.5	<0.001	0.3
6. The bibliography, the sources of information and the recommended didactic material are useful for the follow-up of the subject.	3.8 (1.01)	3 (1.29)	2531.5	<0.001	0.31
7. Complementary activities, such as problems, assignments, practical cases, text comments, etc., allow a better understanding of the theoretical contents.	3.88 (0.98)	3.71 (1.2)	2304	0.57	0.048
8. The teacher clearly indicates the evaluation criteria of the subject.	3.74 (0.91)	2.99 (1.23)	3059	<0.001	0.30
9. Student workload distribution is balanced.	3.5 (1.21)	3.31 (1.14)	2536	0.335	0.082
II. Attitude and dedication of the teacher (items 10–17).	4.01 (1.04)	3.43 (1.2)	158,159	<0.001	0.25
10. I consider that the teacher prepares the classes.	4 (1)	3.74 (1.12)	2656.5	0.166	0.12
11. The teacher explains clearly.	4.03 (1.15)	2.78 (1.13)	3373.5	<0.001	0.46
12. The teacher has helped to create or increase my interest in the subject.	3.84 (1.22)	3.27 (1.13)	3062	0.002	0.25
13. The teacher encourages and facilitates students' participation in class.	4.21 (.96)	3.85 (1.03)	2933	0.012	0.21
14. The teacher has a receptive attitude in his relationship with the students.	4.16 (0.73)	3.85 (1.09)	2643.5	0.179	0.11
15. When I attended the tutorials I was duly attended to by the teacher.	4.5 (0.69)	3.57 (0.96)	289.5	0.003	0.48
16. The teacher is concerned about finding out if the concepts explained have been understood.	3.88 (0.89)	3.08 (1.19)	3185.5	<0.001	0.33
17. Attending classes is of interest in order to acquire the expected skills.	3.79 (1.25)	3.36 (1.17)	2750	0.01	0.22
18. Considering all the above, I am satisfied with the work done by the teacher.	4.03 (0.89)	3.33 (0.97)	3436.5	0.01	0.19
III. Global assessment. Arithmetic mean of items 1 to 17.	3.9 (1.02)	3.28 (1.22)	754,126.5	<0.001	0.26

Note: Table shows the average score both items and their dimensions, SD within brackets, results reported by the Mann–Whitney U and their effect sizes (r).

Moreover, according to the results obtained in the different items, students from the IG considered that the objectives ($r = 0.32$), contents ($r = 0.41$), and resources ($r = 0.31$) were not specified as clearly as in the CG, up to the point that they considered that the IBL

methodology implemented does not enable them to obtain the competences established beforehand at the same level as a lecture-based methodology does ($r = 0.30$). In addition, it is relevant to highlight that, although the IG participants have a clearly active role during the learning process, pre-service teachers considered that in the CG, the lecturer encourages greater levels of participation in class ($r = 0.21$). Likewise, pre-service teachers who were taught with a lecture-based methodology considered the lecturer to have fostered more interest in the subject compared to when the lecturer implemented an active learning environment ($r = 0.25$). Finally, according to an overall evaluation, the IG students were less satisfied with the class dynamics than the CG students ($r = 0.26$).

4. Discussion

Gómez-Carrasco et al. [10] suggested more research is needed on active learning methodologies where technology plays an important role in the teaching of social science subjects such as history. In this line of thought, this study aimed to assess the potential of an IBL methodology supported by LA-based formative assessment through an SRS to learn history in tertiary education. In view of the results obtained, we can affirm that the active methodology proposed in the IG is more effective on the development of the students' performance than the CG's traditional lecture-based methodology. For this reason, and regarding the first objective of the present investigation, our results show that the implementation of an inquiry approach supported by LA, which can be carried out using technological tools known by teachers such as SRSs [39], improves the pre-service teachers' achievement, as it empowers them to take centre stage in their learning journey and fosters their awareness of the learning process itself [14,22,59].

These results are similar to those obtained in other studies carried out in different academic fields concerning the use of active methodologies in general [57,60], the use of IBL and technology tools within the teaching–learning process in social science disciplines [10,26], and the integration of LA to achieve formative student assessment [6,19,38]. Hence, these findings suggest that this educational approach is beneficial to learning at the tertiary level.

Thus, the teaching of social science disciplines such as history should switch from a memorization and lecture expository methodology to a new educational approach centred on the student [14,16,17]. So, IBL is presented as a viable alternative, turning the classroom into a dynamic learning environment whose aim is to improve history lessons [26]. In addition, these results support the necessity of a methodological change to promote the new skills demanded in XXI-century society. Learning is more than just acquiring theoretical knowledge; it also requires skills to search for adequate information, reflect on it, and apply it in real-life settings [12]. Therefore, Gómez-Carrasco et al. [10] argued that the formation of historical consciousness required a change in the didactics of history. Hence, history instruction should encourage the active role of students to critically think and answer historical questions [7]. Thus, it is important to include a formative assessment within the teaching–learning process. As Gómez-Carrasco and Miralles-Martínez [8] pointed out, evaluation has to be implemented as another daily activity. Thanks to the use of technology, techniques aligned with this goal, such as LA, are easier to implement [5,19,25]. As this study points out, the integration of active learning coupled with LA-based formative assessment in social science education empowers future teachers to take a central role in their learning process. This approach fosters daily awareness of their progress, enabling the participants to identify areas where further attention is needed. Ultimately, this leads to improved academic achievement compared to a lecture-based methodology where tertiary students play a more passive role.

Concerning the second research objective, despite the positive impact of IBL and LA based on the use of an SRS on the academic performance of pre-service teachers, it is noteworthy that they have exhibited a negative attitude toward these methodologies when compared to traditional lecture-based teaching. Unlike the results found by Wang et al. [40], this study reveals that prospective teachers who were taught with an active methodology

showed lower levels of satisfaction with the subject. IG participants had a lower perception concerning planning, development, and the teacher's attitude in comparison to the CG participants. These results contrast with those from Chiu et al. [49], where it was discovered that students find active environments to be the best context to learn. Along the same lines, reluctance towards this approach may come from the use of LA through SRSs such as Kahoot. The literature review by Wang and Tahir [61] highlights that students who use this type of tool underline problems when answering, sometimes due to problems in reading the questions on the screen or connectivity problems, reluctance to use it because they cannot modify the answer once it has been sent, or fear of answering wrongly, but at the same time they have to answer quickly to achieve a higher score. In addition, there is a greater aversion on the part of female students to the use of technological tools during the teaching–learning process [22]. Given that the sample was comprised to a greater extent of females, this could also have influenced the results obtained.

Furthermore, despite the promising results found regarding the application of LA, it has to be kept in mind that its implementation has yet to mature as most of the research has only been carried out in the last few years [46]. As de Laet et al. [62] point out, the application of LA presents difficulties when it is carried out in real educational contexts beyond a specific course or setting, as well as ethical and privacy issues given that their use involves different educational agents whose personal data have to be gathered for their identification. Hence, the use of LA still requires a roadmap to establish how to generalise its application in education. This, together with the fact that nowadays it is necessary to establish scales and measures that make it possible to establish how, when, and to what extent to use LA during the teaching–learning process [63], shows that the use of LA should not be considered as a true educational panacea, but rather as a technique with great potential [18] that requires further research.

In contrast to the findings of Owens et al. [50] and Chiu et al. [49], the participants perceive that a lecture-based methodology enables greater levels of interactions in class, something that is striking since it is usually a common feature of active learning. In this regard, although teachers have a better opinion concerning active methodologies than students [52], they do not feel comfortable with completely free instruction, as they believe that contents are not learnt as clearly as in a direct methodology approach [50]. Our results, in addition, indicate that this view is erroneous, suggesting the need to make future teachers aware of this evidence.

Despite what might have been expected before carrying out this research, students consider that the lecture-based methodology, compared to the active methodology proposed, encourages more interest in class and a better environment to achieve the objectives established beforehand. However, this perception represents a distorted vision of reality, since the results obtained show the usefulness of IBL supported by LA-based formative assessment to help improve academic achievement. Nevertheless, if future teachers' perceptions about students' autonomous learning are not modified, it is uncertain whether this methodology will be used [50]. Active methodologies, assisted by technologies, allow students to learn not only in an active way, but also in relevant and contextualized environments [50]. To understand the negative perception shown among university students regardless of their good grades, we should think about the reasons triggering those thoughts. As explained by Owens et al. [50], resistance to active learning could be related firstly to the unfamiliarity of the students with the practices required and, secondly, to ignorance about the purpose of these methodologies.

Limitations and Future Research

From this research, new hypotheses arose that could lead to interesting conclusions in the field of history teaching. Firstly, an implemented IBL methodology, supported by an LA-based formative assessment, has a positive impact on the academic achievement of pre-service teachers. However, based on this study approach, it is impossible to know to what extent each of the integrated innovations caused this, or whether it is a combined

effect. Therefore, it is necessary to deepen our understanding concerning which elements caused this improvement. This means evaluating if this improvement is derived from (i) the search for information on the Internet, promoting historical thinking; (ii) class dynamics; or (iii) the integration of an LA-based formative assessment through the SRS activities at the end of the class. Therefore, in future studies, it will be interesting to develop interventions aimed at isolating the effects caused by each one of these.

Moreover, the participants' negative perception led us to think about the reasons behind this phenomenon (e.g., the methodology, the change in the role of the teacher, etc.) or whether they are related to gender differences in technology use that have not been taken into account in this study. Therefore, future studies are necessary to gain insights into this. In these future studies, teachers' perceptions about their role in this new educational paradigm should also be considered as they can be very informative, and, in this way, students' and teachers' perceptions can be compared. In this line, future studies will be interested in collecting qualitative data that have not been gathered in this study to investigate, in depth, the responses of both educational agents.

All in all, the lack of studies concerning active methodologies in history teaching justifies the need for more studies in the educational field of history teaching. The conclusions reached here could be a starting point for new pedagogical approaches which analyse not only the academic benefits but also students' perceptions and how historical thinking can be fostered in the classroom.

5. Conclusions

The methodologies implemented during the teaching–learning process must be adapted to the demands of current society, a society clearly influenced by emerging technologies. In this way, the didactics of social sciences cannot be oblivious to this need for changes [14]. The introduction of technologies enables new educational methodologies in which students acquire an active role and build their knowledge both in a practical and mindful way, as pointed out by different international frameworks [25] and reports [18]. For this reason, since its inclusion, the interest in placing the student at the centre of the teaching–learning process through active methodologies such as IBL, supported by LA-based formative assessment, has increased in recent years. Nevertheless, active methodologies like IBL are rarely used in the teaching of the social science subjects, and, consequently, there are few studies that research its benefits. Moreover, if active learning environments are not encouraged in this area, it is extremely difficult to implement alternative evaluation processes in the final evaluation (e.g., exams), despite the recognized need for their incorporation in the classroom [8].

However, the widespread use of technology has enabled the integration of techniques such as LA, which enable teachers to conduct formative assessment processes [5,19]. This point is emphasized by DigCompEdu, which highlights that teachers need to know how to integrate technology not only into their methodology but also into their evaluation and feedback processes through the use of LA [25]. Nevertheless, there is a scarcity of evidence regarding their use outside the science–technological field, such as social science subjects [45].

The traditional teaching of social science disciplines such as history, based on lecture-based teaching and content memorization, should move towards practical learning, in which students look for information using technology, reflect on it, and reconstruct the facts, promoting critical history thinking skills [14,16]. In this line of thought, the present study contributes to the educational community, showing the academic benefits of IBL supported by LA in the field of history. Despite the scarcity of evidence concerning these active learning approaches, it has been proven that the use of active learning has a positive impact in terms of learning achievement in history at university levels. These results can be compared with other studies developed in other levels and areas of knowledge [10,26] and in those in which LA, through an SRS, is used to promote formative assessment [6]. In

this way, according to the first research objective, we can encourage teachers to use this class dynamic in their future social science instruction, too.

Nevertheless, despite the fact of its academic benefits, different studies evidence that undergraduate students do not have a clear opinion about active learning methodologies [50]. Some studies evidence the positive attitude of students toward this practical approach [47,49], but also resistance to it [50,51]. For this reason, the present study sought to compare a traditional lecture-based methodology with an active one, such as IBL, and the implementation of LA-based formative assessment with an SRS to make pre-service teachers aware of their learning and reinforce their learning in each lesson.

The higher scores that future teachers from the intervention group achieved suggest that traditional lecture-based teaching in social science subjects such as history needs to give way to new active methodologies [12,15]. It shows pre-service teachers that this methodology can be useful in their future teaching practice. However, despite the positive academic results achieved, undergraduate students have a negative attitude towards this methodology when it is compared to a lecture expository methodology. This may lead to reluctance to use it in the future, or not delegating a comprehensive leading role to the students, which could prevent the promotion of total free instruction [50]. This situation can be justified by the greater fear that teachers have about their students not learning the content efficiently when using this methodological approach [53], or the limited training that they have in the use of technology [2], contrary to the results obtained in the present study. Teaching future teachers how to use emerging technologies and how to apply them in new practical methodologies and formative evaluation approaches is important, but it cannot be effective if they do not have a positive attitude towards them.

Pre-service teachers consider that the use of this active methodology is synonymous with less planning of the learning environment, which means a worse environment in which to learn. Hence, their perception shows that this teaching–learning context does not promote greater peer–peer interactions and interest in the subject. So, if they do not have a positive attitude and think that these educative innovations are not useful, despite what the results have demonstrated, then it will be impossible to get these pre-service teachers to use these innovations in their future class. Therefore, not only is it relevant to study the learning scores achieved by means of new active methodological approaches, but also of relevance is what students or future teachers think about them, since pre-service teachers' interest in using them in their future teaching practice is of vital importance. Based on this paradigm, educational research needs more studies that can clarify these pre-service assumptions in social sciences. This is justified by the scarcity of studies that deal with these hypotheses.

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