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Holding an Inquiry into the Instruction in Türkiye: A Systematıc Review

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Abstract:
The purpose of this systematic review is to investigate the studies focusing on inquiry-based instruction (IBI) conducted in the context of Türkiye. The review reported 34 research articles, published from 2005 till 2024 in ERIC, Web of Science, ULAKBIM, and EBSCOHOST. The studies fitting into the following criteria were included in the present study: 1) contemporary research articles dating from 2005 to 2024 focusing on IBI, (2) studies conducted in the context of Türkiye, sampling Turkish population, (3) studies published in English and Turkish, (4) Peer-reviewed articles, (5) Articles which were based on empirical data. The results of the review showed that IBI related studies conducted in Türkiye have the following major focuses: achievement, attitudes, its effect on various skills, its implications for teacher education and perspectives of the students related to Inquiry-based method and traditional classrooms. The results of the review showed that the majority of the studies signalled the development of a range of skills such as researching, scientific processing and problem solving, developed more positive attitudes towards learning and improved their self-efficacy thanks to inquiry-based method. The studies indicated that IBI enhances students' scientific processing skills, fosters problem-solving abilities, and improves their research competencies. However, the studies in this context also signalled some difficulties to address such as lack of enough materials, guidance, training as well as time constraints. Therefore, there is a need to address these issues in learning environments and for research experimental studies illuminating under which conditions this method is working efficiently are needed.

Keywords: Inquiry-based instruction, Case-based learning, Project- based learning, Problem- based learning, Systematic review, Türkiye

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INTRODUCTION

In our natural learning process, that is before we start schooling, we observe, touch, listen, taste, discover, try, ask questions, find alternative solutions to the problems around us and thus learn. However, Formal education often transforms learning into a teacher-centred process, where students passively receive knowledge from instructors. However, this type of learning has been long criticized as it perishes curiosity and all the joy that can be extracted from learning. As it has become increasingly evident that this method of learning deviates from the 'natural' process, we have been witnessing a shift in teachers and students' role as of 1960s. Although asking questions has always been appreciated, these years have witnessed a move from teacher centred approaches to student centred approaches in which questions are asked by the student to construct knowledge rather than to repeat and keep it. This transformation has led to the adoption of the educational principle that 'wisdom cannot be told and the role of the learner was transformed from passive listener to explorer (Bransford, Franks, Vye & Sherwood, 1989).

The process of inquiry involves observation and asking questions so as discover an unknown phenomenon and has an essential place in the development of mankind. It is the process of inquiry which made Newton ask more about the falling apple and Archimedes about the floating bath porringer. In contemporary education system, inquiry-based instruction consists of scientific investigation through classroom practices, put the learner into the centre of the process helping him/her construct knowledge in the framework of his/her experiences and aiming knowledge acquisition and development as the ultimate purpose (Blanchard, Southerland, & Granger, 2008). Today, Inquiry-based instructed is now highly favoured as a method since students explore the ins and outs of scientific processes and they reach an understanding of how these processes are related to each other with the help of this method (Singer, Marx, Krajcik, & Clay-Chambers, 2000). In addition, there are a great number of studies supporting the notion that inquiry-based instruction fosters a deeper understanding of the subject matter and facilitates transfer process which refers to the application of knowledge outside the classroom (Blanchard et al.,2008). On the other hand, there are also misunderstandings of inquiry-based instruction, and so its application is sometimes perceived as the inclusion of hands-on practice only. According to Schweingruber, Keller and Quinn (2011), it is more appropriate to use the term scientific practices instead of inquiry "to better specify what is meant by inquiry in science and the range of cognitive, social, and physical practices that it requires" (p.30). As Osborne (2014) indicated students should also gain awareness on how scientists establish credibility for the claims that they put forward. Thus, we can conclude that the process of inquiry includes not only finding answers but also validating them by formulating an accurate conception of the process. Furthermore, inquiry based instruction significantly contributes to development of questioning skills, scientific process skills and self-regulation skills giving students the opportunities to make discoveries at their own pace and to use and develop these skills (Wu & Hsieh, 2006). Besides, it has been reported to enrich scientific curiosity (Kırıcı & Bakırcı, 2021).

Inquiry-based instruction is accepted as a constructivist method as it includes several essential elements of constructivism such as prior knowledge, social negotiation, self-regulation, and meaningful tasks (Loyens & Rickers, 2011). Inquiry-based instruction can be said to bring constructivist theory into practice as it involves all these elements in the process. On the other hand, it subsumes different types of instruction which includes different methods of learning and teaching within the framework of constructivist theory. According to Barrows (1986), three

important aspects can vary in different student-centred approaches are the design and format of the problem, project or case, the degree to which learning is teacher-centred or learner-centred; and the sequence in which problems or tasks are offered and information is acquired. According to this classification, we can have four main categories of inquiry-based instruction which are inquiry-based learning (IBL), problem-based learning (PBL), project-based learning (PjBL), and case-based learning (CBL).

In Türkiye, there has been a growing interest in inquiry-based instruction and there has been an increase in the number of studies conducted in this topic since 2000s. Toprakçi et al. (2013) states that Basic Law of National Education and the Law of Higher Education which forms the base for the education system were mainly based on the 'progressive' trend of education. According to progressivism, teacher centred education system in which students are traditionally passive listeners is not the effective way of instruction (Şişman, 2000). Education should serve for continual development and learners should be kept active by constructing new experiences, experimentation and problem resolution. Education should comply with the child's interest. The teacher is a facilitator in this process and guides the learner (Alkan, 1983). These insights into education which are sourced from constructivist perspective lay a foundational ground for a learner centred education. As Piaget (1973) suggested learners need opportunities to have social interaction and experiences so that they can make meaning of the world construct knowledge. Direct instruction should no longer be the major method of learning. Instead, learners should be motivated to set out for their own learning experience (Brooks & Brooks, 1999). For this reason, it is compatible with inquiry-based method which gives the responsibility to the student and suggests the pursuit of following scientific processes like observation and prediction, and further improvement of knowledge by adding new ones in a relation with the already existing ones (Gençtürk & Türkmen, 2007). In addition, Science education curriculum revised in 2017 aims to prepare science literate individuals via inquiry-based learning in Türkiye (Güler & Şahin, 2018). The new curriculum aims to educate individuals to be more active and productive citizens, who develop a unique understanding of the concepts, critically evaluate information and explore the ways to reach knowledge (MEB, 2017). Thus, there has been a shift in the instruction from explanatory methods to inquiry-based learning. As a result, there are several studies in Türkiye investigating the effect of inquiry-based instruction on the progress of students reflected by development of skills or achievement scores. This study investigates the research in the context of Türkiye focusing on inquiry-based instruction so as to analyze the research trends in the area and explore the results of the studies. With this purpose in mind, the following research questions were investigated in the present study:

Research Question 1: What aspects of inquiry-based instruction were explored in the articles published in the context of Türkiye between 2005 and 2024?
Research Question 2: What were the results of the studies focusing on inquiry-based instruction published in the context of Türkiye between 2005 and 2024?

METHOD

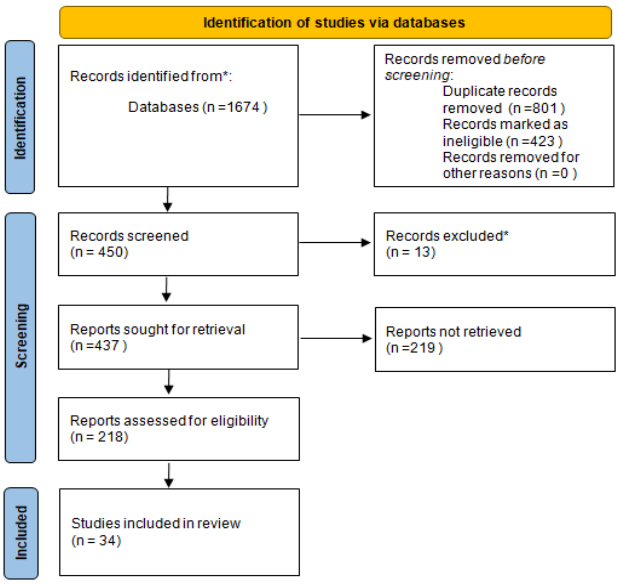
The systematic review was conducted using EBSCOHOST, ERIC, Web of Science, and Ulakbim, as these databases are commonly utilized in educational research due to their extensive coverage of scholarly articles."The following search terms were utilizes inquiry-based instruction, project based learning, case based learning, problem based learning, inquiry-based learning, "sorguya dayalı öğrenme,""proje merkezli öğrenme," vaka çalışması yoluyla

öğrenme," "problem çözme odaklı öğrenme" and each word/ word group searched in combination with Türkiye and Turkish education. In addition, reference lists of relevant identified articles were hand searched on Google scholar. The search was completed on January 28, 2024. When the review was first conducted the year 2000 was selected as the starting point. However, it was seen that the number of the studies conducted in this theme has greatly accumulated after the year 2005 when a new curriculum change was articulated in Turkish educational system aiming to make curriculum more student-centred and constructivist (Güven & İşcan, 2006). Thus, it can be concluded that the curriculum change implemented since 2005 has affected the course of research in the area and inquiry-based instruction has gained prominence. What is more, the latest curriculum change made in 2017 reshaped the curriculum to provide more room for inquiry-based approach (MEB, 2017). For this reason, peer reviewed journal publications starting from 2005 to 2024 inclusive were identified for the thematic review. The study was conducted with the help of PRISMA 2020 checklist. Certain inclusion and exclusion criteria were determined for the review. The studies fitting into the following criteria were included in the present study: 1) contemporary research articles dating from 2005 to 2024 focusing on IBI (2) studies conducted in the context of Türkiye, sampling Turkish population, (3) studies published in English and Turkish, (4) Peer-reviewed articles (5) Articles which were based on empirical data. The studies fitting into the following criteria were excluded in the present study: (1) conference proceedings or book chapters, thesis, and books (2) review studies and meta-analyses (3) studies sampling populations other than Türkiye (4) studies dealing with online education or special education.

These inclusion and exclusion criteria were determined after careful research and consideration. Studies which were not carried out in the context of Türkiye were excluded as they were not in line with the aims of the study. Peer reviewed articles were included to keep a certain standard of publications. Online education and special education were not included as they require different methods to foster student learning. In order to keep a record of the review process, the Figure 1 PRISMA diagram was created (Moher et al., 2015).

Figure 1

The PRISMA flowchart, summarizing the inclusion and exclusion process in the systematic review



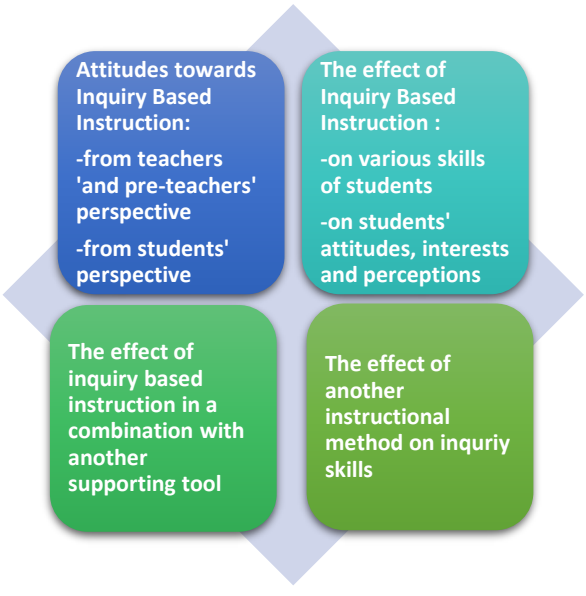
After the implementation of the inclusion and exclusion criteria, 34 studies were found eligible for the review. The studies which fitted into the criteria of the research were analyzed via content analysis method. They were classified under certain codes and reported considering these codes. The definitions of the codes were clearly noted so as to make sure that rationale of the codes in each study can be clearly expressed. Once the coding process is completed, the results of the systematic review were reported as the themes in the studies.

RESULTS AND DISCUSSION

The results of the review showed that studies focusing on inquiry-based instruction were shaped around the following themes: studies measuring the effect of inquiry-based instruction on student achievement, development of various skills such as scientific processing, research, teaching ability as well as vocabulary learning, or attitudes towards a specific course, opinions of students or teachers on the relevant method and use of this method by supporting it with a tool. In addition, a study that is Aslan (2017) which measures the effect of another method namely learning by teaching on the inquiry skills of the students were included to explore the effect of a different method on inquiry competency. The research designs of the studies were experimental, quasi-experimental, action or descriptive research based on qualitative data. Majority of the studies included both qualitative and quantitative data, so they have mixed designs. In this study, the themes and major findings of the inquiry-based instruction are reported so as to see overall picture of the relevant method in Türkiye. Figure 1 provides a summary of the themes of such studies:

Figure 2

Themes of the Studies Investigating Inquiry-based Instruction



In the studies conducted in the context of Türkiye, there are various studies reporting the positive effect of inquiry-based instruction on students' or pre-service teachers' attitudes towards a specific course (Kılınç,2007; Yaşar & Duban, 2009; Akınoğlu, 2008; Köksal & Berberoğlu, 2014; Şen &Vekli 2016; Güler & Şahin, 2018). Research shows that attitudes of students towards particular course has changed in a positive way and there is an increase of

interest from students' perspective thanks to the relevant method (Yaşar & Duban ,2009; Akınoğlu, 2008). In addition, Güler and Şahin (2018) states that participants stated a positive attitude towards the approach and emphasized advantages such as concreting information, fostering creativity, entertaining and promoting research. On the other hand, Tekin and Mustu (2021) explored the effect of research-inquiry-based teaching strategies on students' academic achievements, attitudes, and scientific process skills and found a significant effect of inquiry-based instruction on these three areas. Similarly, Köksal and Berberoğlu (2014) indicate the positive effect of guided-inquiry approach on the Turkish students' cognitive and affective characteristics. Research also shows that the process of implementation of inquiry-based instruction is worth exploring as well as the outcome. Kılınç (2007) underlines that the knowledge learned through inquiry-based laboratory activities were more permanent pupil-centered than the traditional methods, and thanks to this method, students studied cooperatively and benefit from different aspects through group discussion. Similarly, Sarioglan and Gedikci (2020) points out that the rate of giving scientific answers about the density concept of increased, whereas the rate of misconceptions decreased in science classes, more enjoyable, and more as a result of inquiry-based instruction. This study also showed that the students could retain scientific knowledge 6 and 24 weeks after the instruction after this method have been applied. On the other hand, Sen and Oskay (2017) underscore that although inquiry learning activities were more effective in improving the achievement, there was no statistically significant mean difference between experimental and control groups with respect to attitude toward chemistry. However, no negative effect of the method was reported either.

In addition to these studies which focus on inquiry-based instruction in a general sense, there are studies which investigates the sub-branches of this method such as case-based learning and problem- based learning and project-based learning (Çıbık, 2006; Ayyıldız & Tarhan, 2012; Çelik, Çevik & Haşlaman, 2012; Adanalı & Alim, 2017; Kimsesiz Dolgunsöz & Konca, 2017; Sarı, Alıcı & Şen, 2017; Çelik, Ertaş & İlhan, 2018; Koç, 2018; Uzun & Kilis, 2018). Among these studies, Koç (2018) puts forward a crucial point in the context of Türkiye about the application of inquiry-based method. He states that the reason why problem-based instruction has not found much room in Türkiye is mostly because of extensive use of traditional teaching methods such as lectures as the usual way of teaching. For this reason, the participants reported that they initially had difficulty in getting accustomed to this new type of instruction. However, problem-based learning process positively contributed to their self-confidence and the development of their academic research skills and their sense of responsibility. Similarly, Kimsesiz Dolgunsöz & Konca (2017) states that PBL was rarely adopted in EFL classes in Türkiye, but the results of the study show that PBL instruction could increase EFL vocabulary learning gains when compared to common methods. In addition, it can help teacher to keep young learners more active in PBL classes. This shows us that types of inquiry-based instruction methods have not been applied enough although they have various benefits to learners in a range of subjects and even in English language learning.

Research exploring the types of inquiry-based instruction indicates several positive contributions of them. To illustrate, Çelik, Çevik and Haşlaman (2012) states a vital benefit of case-based instruction related to teacher training process. They conclude that case based learning provide a valued opportunity to engage developing teachers in solving real life problems that tend to occur in actual teaching by putting the theoretical information that they learn in classroom into practice. Similarly, Sarı, Alıcı & Şen (2017) integration of problem-based activities enabled students to develop 21st century research skills as well as increasing their interest in the profession of engineering and helping them to select their future career.

Uzun & Kilis (2018) took a different approach and used case based learning to teach ethics to the students. They concluded that thanks to this method, the participants have mastered all types of unethical behaviors and misuse of information communication technologies since they have examined and discussed a variety of sample cases. They have raised awareness and reported an urgent need of raising awareness and educating other people, particularly for families and children at small ages. They also favored case-based learning designed course and benefitted from it very much to gain basic skills and knowledge about ICT ethics. This provides us the evidence that case-based learning can be used to teach various subjects including ethics. In the same way, there are also several studies such as Ayyıldız & Tarhan (2012) underlining the effect of case-based studies on the positive attitude development of students towards lessons such as Chemistry.

Moreover, there is a series of studies in the context of Türkiye that evaluates the effect of inquiry-based instruction involving project based, case based and problem-based learning on the achievement and skills development of students. Adanali and Alim (2017) is the only study identifying that PBL did not lead to a significant difference regarding the students' problem-solving skills, since the effect size is small ($\eta^{2=}$ .013.). However, there are many studies suggesting the positive impact of inquiry-based methods on achievement and competencies (Akınoğlu, 2008; Yaşar & Duban, 2009; Çorlu & Çorlu,2012; Köksal &Berberoğlu, 2014; Şen & Vekli, 2016; Kimsesiz Dolgunsöz & Konca, 2017; Sen & Oskay, 2017; Sarıoğlan & Abacı, 2017; Çelik, Ertaş & İlhan, 2018). Among these Sarıoğlan and Abacı (2017) touches upon a different impact of the method and emphasizes that owing to the effect of inquiry-based learning on 5th grade students, students have started to give more scientific anwers to the questions and the frequency of misconceptions encountered during instruction has decreased. Similarly, Sen and Oskay (2017) indicated that 5E inquiry learning activities were more effective in improving the achievement in chemical equilibrium compared to lecture-based traditional activities. Azizoglu et al. (2022) present similar research investigating the effect of 5E Inquiry Learning Activitieson students' learning of the topic of the main subatomic particles forming the atom as well as on their level of motivation. The results of this quasi-experimental research signal a significantly positive impact of 5E Inquiry Learning Activities on academic achievement as compared to traditional instruction. However, it did not produce a significant difference in student motivation compared to traditional methods. Similarly, Şensoy and Güneş (2023) examined the effect of inquiry-based learning on academic achievement and scientific process skills. The results of their quasi-experimental research showed that the contribution of inquiry-based instruction to scientific processing is significant while it does not have a significant effect on academic success when it was analyzed within the framework of the "human body systems" unit at the seventh-grade level. Furthermore, Yaşar and Duban (2009) added that inquiry-based instruction positively contributed to the development of students' scientific process skills and the acquisition of science technology-society-environment gaining. Similarly, Cevik and Surmeli (2024) explored the effect of inquiry-based instruction on 7th grade students' conceptual development on geoscience subjects. They provided students with lesson plans and activities within the framework of IBI method and tested their understanding through Geoscience Concept Achievement. The results of the study showed that the application of this method positively contributed to the conceptual development of 7th graders in the field of geoscience. Erkol and Şahintepe (2020) investigated the use of the same method in a different area which is metacognitive awareness and tested the results of the use of IBI via Metacognitive Awareness Scale B form (MAI-B) and Semi-Structured Interview Forms. The results of the study showed statistically significant results on the increase of metacognitive awareness,

scientific thinking, independent learning as well as cooperation and positive beliefs of self-efficacy.

In addition to the studies focusing solely on inquiry-based instruction, there are studies which combine this method with another method or a supporting tool (Balım et al., 2016; Buyruk & Bekiroğlu, 2017; Kırıcı & Bakırcı, 2021; Konokman & Yelken, 2016). Konokman and Yelken (2016) utilizes inquiry-based instruction in a combination with digital stories to measure the effect this learning approach on prospective teachers' resistive behaviours toward research and technology-based instruction. They conclude that the resistance of participants towards technology-based instruction has lessened with the help of inquiry-based learning. While preparing digital stories within the framework of the relevant method, they witnessed how technology had been integrated into instruction, encountered technology-based instruction's innovativeness, and explored the advantages of digital storytelling, so they developed a more positive attitude compared to the control group. Buyruk & Bekiroğlu (2017) reports a similar result by evaluating the effect of inquiry-based instruction in a combination with modelling. They state that putting modelling explicitly into the centre of inquiry facilitates conceptual learning. Thus, model building and formation in inquiry can be regarded as a way not only to illustrate what learners have already known but also to create new knowledge. Besides, creating associations with other phenomena under the framework of epistemic characters of knowledge and expanding on these associations with interactions in inquiry learning environment enriches students' understanding.

Kırıcı & Bakırcı (2021) offers enlightenment to the understanding of benefits and challenges of application of inquiry-based learning approach by supporting it with STEM curriculum. A pre-test and post-test quasi-experimental design with the control group was utilized in the research. The sample included 64 secondary school students. The results of the intervention obtained through Wilcoxon signed ranks test, Mann-Whitney U-test, dependent t-tests, there was a significant difference in scientific creativity test scores of the experimental group. These results indicated that the intervention has the potential to enhance the scientific creativity of seventh grade students. Finally, Balım et al., (2016) explores the effect of inquiry-based instruction in a combination with concept cartoons. They state that students' inquiry learning skill perceptions scores differ significantly in favour of experiment groups who received the instruction through concept cartoons supported inquiry-based learning method. However, no significant difference found between groups in terms of knowledge-daily life relation scores which measures the transfer of classroom knowledge into real life.

Another study type that explored inquiry-based instruction in Türkiye was comparative studies. These studies have presented an interesting perspective on the relevant instruction as they measured the perception of this instruction type in relation to various aspects such as country, teaching experience and grade level rather than exploring its effect or perception of it from the perspective of a specific population. There were 3 studies conducted in this pattern and included in this review namely articles by Isiksal-Bostan et al., (2015), Senler (2015) and Havuz & Karamustafaoğlu (2016). Table 1 summarizes the design and results of these studies:

Table 1
A Summary of Comparison Studies Focusing on Inquiry-based Instruction in Türkiye

Author, Year	Purpose	Study Design	Sample	Major Findings
Senler (2015)	To compare Turkish and American middle school students' views of scientific inquiry	Quantitative data was collected via the Views of Scientific Inquiry-Elementary (VOSI-E) scale.	-489 middle school students (238 from the United States, and 251 from Türkiye) -Convenience sampling method	A significant difference between the countries was found in terms of students' views of scientific inquiry.
Havuz & Karamustafaoğlu (2016)	To compare the perspectives of prospective teachers towards inquiry-based method in accordance with their grade level	Quantitative data was collected via the Scale of Attitude towards Inquiry.	-158 prospective science education teachers studying in Amasya University -Random sampling method	The results of the study indicated that prospective teachers develop a more positive attitude towards the relevant method as their grade level increases.
Isiksal-Bostan et al., (2015)	To examine the relationships among Turkish classroom, science and mathematics teachers' beliefs toward using inquiry-based approaches and the years of experience	Quantitative data was collected via the Teacher Beliefs toward Instructional Approaches Questionnaire-Revised Scale.	258 teachers working at an elementary school in Ankara, Türkiye	The teachers with an experience of more than 16 years had significantly more favorable beliefs on using inquiry-based instructional approaches than the teachers with an experience of 6-10 years.

These studies are particularly distinctive as they compare the views of different groups on inquiry-based instruction rather than interpreting the views of one single group. Senler (2015) studied the views of Turkish and American middle school students on the matter and found a significant difference between them. According to the results of this study, American students demonstrated more contemporary views on the aspects of "all investigations begin with a question", "scientists collect empirical data to answer their questions", and "data and prior knowledge are used to answer questions" while Turkish sample demonstrated more contemporary views on the aspect of "there is no single scientific method." He concludes that while American students are exposed to more hands-on practice and the procedures of inquiry-based method, Turkish students are exposed to various methods such as traditional, explanatory and inquiry-based. For this reason, whereas American students hold up-to-date information on the relevant method, Turkish students develop a more flexible approach to scientific way of learning.

Havuz & Karamustafaoğlu (2016) and Isiksal-Bostan et al., (2015) compares the views of prospective teachers and teachers' views on inquiry-based instruction taking their grade and years of experience respectively. They have similar results as they both indicate that the teachers become more favoured of the relevant approach as their grade or year of experience increases. Isiksal-Bostan et al., (2015) also add that beliefs in using inquiry-based approaches are positively associated with beliefs in using technology-enhanced approaches most probably because both approaches fosters to go out of ordinary and explore something new.

On the other hand, the reviewed studies indicated a few difficulties in the process of application of inquiry-based instruction. Akınoğlu (2008) states time constraint as the major challenge while Güler & Şahin (2018) reported difficulties such as lack of materials, experience, time and skills. What is more, Bayram (2015) states that teacher candidates experienced extrinsic difficulties such as students' readiness, materials, and time, and they also faced with intrinsic difficulties such as guidance, content knowledge, process knowledge, and paradigm change while designing inquiry-based activities.

Finally, Aslan (2017) opens a new window and explores the effect of another approach on inquiry skills of students. This study has been included into this review as it presents us a different path to facilitate the inquiry skills of students. He concludes that learning by teaching has a positive effect on the prospective science teachers' inquiry skills particularly on three thematic dimensions; information, thinking and affective. For this reason, learning by teaching can also be a method to develop inquiry skills of students.

CONCLUSIONS AND FUTURE SUGGESTIONS

This systematic review examined inquiry-based instruction (IBI) studies conducted in Türkiye, highlighting their contributions and challenges. The results of the study show that there are several studies surveying different aspects of this method proving the increasing interest in the method and efforts in making education more learner centred. The studies show statistically significant conclusions in favour of the method although it cannot be defined as a silver bullet addressing all educational problems.

The studies included in this review also indicated that IBI has a positive contribution on various skills such as science processing, problem solving and researching, attitude towards the course and achievement. This is compatible with the studies conducted outside the country (i.e. Blanchard et al., 2008; Krajcik, and Clay-Chambers 2000; Singer et al., 2006; In addition, just as the international studies (i.e. Loyens & Rickers, 2011), the ones conducted in Türkiye analyzed the relevant approach from a constructivist perspective and placed the learner his/her needs, ideas, attitudes and skills into the centre. On the other hand, the studies in this context signalled some difficulties to address such as lack of enough materials, enough knowledge on the implementation of this type of instruction, guidance and skills and also time constraints as also stated by Büyükbayraktar (2023). These difficulties should be recognized and addressed while inquiry-based instruction is employed.

Furthermore, there are studies in Türkiye comparing perceptions of inquiry-based instruction in different populations such as with American students or with more experienced teachers or older peers. However, although there is plenty of international research assessing the effect of inquiry-based approach on critical thinking and knowledge retention, there are not many studies in this topic in the context of Türkiye as studies are mostly concentrated on attitudes or views of this approach. For this reason, future research should prioritize experimental studies to evaluate the impact of IBI on students' skill development comprehensively.

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