Inquiry-based learning in the university context: A systematic review*

El aprendizaje basado en la investigación en el contexto universitario: una revisión sistemática

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Abstract:

Inquiry-Based Learning (IBL) is a methodology that enhances learning through a knowledge construction process. The aim of this study is to establish how IBL is used and what effects it has on university students from social sciences and health sciences. This study follows the PRISMA guidelines for conducting systematic reviews. It comprises an analysis of 31 studies extracted from four electronic databases and reference lists on the topic, published in English between 1998-2019. The results show that the strengths of IBL are: 1) promoting cooperative learning, 2) engaging students in self-learning, and 3) increasing critical thinking. Its weaknesses include: 1) the inability to meet learning expectations, and 2) the reluctance of university hierarchies to embrace IBL. The potential of IBL as a teaching strategy at university level is discussed as it allows deep knowledge construction, increased learning motivation, and development of students' research skills as well as their self-learning, self-confidence, critical thinking, and academic performance. IBL favours meaningful learning by university students by offering a space for the creation of knowledge stimulated by the inquiry process.

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Keywords: inquiry-based learning, college students, teaching methods, active learning, systematic review, PRISMA.

Resumen:

El aprendizaje basado en la investigación (ABI) es una metodología que potencia los aprendizajes mediante un proceso de construcción del conocimiento. La finalidad del estudio era conocer cómo se está aplicando el ABI y sus efectos en estudiantes universitarios de ciencias sociales y de la salud. El método para realizar la revisión sistemática ha seguido las directrices de la declaración PRISMA. Se analizaron un total de 31 estudios extraídos de cuatro bases de datos electrónicas y listas de referencias sobre el tópico, publicados en inglés entre 1998-2019. Los resultados mostraron como fortalezas del ABI: 1) la promoción del aprendizaje cooperativo; 2) el compromiso del alumnado en su autoaprendizaje, y 3) el aumento de un pensamiento crítico. Entre sus debilidades se señalan:1) la incapacidad de cubrir las expectativas de aprendizaje, y 2) las reticencias de las estructuras universitarias hacia el ABI. A partir de estos resultados se discute el valor del ABI como estrategia didáctica en la universidad, en la medida en que permite profundizar en la construcción del conocimiento, incrementar la motivación de aprendizaje, desarrollar las habilidades de investigación, el autoaprendizaje, la autoconfianza, el pensamiento crítico, y el rendimiento académico. El ABI favorece el aprendizaje significativo en el alumnado universitario al ofrecer un espacio de creación de conocimiento estimulado por el proceso de indagación.

Descriptores: aprendizaje basado en la investigación, alumnado universitario, métodos de enseñanza, aprendizaje activo, revisión sistemática, PRISMA.

1. Introduction

Inquiry-based learning (IBL) encompasses a variety of teaching focuses deriving from the perspectives of Dewey and Bruner (Herman & Pinard, 2015) who argue that inquiry is at the centre of tasks, the use of resources, and learning instructions. IBL sets students challenges that: a) catalyse their engagement and participation, b) promote experiential learning, and c) stimulate exploration and the search for solutions (Aditomo, Goodyear, Bliuc, & Ellis, 2013; Levy, Aiyegbayo, & Little, 2009; Oliver, 2008; Prince & Felder, 2007; Spronken-Smith, Angelo, Matthews, O'Steen, & Robertson 2007). IBL is a promising approach for improving teaching and learning processes in universities.

IBL promotes a pedagogy centred on the student as an agent who actively seeks out and constructs knowledge (Healey & Jenkins, 2009; Justice, Rice, & Warry, 2009; Sproken-Smith & Walker, 2010). The importance of inquiry-based pedagogies resides in fostering students' capacity to adopt learning strategies that use inquiry techniques and tools, allowing them to construct their own knowledge

in greater depth (Levy & Petrulis, 2012). In IBL: a) scientific enquiry is built into the teaching-learning process; b) teaching focusses on the learner; c) learning is stimulated by inquiry when questions or doubts arise; d) teaching staff play a role as knowledge facilitators; e) learning is the outcome of a knowledge construction process that fosters cognition and metacognition; f) self-directed learning is stimulated (Aditomo et al., 2013; Levy & Petrulis, 2012; Spronken-Smith & Walker, 2010; Justice et al., 2007; Kahn & O'Rourke, 2004).

IBL provides students with a broad social scaffolding and guidance for managing their inquiry (Hmelo-Silver, Duncan, & Chinn, 2007); it promotes active learning with positive effects on students' achievements and their attitudes towards research (Maass & Engeln, 2018); it stimulates their problem-solving capacity, critical thinking, and reflection on learning (Bruder & Prescott, 2013; Minner, Levy, & Century, 2010); it fosters university students' research competence and training, improving the quality of what they learn and the process of peer collaboration (Bevins & Price, 2016); it promotes better understanding of subjects among students, as they accept the challenges their academic training involves (Åkerlind, 2008; Brew, 2003; Healey & Jenkins, 2009; Hunter, Laursen, & Seymour, 2007); and it increases their academic writing skills (Justice, Rice, & Warry, 2009).

Griffiths (2004) and Healey (2005) identify four IBL modes depending on how the link between teaching and research is built:

a) *Research-led*. The curriculum is dominated by the interests of teaching staff who set the information transmission model. Students learn about the results of research.

b) *Research-oriented*. Teachers attempt to create a research ethic through teaching; the curriculum emphasises knowledge-production processes and the learning achieved. Students learn through the research process.

c) *Research-based*. The division between the roles of student and teacher is minimised. The curriculum is largely designed around inquiry-based activities. Students learn as researchers.

d) *Research-tutored*. Students learn on the basis of the results of research, formulated in small discussion groups with a teacher who facilitates the process.

According to Healey (2005), the curriculum must be redesigned to make the research-teaching nexus practical, planning a teaching process centred on students as the authors of their own learning. IBL has mainly been implemented in science subjects such as maths, physics, and biology. Systematic review studies of the application of IBL with university students from social and/or healthcare courses are rare. In order to establish how IBL is applied in these courses, we performed a study following the

guidelines from the PRISMA statement for performing systematic reviews and meta-analyses (Liberati et al., 2009). The objectives of this study are:

1. To identify the duration, source, and methodological characteristics of the studies analysed.

2. To examine the type of IBL mode used.

3. To analyse the objectives of the studies on the implementation of IBL and its effects on social science and health science students.

4. To analyse the limitations of the studies.

2. Method

2.1. Search and eligibility criteria

To search for publications about the use of IBL with university students from the social sciences and health sciences, we proposed a series of inclusion and exclusion criteria: a) articles must specifically state the use of active methodologies such as IBL; articles that only mention "Research Teaching Nexus", "Learning Strategies", "Competence-Based Learning" are excluded; b) the study population must be university students; studies focussing on non-university students are rejected; c) the date range of the publications included in the review must be 1998-2019; articles published before then are excluded; d) the selected publications must be limited to the fields of social sciences (education, psychology, anthropology, social work, etc.) and health sciences (medicine, nursing, physiotherapy, etc.); articles focussing on qualifications from other areas of knowledge are excluded; e) the articles must be written in English; those written in other languages are excluded.

The systematic review was carried out using various online databases: ERIC, Web of Science, Current Contents Connect, MEDLINE, PsycArticles, Academic Search Complete, and PsycInfo. These databases were selected for their relevance as they contain scientific articles published in indexed journals. To identify the search terms relating to the topic to be studied, we performed a preliminary literature search and consulted experts in IBL. We performed an iterative search in each database, combining the two sets of terms shown in Graph 1.

GRAPH 1. Truncated search strategy.

su(Inquiry-based learning OR Enquiry-based learning OR Guided-inquiry* OR Inquiry-based learning cycle OR Research teaching nexus OR research-based* method) AND su(method of teaching IBL* OR active learning OR Undergraduates* research OR self-directed learning OR student-centred OR student-focus OR High education)

Source: Own elaboration.

We used thesaurus terms (Graph 2) in the databases that offer this search option to find entries with the exact terms, according to the inclusion criteria established in the study.

GRAPH 2. Thesaurus terms search strategy.

SU.EXACT("Inquiry-based learning") OR SU.EXACT("Enquiry-based learning") OR SU.EXACT("Inquiry-based learning cycle") OR SU.EXACT("Inquiry-based activities") AND SU.EXACT("Research-led learning") OR SU.EXACT("Research-oriented learning") OR SU.EXACT("Research-based learning")

Source: Own elaboration.

2.2. Data collection and analysis procedure

The steps in this search were:

1. Establishing truncated search terms and thesaurus terms to limit the searches in accordance with the objectives of the study.

2. Searching for entries in the selected databases.

3. Ordering the entries obtained by relevance. When the number of search results exceeded 100 entries, we used the following filters to reduce the number: works subjected to double blind review; full texts with links; works from the 1998-2019 period; works published in English in academic journals.

4. Carrying out a second selection of the entries retrieved, using the title and/or abstract as the criteria and excluding ones that do not match the thematic area.

5. Making a data extraction sheet for each article with the inclusion criteria specifying: the reference of the study; the reason for selection; title and/or abstract (university population, social sciences or health sciences, IBL); year of publication. Finally, their suitability was determined for subsequent analysis.

6. Verifying the degree of accuracy of the data extracted in the selection of articles.

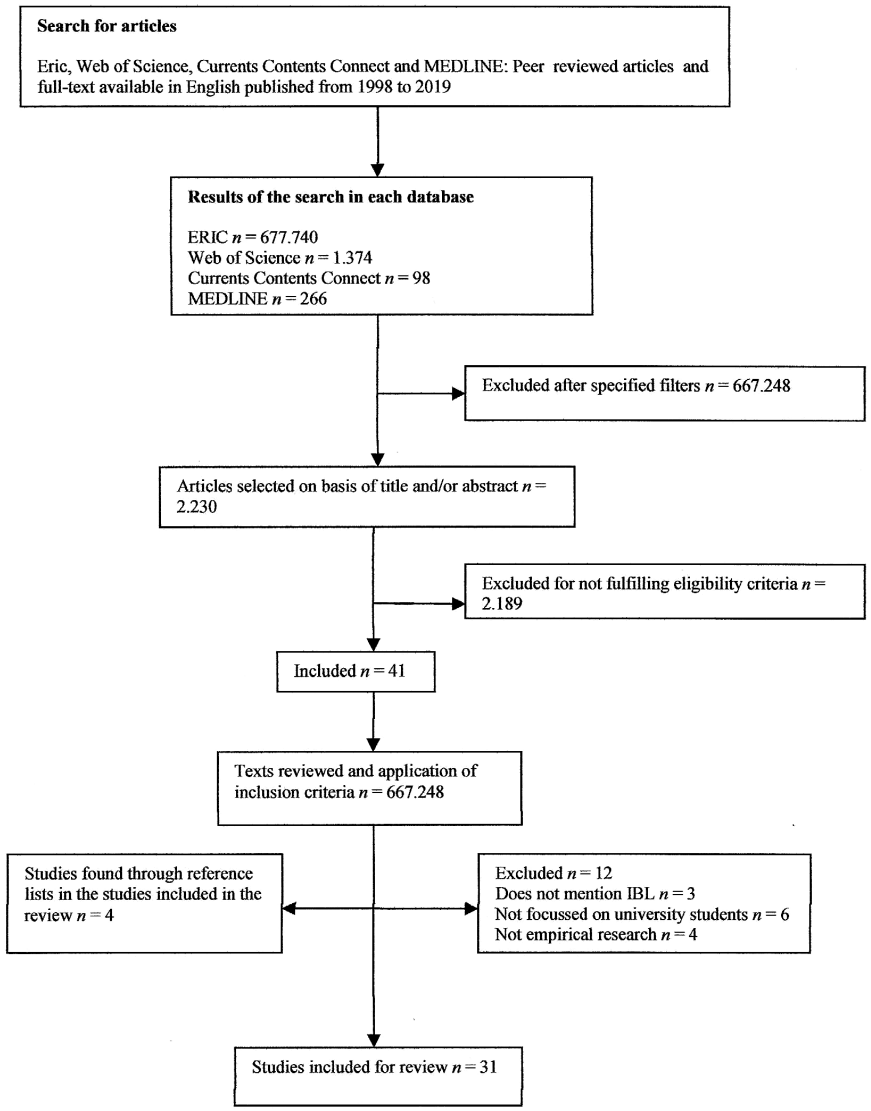
After a preliminary search in each database, we found that PsycArticle, Academic Search Complete, and PsycInfo did not return results that fitted what we wanted, and so we decided to eliminate them from the study. The search of the four remaining databases gave a total of 679,478 entries (Graph 3). After adjusting the search on the basis of the filters described in step 3, the number of entries was reduced to 2,230. Of these entries, 2,189 were rejected as they did not match the inclusion criteria. Once we had carried out the selection, we reviewed the complete texts of the 41 remaining studies. Of these, 29 met the inclusion cri-

teria. After reviewing the references in the selected articles, we decided to add 4 more works to the study as they fulfilled these criteria. Finally, in the systematic review we analysed 31 articles describing the application of IBL in social science and health science courses.

Each of the selected articles was analysed based on the following questions:

1. What are the origin, duration, and methodological characteristics of the studies?
2. What IBL mode do they use?

GRAPH 3. Systematic Search Procedure.



Source: Own elaboration.

3. What type of objectives are set and what are the effects on the students?

4. What are the limitations of the studies analysed?

3. Results and discussion

3.1. Duration, origin, and methodological characteristics of the studies

Of the studies analysed, 16% were carried out over one semester, 22% over an academic year, 25% in a few sessions or months, 12% over several years, and 25% did not state the duration of the intervention. Regarding the country where the studies were performed, 29% were carried out in England, 19% in the USA, 12% in Australia, 9% in Spain, another 9% in Turkey, and the remaining 22% in China, Thailand, Canada, Iran, New Zealand, Indonesia, and Saudi Arabia, with only one study from each of these countries. Regarding the main methodological characteristics of the studies, 36% used a quantitative methodology, 48% were qualitative studies, and 16% used a mixed methodology (Table 1).

a) *Quantitative studies*. Of these, 84% are experimental, 8% quasi-experimental, and 8% descriptive. The quantitative studies are generally: 1) experimental, with a control group and an experimental group, using pretest-posttest analysis with standardised questionnaires in a limited experimentation time (Irwanto, Saputro, & Prodjosantoso, 2018; Konokman & Yelken, 2016; Piyayodilokchai, Panjaburee, Laosinchai, Ketpichainarong, & Ruenwongsa, 2013); 2) longitudinal, evaluating students' progress, starting with a conventional methodology and gradually introducing the IBL methodology (Zafra-Gómez, Román-Martínez, & Gómez-Miranda, 2015). Kienzler and Fontanesi (2017) propose a step-by-step study in which: 1) small groups of students were created who formulated a well-structured research challenge relating to KTE (Knowledge, Translation and Exchange) with the aim of breaching the "knowledge to action" barrier; 2) the students presented their challenges to the working groups for critical discussion; 3) they chose the challenges to continue to investigate; 4) the challenges were discussed in a workshop; 5) the learning process was evaluated using a feedback form halfway through the course and at the end of it.

b) *Qualitative studies*. Of these, 50% were descriptive, 22% were single-case studies, 14% ethnographic, and 14% were interpretative. The main characteristic of the qualitative studies was the time dedicated to the teaching programme or process (Barbera, García, & Fuertes-Alpiste 2017; Ghahremani-Ghajar, Mohammadi Doostdar, & Sadegh Mirhosseini, 2012; Levy & Petrulis, 2012; Tatar, 2015). For example, the aim of the study by Justice et al. (2009) was to investigate the use of IBL at McMaster University (Canada) since 1979; the informants were the teaching staff, administrative staff, and instructors who were interviewed to establish first-hand the experience of adapting IBL. Barbera et al. (2017) and Levy et al. (2009) carried out single-case studies, focussed on the information obtained from key respondents through interviews.

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TABLE 1. Methodological characteristics, country, and duration of the studies analysed.

	Authors	IBL mode	Research	Methodology	Participants	University/Country	Duration
1	Aditomo et al. (2013)	Research-Based	Experimental	Quantitative	224 Teachers from Various Disciplines (62% from Soc. Sci.)	Sandstone, Unitech, and Gumtree, Australia	Not Specified
2	Akgul (2006)*	Research-Oriented	Descriptive	Qualitative	35 Primary Education Degree Students	Medipol, Turkey	Spring 2001
3	Azer et al. (2013)	Research-Tutored	Experimental	Quantitative	981 Students Faculty of Medicine	King Saud, Saudi Arabia	Not Specified
4	Barbera et al. (2017)	Research-Led	Single Case	Qualitative	2 Volunteer Students, 1 Teacher Online Tourism Degree	Oberta de Catalunya, Spain	1 Academic Year
5	Bolton et al. (2009)	Research-Based	Experimental; Descriptive	Mixed	90 Students (Business Admin.; Family, Youth, & Community Sciences)	Florida, USA	4 months
6	Brown (2010)*	Research-Oriented	Experimental	Quantitative	217 Students Medical Chemistry Course	East Tennessee State, USA	Autumn 2007
7	Bugarci et al. (2012)	Research-Oriented	Experimental	Quantitative	120 Students Biomedical Sciences	Queensland, Australia	One Semester
8	Deignam (2009)	Research-Oriented	Single Case; Experimental	Mixed	16 Tutors, 9 Students from 8 Higher Education Centres	Manchester, England	Not Specified
9	Ghahremani-Ghajar et al. (2012)	Research-Oriented	Ethnographic	Qualitative	120 Third-Semester Medicine Students	University of Tehran, Iran	2002-2006
10	Gros and López (2016)*	Research-Led	Exploratory	Quantitative	6 Lecturers from Different Faculties	Oberta de Catalunya and Barcelona, Spain	Not Specified
11	Healey et al. (2010)*	Research-Based	Single Case; Experimental	Mixed	200 Students	Gloucestershire, England	Not Specified
12	Horne et al. (2007)	Research-Led	Descriptive	Qualitative	15 Nursing Educators / 121 Students	Manchester, England	15 Weeks
13	Hosein and Rao (2017)	Research-Oriented	Interpretative	Qualitative	16 Students Education Faculty	Liverpool Hope, England	1 Academic Year
14	Irwanto et al. (2018)	Research-Tutored	Quasi-Experimental	Quantitative	48 2nd-Year Students	Muhammadiyah Ponorogo, Indonesia	One Semester
15	Ji and Bo (2017)	Research-Oriented	Experimental	Quantitative	53 Students	Hubei University, China	One Semester
16	Justice et al. (2009)	Research-Led/ Based	Descriptive	Qualitative	Soc. Sci., Health Sci., and Humanities Students	McMaster, Canada	Since 1979

17	Kienzler and Fontanesi (2017)	Not Specified	Experimental	Quantitative	22 3rd-Year Degree Students	Washington, USA	10 Weeks
18	Kirwan and Adams (2009)	Research-Led	Descriptive	Qualitative	8 Mentors for Nursing Students	Anglia Ruskin, England	Not Specified
19	Konokman and Yelken (2016)	Research-Led	Quasi-Experimental and Descriptive	Mixed	50 Future Early-Years Teachers	Mersin University, Turkey	2013–2014 Academic Year
20	Levy et al. (2009)	Research-Based	Single Case	Qualitative	12 Members of Academic Staff, Faculty of Arts and Soc. Sci.	Sheffield, England	2006–2007 Academic Year
21	Levy and Petrulis (2012)	Research-Tutored	Descriptive	Qualitative	1st-Year Students Arts, Humanities, Soc. Science	Sheffield, England	Three or Four Full Years
22	Luke (2006)	Research-Based	Descriptive	Qualitative	17 Students, 1 Research Assistant, 1 Research Professor	Ball State, USA	Fourth Semester
23	Magnussen et al. (2000)	Research-Tutored	Experimental	Quantitative	257 Nursing Students	Hawaii, USA	1991–1995
24	McLean and Baker (2004)	Research-Led	Descriptive	Qualitative	History Students	Various Universities, England	January–June 2002
25	Morris and Turnbull (2004)	Research-Tutored	Ethnographic	Qualitative	240 Nursing Students	Anglia Polytechnic Uni., England	4 Months
26	Oliver (2008)	Research-Oriented	Experimental	Quantitative	263 Students	Edith Cowan, Australia	12 Weeks
27	Ortlieb and Lu (2011)	Research-Led/ Based	Interpretative	Qualitative	Education Students	Texas, USA	Not Specified
28	Piyayodilokchai et al. (2013)	Research-Based	Experimental	Quantitative	95 Students	Mahidol, Thailand	2 Sessions; 3 Hours Each
29	Spronken-Smith and Walker (2010)	Not Specified	Single Case and Checklist	Mixed	3 Students	Otago, New Zealand	Not Specified
30	Tatar (2015)	Research-Led	Single Case	Qualitative	41 Primary Teaching Students	Cumhuriyet, Turkey	2007–2008
31	Zafra-Gómez et al. (2015)	Research-Tutored	Experimental	Quantitative	Business Admin. and Management Students	Granada, Spain	2009–2010

* Works found through the reference lists of the studies included in the review.
Source: Own elaboration.

Hosein and Rao (2017), Levy and Petrulis (2012), McLean and Barker (2004), and Ortlieb and Lu (2011) carried out descriptive and interpretative studies in which they analysed reflective essays and interviews using the ATLAS.ti program.

c) *Mixed methodologies*. Of these, 20% combine an experimental and interpretative method; 40% a single-case study and an experimental study; 20% a quasi-experimental study and an interpretative study; and 20% a single-case study and a checklist to extract quantitative data. In the study by Spronken-Smith and Walker (2010), three lecturers who used the IBL methodology were given a checklist about the focus of the inquiry, they were observed during class sessions, and they were interviewed about the processes and the results obtained.

3.2. IBL Mode

The studies display the four IBL modes described by Griffiths (2004) and Healey (2005) (see Table 1). Of the studies analysed, 29% used the research-led mode, emphasising the elaboration of a knowledge-construction process dominated by the interests of the institution; 26% of the studies used the research-oriented mode, centring the students' learning process on research and on how knowledge is created; 26% of the studies used the research-based mode, as the teaching process focussed on the active role of the student in this process, minimising the role of lecturers; and 19% were based on the research-tutored mode, as the teaching process focusses on small discussion groups guided by the lecturers who offer students feedback on the progress they make.

After identifying the modes in each of the studies analysed, the question arose of whether they all conceptualised the IBL methodology in the same way. Many authors regard the IBL methodology as a constructivist teaching method that connects students with learning, enabling them to explore research and knowledge creation from different perspectives (Healey, Jordan, Pell, & Short, 2010; Levy & Petrulis, 2012; Spronken-Smith & Walker, 2010; Zafra-Gómez et al., 2015).

Although the terms used to describe the four IBL modes vary, they do all describe the students' participation in an inductive way in which they are encouraged to take responsibility for their own learning and knowledge exchange when working in groups. Some authors identify the IBL methodology with the problem-based learning methodology without distinguishing between them; both are regarded as part of a common philosophical approach to achieving inductive learning (Azer, Hasanato, Al-Nassar, Somily, & Al-Saadi, 2013; Deignan, 2009; Horne et al., 2007; Kirwan & Adams, 2009; Morris & Turnbull, 2004).

According to Ghahremani-Ghajar et al. (2012), IBL starts from a broad teaching–learning focus as it derives from a variety of interpretations and practices rooted in problem-based learning (PBL) that were originally proposed in medical education. Aditomo et al. (2013) note that IBL is based on pedagogical focuses

aimed at achieving learning based on inquiry; in this case, it is applied through problem-based learning strategies, project-based learning, and case-based learning. Although there are differences with how IBL is conceptualised, including whether or not it is combined with other pedagogical focuses, all of the authors identify their methodology as an opportunity to achieve inductive learning, as: a) it enables responsibility-taking in learning and in actively contributing to the teaching process; and b) it offers multiple benefits in the training of future education and health professionals (Hosein & Rao, 2017; Ji & Bo, 2017; Magnussen, Ishida, & Itano, 2000; Oliver, 2008).

3.3. Student objectives and effects on students of using IBL

In the studies analysed, five objectives in the implementation of IBL were identified, as well as the effects this methodology had on university students (Table 2).

TABLE 2. Effects on students of using IBL.

	Authors and Year	Increase in Knowledge	Search Skills	Academic Performance	Self-Confidence	Self-Learning	Motivation	Critical Thinking
1	Aditomo et al. (2013)	Yes	Yes	-	-	Yes	Yes	Yes
2	Akgul (2006)	Yes	Yes	-	-	Yes	-	-
3	Azer et al. (2013)	Yes	Yes	Yes	Yes	Yes	Yes	-
4	Barbera et al. (2017)	Yes	-	-	-	Yes	Yes	-
5	Bolton et al. (2009)	Yes	-	-	-	Yes	Yes	Yes
6	Brown (2010)	Yes	Yes	-	Yes	-	-	Yes
7	Bugarci et al. (2012)	Yes	Yes	-	-	Yes	-	-
8	Deignam (2009)	Yes	Yes	Yes	-	Yes	Yes	-
9	Ghahremani-Ghajar et al. (2012)	Yes	-	-	-	Yes	-	Yes
10	Gros and López (2016)	Yes	-	-	-	Yes	-	-
11	Healey et al. (2010)*	Yes	Yes	-	-	Yes	Yes	-
12	Horne et al. (2007)	Yes	Yes	-	Yes	-	Yes	Yes
13	Hosein and Rao (2017)	Yes	Yes	-	Yes	Yes	Yes	-
14	Irwanto et al. (2018)	Yes	Yes	Yes	-	Yes	-	Yes
15	Ji and Bo (2017)	Yes	Yes	-	-	Yes	Yes	-
16	Justice et al. (2009)	Yes	-	Yes	-	Yes	Yes	-
17	Kienzler and Fontanesi (2017)	Yes	Yes	-	Yes	Yes	Yes	Yes
18	Kirwan and Adams (2009)	Yes	-	-	Yes	Yes	Yes	-
19	Konokman and Yelken (2016)	Yes	Yes	Yes	-	Yes	Yes	-
20	Levy et al. (2009)	Yes	Yes	-	-	Yes	Yes	-

21	Levy and Petrulis (2012)	Yes	-	Yes	Yes	Yes	Yes	Yes
22	Luke (2006)	Yes	-	Yes	-	Yes	-	-
23	Magnussen et al. (2000)	Yes	-	-	-	-	Yes	Yes
24	McLean and Baker (2004)	Yes	-	-	-	Yes	Yes	Yes
25	Morris and Turnbull (2004)	Yes	-	-	Yes	Yes	Yes	-
26	Oliver (2008)	Yes	Yes	-	Yes	Yes	Yes	-
27	Ortlieb and Lu (2011)	Yes	Yes	-	Yes	Yes	Yes	Yes
28	Piyayodilokchai et al. (2013)	Yes	Yes	Yes	-	Yes	Yes	-
29	Spronken-Smith and Walker (2010)	Yes	Yes	-	-	Yes	Yes	-
30	Tatar (2015)	Yes	Yes	-	-	Yes	Yes	-
31	Zafra-Gómez et al. (2015)	Yes	-	Yes	Yes	Yes	Yes	Yes

Source: Own elaboration.

Objective 1. *Examining the effect of using the IBL methodology in the teaching-learning process*. Of the studies, 33% set out to evaluate what the main effects of implementing the IBL methodology were. For example, analysing students' misgivings about the implementation of IBL for preparing digital stories, or the use of alternative measures taking Pierce's triadic model of inference as a starting point (Konokman & Yelken, 2016; Ortlieb & Lu, 2011); observing how students accept information about the current economic and financial situation after working on the topic (Zafra-Gómez et al., 2015); examining possible departmental resistance to the implementation of IBL and the benefits it provides for graduates (Justice et al., 2009). The studies showed: 1) positive effects in the adoption of the IBL methodology, so long as the process is appropriately structured; 2) a significant increase in students' knowledge and skills in the short and long term; 3) an improvement in their academic performance (Azer et al., 2013; Konokman & Yelken, 2016; Justice et al., 2009). The results of the study by Levy et al. (2009) show the great potential of the IBL methodology, as it offers opportunities for reflection and discussion that foster a high degree of empowerment; to do this, teaching staff need to have access to a wide range of IBL experiences, some structured and others led by the students.

The students identified the need to take the social aspect of IBL into account, as they learnt from the efforts of their classmates as well as their own efforts. Although they were aware of a possible increase in anxiety and stress in the learning process, they viewed it positively owing to the benefits for their learning (Deignan, 2009; Ji & Bo, 2017; Luke, 2006). Healey et al. (2010) observed that IBL fosters students' interest in curriculum content and increases their motivation as they believe that pursuing postgraduate study is practical.

Objective 2. *Evaluating the development of research competences in students*. Of these studies, 11% set out to examine students' own awareness of the development of their research competences when writing reflective essays (Hosein & Rao, 2017), and to evaluate how the inquiry based teaching process is understood and experienced, relating it to the students' epistemological construction (Levy & Petrulis, 2012). These studies showed a growing enthusiasm among students for research learning, as they see the potential of a student-centred methodology for their future training (Hosein & Rao, 2017; Levy & Petrulis, 2012). Akgul (2006) observed that students regarded science as a process of finding more truths or facts, and that their levels of learning depended on their involvement and commitment.

Objective 3. *Promoting learning tasks or results by implementing IBL.* Of these studies, 22% use IBL as a way of introducing values related to volunteering in a non-profit organisation (Bolton, Brennan, & Terry, 2009), or of investigating students' achievement when a cyclical learning model is assumed that is complemented by multimedia resources (Piyayodilokchai et al., 2013). We observed that this methodology is effective for inverting the role of the student as a mere passive receptor; students were able to learn how learning is managed, they accepted challenges, and their self-confidence increased (Bolton et al., 2009; Kienzler & Fontanesi, 2017). Aditomo et al. (2013) identify eight research tasks for achieving satisfactory learning outcomes after applying IBL: academic research, simplified research, inquiry-based literature, inquiry-based discussion, applied research, simulated applied research, implementing practice, and role playing. After implementing IBL, a wide range of educational objectives were achieved that involved cognitive, metacognitive, affective, social, and epistemological aspects.

Objective 4. *Exploring the development of critical thinking*. Of these studies, 19% set out to explore what the students' critical perspectives were when a research challenge was posed in language learning (Ghahremani-Ghajar et al., 2012), or to examine changes in students' critical thinking after implementing IBL, comparing their opinion at the start of their course with their opinion at the end of it (Magnussen et al., 2000; Tatar, 2015). It was apparent that if the IBL methodology was well structured and implemented in small groups, it provided benefits for university students, and a significant impact on critical thinking and problem-solving skills was also noted (Irwanto et al., 2018; Ghahremani-Ghajar et al., 2012; Tatar, 2015; Gros & López, 2016). Bugarcic, Zimbardi, Macaranas, and Thorn (2012) observed that using IBL promotes meaningful learning and encourages students to approach ideas and critically evaluate what they encounter in a "real" research setting, while at the same time obtaining a high level of detailed knowledge of the content.

Objective 5. *Promoting personal skills and competences for self-learning.* Of the studies, 15% had the aim of examining whether using IBL has an impact on mo-

tivation, self-confidence, self-learning, scientific attitudes, and engagement in participation (Ji & Bo, 2017; Oliver, 2008; Brown, 2016), or examining students' capacity for autonomy in their learning, positively and/or negatively, and their reactions and interpretations in the face of cyclical research (Luke, 2006). The students reported that the IBL methodology stimulated their desire for knowledge, stimulated their enthusiasm for self-learning, and strengthened their self-efficacy and motivation.

In general, studies identify: a) increased student motivation, b) improved understanding of subjects and of their relevance to society, c) increased collaboration between students when working together to achieve a common goal, d) an increase in joint responsibility in carrying out tasks, e) improved interpersonal skills and skills in performing work roles (Bruder & Prescott, 2013; Frezell, 2018). One hundred per cent of the studies showed that using IBL fostered increased knowledge by students; 61% demonstrated a development of research skills; 29% showed an increase in academic performance; 36% an increase in students' self-confidence; 90% an increase in students' self-learning; 70% enhanced motivation for learning; and 40% an increase in critical thinking.

3.4. Some limitations of the studies

This section sets out some limitations of the studies:

1) The research in the articles was carried out on the basis of a particular IBL model and with very specific groups of students; although a snapshot of the students' experience and of facilitator perspectives in a given context was obtained, the application of IBL with other samples should be explored to consider generalising the results (Horne et al., 2007; Spronken-Smith & Walker, 2010).

2) In some studies, the limitations derive from the university structures, as there can be resistance in departments as they do not see obvious benefits in the implementation of IBL or they believe that it might alter existing power structures and how resources are assigned (Justice, Rice, Roy, Hudspith, & Jenkins, 2009).

3) Other limitations derive from the research method used; using a qualitative method risks biasing students' responses towards an excessively optimistic focus on IBL if the interviews are carried out by the principal researcher (Luke, 2006). The use of focus groups can influence results as students who enjoyed the class or interacted with the teacher-researcher sometimes talk more (Luke, 2006; Morris & Turnbull, 2004). Regarding the quantitative methodology, standardised measurement instruments can bypass the experiences and emotions generated in the process by only offering students closed answers (Magnussen et al., 2000).

4. Conclusions

This systematic review identified 31 articles on IBL experiences in social science and health science courses. These experiences were not limited to a single country and they approached the appli-

cation of IBL from different research perspectives (quantitative, qualitative, and mixed). The objectives identified in the studies not only focus on establishing the possibility of implementing IBL in the classroom but also on understanding what the main effects are on the teaching process, what research competences the students acquire, how learning results are promoted, how critical thinking is developed, and how personal skills and competences are fostered. To discover whether this methodology can be beneficial for the teaching–learning process and the development of students' research competences, the authors applied different IBL modes and determined their strengths and weaknesses. As strengths, the authors identified: exploring knowledge in greater depth, promoting cooperative learning, students' commitment in their self-learning, and increased critical thinking. Among the weaknesses, the following were noted: the inability to cover the students' learning expectations and university hierarchies' misgivings about IBL.

IBL favours meaningful learning by university students by involving them in a process of doing research and it strengthens the inquiry-teaching bond so long as the process allows agents to express their experiences and emotions. To carry out IBL processes, it is necessary to emphasise to students the need to construct knowledge and strengthen their responsibility in the teaching-learning process (Healey, 2005; Levy & Petrulis, 2012). The IBL methodology provides a strong social scaffolding and active learning, fostering personal research skills, joint responsibility in completing tasks, and the capacity for reflection in learning situations (Bruder & Prescott, 2013; Frezell, 2018; Hmelo-Silver et al., 2007).

In essence, IBL provides a learning process that: a) fosters the development of research competences in a student cohort that accepts the challenge of their self-learning; b) provides a space for knowledge creation stimulated by inquiry; and c) fosters students' interest in and commitment to their learning process and doing work of high academic quality.

This study's main limitations are that it restricted its search to: 1) articles on IBL written in English, 2) articles that applied this methodology to qualifications from the social sciences and health sciences in a university setting. In future research, it will be necessary to expand the search criteria to include works written in Spanish and works that cover other fields of knowledge and educational stages. Nonetheless, this study provides valuable information for identifying possibilities for implementing IBL in qualifications that educate future professionals in the fields of the social sciences and health sciences.

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