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Experimental Self-Efficacy in Biology Education: A Systematic Literature Review

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Abstract

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The aim of this study was to examine the status of experimental self-efficacy in biology education in national and international literature. The research was designed using a systematic literature review as a qualitative method. The PRISMA statement was taken into account to ensure reliability and validity in the research. The keywords “experiment self-efficacy, experimental self-efficacy, lab self-efficacy and laboratory self-efficacy” were determined as search terms and all results were reduced to biology and science. The searches were conducted on 6 databases [Web of Science, Scopus, Science Direct, ERIC (Education Resources Information Center), Google Scholar and National Thesis Center] without any limitations such as time period or language preference. 19 studies were included in the research. Content analysis was used in data analysis. As a result of the research, it was determined that the studies were mostly conducted in 2020-2021, in international publications and in Türkiye on a country basis, in the field of science, with quantitative methods and through scales. It is recommended to focus on qualitative, scale development and intervention-based research in the field of biology education.

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Introduction

Science and technology follow developments in biology to keep pace with the times. Biology experiments and observations offer solutions to various problems, big and small, in our lives, from biological warfare to nutrigenetics. Biology, which is of vital importance, should fill its place in education by using field and laboratory studies. According to research, when biology is approached in an applied way, learning is meaningful, complete and useful (Kırpık & Engin, 2009).

Although critical, the application of biology to practice is not easy in many respects. The first reason that comes to mind for this is the lack of appropriate environment and materials (Akgün, 2005; İnce & Kutlu, 2017; Koç Ünal & Şeker 2020). However, it can be said that in addition to such financial inadequacies, the low level of experimental self-efficacy, plays a significant role in characterizing biology as theoretical, rote, boring and difficult (Şimşek et al., 2012; Aydın Gürlü, 2023). Damerau (2013) defined the experiment self-efficacy as the belief that a person can successfully conduct an experiment. In fact Bandura argues in Self-Efficacy Theory (1995) that beliefs are decisive on behavior. This context can be explained by Gandhi's words too, "People generally become what they believe they are. If I believe I can't do something, that belief takes away my power to do it. If I believe I can, I find within myself the power to do it, even if I don't have it at first" (Arseven, 2016). From this perspective, that Damerau's (2013) found individuals with low experimental self-efficacy approach experiments more hesitantly, which is very important for biology education.

The literature has various studies on this topic in the fields of biology and science education. Some of these are the chemistry laboratory self-efficacy scale study developed by Alkan (2016), the study of Akkiş (2024) to increase laboratory self-efficacy in science education, the study of Cramman et al. (2024) revealing the negative impact of the COVID-19 period on experiment self-efficacy, and the study of Reinboth et al. (2017) revealing that high school students who gained experience with low-cost, simple experiments improved their biology experiment self-efficacy.

Studies generally appear to progress within the framework of chemistry discipline and laboratory self-efficacy. However, when biology is put into action, it penetrates into areas much wider than the confines of the laboratory. At the same time, it is evident that the skill based new Biology Curriculum (2024) in Türkiye focuses heavily on field skills. In order for biology skills to develop, teachers and students must be empowered to believe that they will successfully demonstrate these skills (Atik & Doğan, 2020). For this purpose, the literature on biology education is expected to be a guide. However, there are not enough studies in the literature on belief in biology experiment skills, and accessing such studies is sometimes difficult.

Purpose and Importance of the Research

The aim of this study was to examine the status and place of experimental self-efficacy in biology education in Türkiye and the world. In addition, it is thought that evaluating related studies together will contribute to the literature and future studies by providing a holistic, systematic and detailed perspective that will improve

experiment self-efficacy.

Problem Statement

What is the current status of experimental self-efficacy in biology education in terms of literature?

Sub Problem

What is the status of experimental self-efficacy in biology education in national and international literature?

Method

In this research, which will be conducted with qualitative method, the situation of experimental self-efficacy in Türkiye and the world was examined by systematic literature review. Systematic literature review is a method that presents relevant information, terms, methods and problem frameworks; provides information about useful and useless methods; enables awareness of new problems and puts forward suggestions for the future (Gall et al., 1996). However, the increase in the number of articles and the frequent use of this method with the development of technology have led to concerns about its quality (Toker, 2022). As a solution to this, it was decided to use the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement recommended by Moher et al. (2010) for meta-analyses and systematic reviews in this study. The PRISMA statement is a set of recommendations that researchers are advised to follow, which helps in the complete reporting of reviews based on evidence (Sarkis-Onofre et al., 2021).

Data Collection Process

Considering the PRISMA flow chart (Moher et al., 2010) for the systematic literature review method, national and international scientific publications were selected according to the following steps. This research has been carried out taking into account research and publication ethics; since it was carried out on openly available written documents and using the document review method, it is not one of the studies requiring an ethics committee decision; however, since it is part of the thesis study, it has an ethics permit from the Hacettepe University commission with the E-82474949-300-00003698264 number and 09.08.2024 date.

Study Selection Stages According to the PRISMA Flowchart

Stage 1: Identification

At this stage, the research problem was determined as “What is the status of experimental self-efficacy studies in biology education in Türkiye and the world?” and a research was conducted in this direction. The keywords “experiment self-efficacy, experimental self-efficacy, lab self-efficacy and laboratory self-efficacy” were determined as the search term and all results were reduced to biology education and science education. It was preferred to conduct searches on 6 databases [Web of Science, Scopus, Science Direct, Education Resources

Information Center (ERIC), Google Scholar and National Thesis Center] without any limitations such as time interval or language preference.

Stage 2: Screening

At this stage, the search terms were scanned starting from 15.10.2024 and continuing on dates such as 31.10.2024, 07.11.2024 and 13.11.2024, and a total of 743 records were identified, 739 from the specified databases and 4 from other sources.

Stage 3: Eligibility

At this stage, the criteria for the research problem were determined. First, the studies were checked for compliance with the criteria in terms of titles, keywords, and abstracts. The studies were then rechecked based on their full texts. The selected studies were submitted to expert evaluation and the studies were included in the research after consensus was reached on the opinions. The eligibility criteria determined at this stage are as follows:

- it should only be related to experiment/laboratory self-efficacy in terms of biology education and science education,
- it should not be a study in a non-target field such as chemistry laboratory self-efficacy or laboratory self-efficacy belonging to engineering,
- the scale used in the study, if any, should measure experiment/laboratory self-efficacy,
- it should not be limited to the scale only for classroom-laboratory management,
- it should be an article and national thesis study, not an (unpublished) presentation or international thesis study, and
- it should be open access, and it should not be a duplicate publication.

Thus, after removing the duplicates, it was determined that only 130 full texts out of the remaining 712 records met the biology and science education criteria, but approximately 110 of these were found to be outside the criteria.

Stage 4: Inclusion of Studies in the Systematic Review

It was observed that there were 19 studies remaining that met the specified criteria. The search strategy followed while reaching the 19 studies that were decided to be examined with the PRISMA method suggested by Moher et al. (2010) is shown in Table 1 and Figure 1.

Stage 5: Data Evaluation and Analysis

Studies that were confirmed to be examined for systematic literature review were subjected to content analysis.

The table below shows the evaluation of the number of studies considered according to the search terms and databases, depending on the PRISMA stages.

Table 1. Number of Studies by Search Terms and Databases

Search Terms	WOS			Scopus			Science direct			Google Scholar			ERIC			National Thesis Center		TOTAL	
	R	I	E	R	I	E	R	I	E	R	I	E	R	I	E	N	O	R	E
Laboratory self-efficacy	7	7	0	6	6	0	3	3	0	176	55	121	7	7	0	2	1		
Experiment self-efficacy	2	0	2	3	1	2	8	7	1	91	2	89	23	6	17				
Experimental self-efficacy	4	4	0	6	6	0	7	7	0	262	28	234	81	9	72				
Lab self- efficacy	0	0	0	0	0	0	3	3	0	46	2	44	1	1	0				
Total Record	13	11	2	15	13	2	21	20	1	575	87	488	112	23	89	3		739	582

R: Result, I: Included, E: Excluded, N: Thesis obtained from the National Thesis Center, O: Thesis obtained from other sources.

Of the 739 results, 582 studies were excluded from the systematic literature search. Figure 1 shows the number of studies included in the research and the reasons for their inclusion according to the PRISMA flow chart.

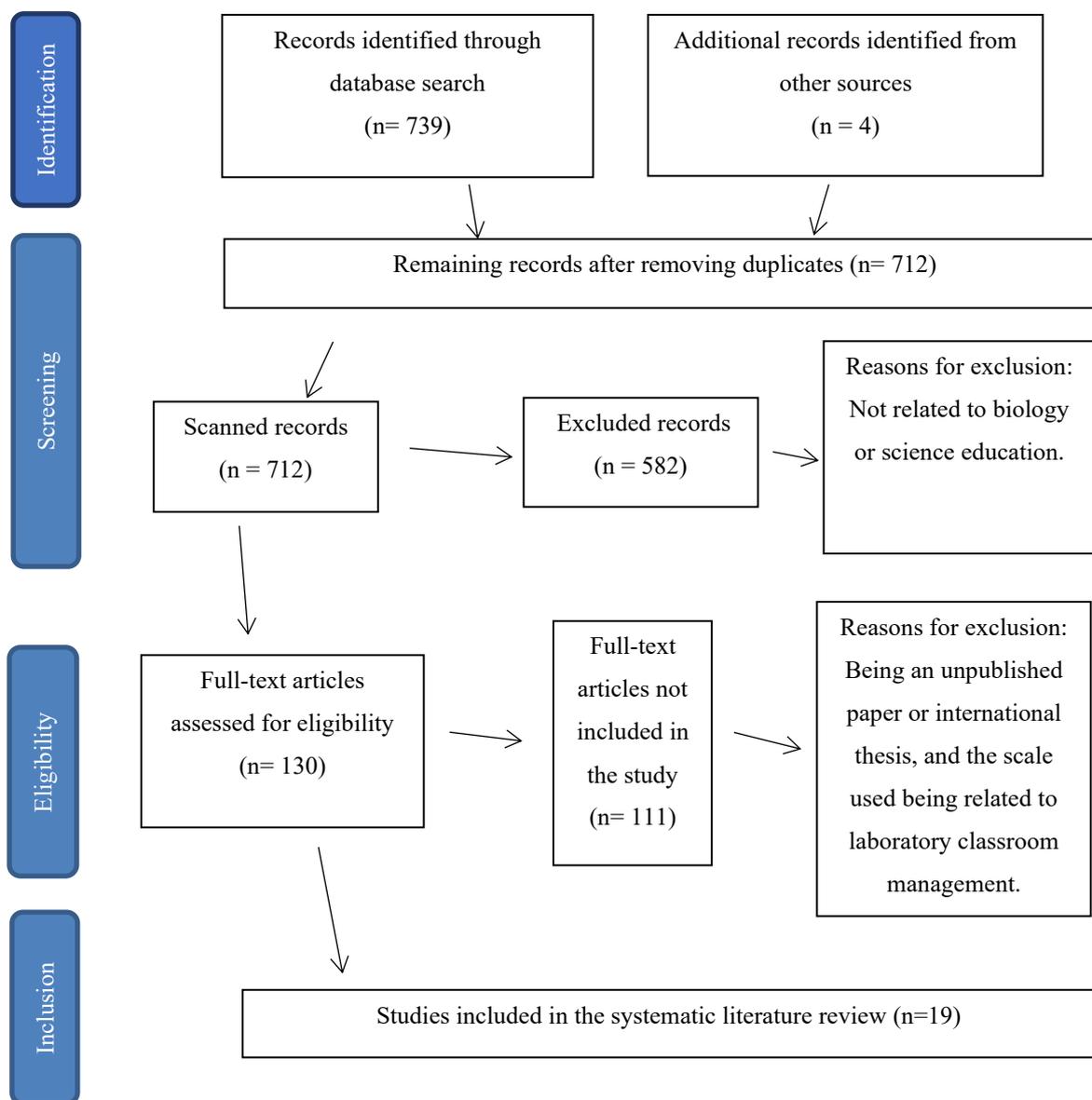


Figure 1. Number and Reasons for Inclusion of Studies

Data Analysis

The data obtained through systematic literature review was examined with content analysis, compared, and separated into themes, codes, and categories. Content analysis was conducted using a Microsoft Excel spreadsheet, focusing on the publication years, countries, methods and patterns, objectives, participants, and data collection tools of the studies.

Reliability

To minimize bias in the analysis of the qualitative data obtained, the data set was analyzed by two researchers. Using Miles and Huberman's (1994) intercoder reliability formula, the intercoder consistency in our study was determined to be 93% ($[\text{Consensus}/(\text{Agreement} + \text{Disagreement})] \times 100$). In addition, research methods, research stages and the entire process are clearly explained and the list of reviewed publications is added in detail to the last part of the study (APPENDIX).

Findings

In this part of the research, the findings obtained from 19 studies included in the systematic literature review are explained in detail and national and international studies are tabulated within the framework of certain characteristics (Appendix). The 19 studies included in the research through systematic literature review were analyzed through content analysis in terms of publication years, national and international origins, countries, participants, study areas, aims, method types, method patterns, data collection tools, and the findings are explained in the tables below.

Table 2. Distribution of the 19 Studies Reviewed by Year

Themes	Codes	Frequency	Percentage(%)
Year	2024	2	10%
	2023	2	10%
	2022	1	5%
	2021	3	15%
	2020	3	15%
	2019	1	5%
	2018	1	5%
	2017	1	5%
	2016	1	5%
	2015	1	5%
	2014	1	5%
	2009	1	5%
	1994	1	5%
	Total	19	100%

According to the data in Table 2, it is clear that the studies were most concentrated in 2020 and 2021 and remained at the lowest level in 2022. The studies cover the years 1994–2024.

The 19 studies included in the research through systematic literature review were analyzed with content analysis in terms of their national and international origins and the findings are explained in Table 3. According to the table, the majority of studies are international publications. National publications were published especially in 2020 and later.

Table 3. Distribution of the 19 Studies Reviewed by Origin

Themes	Alt Themes	Codes	Frequency	Percentage (%)
Origin	National	2024	1	
		2021	2	
		2020	1	
		2018	1	
		2014	1	
		2009	1	
		Total	7	36.84%
	International	2024	1	
		2023	2	
		2022	1	
		2021	1	
		2020	2	
		2019	1	
		2017	1	
		2016	1	
		2015	1	
		1994	1	
		Total	12	63.16%
		General Total	19	100%

The 19 studies included in the research through a systematic literature review were analyzed using content analysis based on their countries, and the findings are presented in Table 4. According to this distribution, although international publications on experimental self-efficacy outnumber national publications, Türkiye is the country where the most studies have been conducted.

The 19 studies included in the research through systematic literature review were analyzed with content analysis in terms of their participants and the findings are explained in Table 5. An examination of the table reveals that the majority of participants in studies on experimental self-efficacy are pre-service teachers. This group consists of pre-service teachers from various fields, including primary school teaching, science, and biology. Studies are also conducted with high school and university students.

Table 4. Distribution of the 19 Studies Reviewed by Country

Themes	Alt Themes	Codes	Frequency	Percentage (%)
Country	National	Türkiye	7	
		Total	7	36.84%
	International	United States	4	
		Canada	1	
		India	2	
		Indonesia	1	
		Philippines	1	
		Germany	2	
		United Kingdom	1	
		Total	12	63.16%
		General Total	19	100%

Table 5. Distribution of Participants in the 19 Studies Reviewed

Themes	Alt Themes	Codes	Frequency	Percentage (%)
Participants	Teacher	-	4	
		Total	4	14.81%
	Pre-service Teacher	Primary School	2	
		Science	7	
		Biology	3	
		Total	12	44.44%
	Student	University	4	
		High School	6	
		Middle School	1	
		Total	11	40.74%
General Total	27	100%		

The 19 studies included in the research through systematic literature review were analyzed with content analysis in terms of study areas and the findings are explained in Table 6. An examination of the table reveals that the majority of the experimental self-efficacy studies were conducted in the field of science, followed by biology and pre-service primary teacher education programs. It has been determined that various sub-fields such as physics and chemistry are included in the field of science, and different areas of expertise (microbiology, molecular biology, cell biology, etc.) are taken into account in the field of biology.

The 19 studies included in the research through systematic literature review were analyzed with content analysis in terms of their aims and the findings are explained in Table 7. As shown in the table, the studies demonstrate that the most common research aim is to examine the variables that affect or are affected by experimental self-efficacy, followed by scale development and adaptation, examining relationships, analyzing opinions, and investigating predictor variables.

Table 6. Distribution of the 19 Studies by Field

Themes	Alt Themes	Codes	Frequency	Percentage (%)	
Field of Study	Primary School	Pre-service Primary Teacher Education Program – (Science Laboratory Course)	Total	2	7.69%
	Science	Physics	Total	15	57.69%
		Chemistry			
		Science			
	Biology	Microbiology	Total	9	34.62%
		Molecular Biology			
		Medicine			
		Biodiversity, Evolution, and Ecology			
		Introduction to Cells, Molecules, and Genes Curriculum for Agricultural Science Education (CASE)			
		Total	26	100%	
		General Total			

Table 7. Distribution of the 19 Studies by Purpose

Themes	Codes	Frequency	Percentage (%)
Purpose	Examining Variables Affected by and Affecting Experimental Self-Efficacy	11	52.36%
	Developing and Adapting an Experimental Self-Efficacy Scale	5	23.81%
	Examining Relationships with Experimental Self-Efficacy	3	14.29%
	Examining Views on Experimental Self-Efficacy	1	4.76%
	Examining Predictors of Experimental Self-Efficacy	1	4.76%
	Total	21	100%

The 19 studies included in the research through systematic literature review were analyzed with content analysis in terms of method types and the findings are explained in Table 8. According to the data in the table, the findings indicate that quantitative methods were used most in the studies examined, followed by mixed and qualitative methods, respectively.

Table 8. Distribution of the 19 Studies Reviewed by Method

Themes	Codes	Frequency	Percentage (%)
Method Types	Qualitative	4	20%
	Quantitative	10	50%
	Mixed	6	30%
	Total	20	100%

The 19 studies included in the research through systematic literature review were analyzed with content analysis in terms of method patterns and the findings are explained in Table 9. The results suggest that the most commonly used method design in the studies is the experimental design (f:9), followed by the predictive design (f:5), scale development and adaptation studies (f:5), case study (f:3) and other designs.

Table 9. Distribution of the 19 Studies by Method Designs

Themes	Codes	Frequency	Percentage (%)
Method Designs	Experimental Design	9	36%
	Predictive Design	5	20%
	Case Study	3	12%
	Total	17	68%
	Scale Development (International 2)	2	8%
	Scale Adaptation (National 2, International 1)	3	12%
	Total	5	20%
	Correlational Pattern	2	8%
	Descriptive Pattern	1	4%
	Total	3	12%
General Total		25	100%

The 19 studies included in the research through systematic literature review were analyzed through content analysis in terms of data collection tools and the findings are explained in Table 10.

Table 10. Distribution of Studies by Data Collection Tools

Themes	Codes	Frequency	Percentage (%)
Data	Scale	19	73.15%
Collection Tools	Survey	3	11.55%
	Document	2	7.70%
	Interview Form	1	3.85%
	Experiment Reports	1	3.85%
General Total		26	100%

As seen in Table 10, scales (f: 19) were the most common data collection tools used in the reviewed studies. Other tools included surveys (f: 3), documents (f: 2), interview forms (f: 1), and experiment reports (f: 1).

Discussion and Conclusion

When the results of the systematic literature review on experiment self-efficacy were examined, the 19 publications included in the study demonstrated the highest study rate in 2020 (15%) and 2021 (15%). However, after Covid-19, a significant decrease in studies can be observed in 2022 (5%), and publications started to rise again in the following years (see Table 2). This situation is hopeful because it suggests that awareness of the

importance of belief in the ability to experiment will become widespread. In fact, it can be said that the value of experimental self-efficacy will be exalted thanks to the frequent mention of experimental activities in the Biology Curricula. This suggests that the new biology curriculum in Türkiye, which strongly includes field skills, will support experiment self-efficacy (MEB TYMM BÖP, 2024).

It is seen that publications specific to experimental self-efficacy lag behind the international literature in terms of quantity at the national level in Türkiye (see Table 3). However, when examined on a country basis, the national publication rate is higher than the individual studies on experimental self-efficacy of other countries (see Table 4). When the increasing number of national studies in recent years are examined, it is thought that biology education will develop further in the future in terms of experiment self-efficacy studies that will increase experimentation (see Table 3). In addition, the fact that there have been recent studies reporting that experimental studies will not only remain within the school boundaries but will also gain importance in out-of-school learning environments (Kirchhoff et al., 2024), and that experimental environments are supported by Science and Art Education Centers, strengthens the belief that experimental self-efficacy studies will develop.

It is noteworthy that among the countries where these 19 studies were conducted, Türkiye is the country that publishes most frequently on experimental self-efficacy, followed by the USA and other countries in terms of publication frequency (see Table 4). This situation may have been shaped by the fact that scale adaptation studies have been conducted in our country, making it possible to use the scale in the native language (Ekici, 2009; Yılmaz, 2018). Then, the publication frequencies are ranked from most to least as America, Asia and Europe (Table 4). When evaluated according to the participants, nineteen studies included in the analysis were mostly conducted with pre-service teacher (see Table 5). This result is consistent with the results of studies emphasizing the importance of developing experimental self-efficacy in the training of teachers who create permanent behavioral changes in students (Gezer, 2014). Additionally, some studies indicate that experimental self-efficacy has an impact on success, performance, and motivation in high school and university students. This may also explain the high number of studies on these groups (Ekici, 2009; Kolil, 2020).

It is evident that the studies were mostly conducted in the field of science (f:15), and at the same time, the number of experimental self-efficacy studies in the field of science is twice as much as the number of experimental self-efficacy studies in the field of biology (f:9) (see Table 6). This result reflects the need to increase the number of experimental self-efficacy studies in the field of biology. This need is also compatible with studies emphasizing the importance of experimentation in biological sciences (Yılmaz, 2018; Ekici 2009). According to research, no other teaching method is as effective as experiments on scientific process skills (Yılmaz, 2018).

The aims of the study are mostly focused on examining the variables affected by experimental self-efficacy and examining the variables that affect experimental self-efficacy (f:11) (see Table 7). Apart from this, it was determined that the number of studies aiming at scale development-application and examining the relationships was also high (see Table 7). This result demonstrates the rarity of studies aiming to investigate the causes of situations related to experimental self-efficacy and suggests that there is a need for investigation and intervention studies specifically aimed at increasing experimental self-efficacy. Intervention studies are important for the

development of experimental self-efficacy, as they not only identify the data but also make it possible to try and evaluate the methods designed to change it in a positive and meaningful way (Büyüköztürk et al., 2021).

When the studies are examined according to their methods, it is seen that quantitative studies are the most intense (50%) and qualitative studies are the least intense (20%) (see Table 8). However, it can be said that qualitative research methods should be used more frequently, as the qualitative method will make it easier to intervene in the negative variables that affect experimental self-efficacy while examining the causes of events and phenomena (Yıldırım & Şimşek, 2018). Büyüköztürk (2021) states that more meaningful results can be obtained by examining variables that can be classified, such as teaching method and gender, from a qualitative perspective. However, the information that studies were conducted intensively with mixed methods (30%) shows that quantitative and qualitative method data are evaluated together from a broader perspective in the literature. Because experimental self-efficacy is a structure that requires not only determining the level but also examining the variables related to experimental self-efficacy in depth and increasing its level, and since it involves multidimensional and complex problems, the use of mixed methods, which benefit from the complementarity of more than one method, which also increases reliability and validity, is parallel to the emphasis of the publications (Akkış, 2024; Atik & Doğan, 2020). It is seen that the studies used the experimental design extensively (f: 9, 36%), which reported the effectiveness of experiment self-efficacy (see Table 9). However, the lack of action research aimed at improving experimental self-efficacy is noteworthy. However, in order to carry out experimental activities in a more healthy way at the frequency required by the new biology curriculum, experimental self-efficacy needs to be strengthened (MEB TYMM BÖP, 2024). Therefore, it is pleasing that beyond descriptive detection studies, there are also a high number of publications that predict and explain (f:9+5=14, 56%). However, the fact that qualified scale development and adaptation studies on experimental self-efficacy are few in our country compared to international publications and that there are only two adaptation studies may be important in indicating the need for new scale studies to be developed on this subject (see Table 9).

Finally, it was determined that 19 studies (f: 19) used the scale data collection tool the most (see Table 10). In addition, it is seen that interview forms are used in relatively low numbers (f:1). However, research emphasizes the need for studies that involve deep inquiry to identify and solve students' problems related to the experiment and research emphasizes the need for studies to develop an experimental self-efficacy scale that can be a determinant on professional choices (Damerau, 2013; Yılmaz, 2018).

Recommendations

In this section, several important recommendations are presented to strengthen the literature based on data obtained from national and international studies on experimental self-efficacy in biology education:

- Experimental self-efficacy, which has been studied extensively in science education in the literature, should be studied more specifically for biology education.
- Experimental self-efficacy scales should be developed (in Turkish and the other languages) that will address the problems related to experimentation from different and broader perspectives, have diversified scope and content, and are suitable for different target groups.

- The use of qualitative data collection tools such as open-ended interviews, focus group studies, and observation forms, which can provide more in-depth information about experiment self-efficacy, should be expanded.
- In order to contribute to the development of experimental teaching strategies, the number of qualitative research and intervention-based studies focusing on the reasons and development processes of experimental self-efficacy should be increased.
- For future research, it is recommended that the search options of the National Thesis Center in Türkiye be improved. This will make it possible to access more resources on the subject.

Statements and Declarations

Data Availability/Ethics Statement: This research has been carried out taking into account research and publication ethics; since it was carried out on openly available written documents and using the document review method, it is not one of the studies requiring an ethics committee decision; however, since it is part of the thesis study, it has an ethics permit from the Hacettepe University commission with the E-82474949-300-00003698264 number and 09.08.2024 date.

Notes: This study was presented as an oral presentation at Gazi University International Turkish World Educational Sciences Congress-IV (12-13 December 2024) in Ankara; this article is an expanded, developed version of the relevant paper and is also derived from the first author's master's thesis on supervision of the second author's completed in 2025.

Disclosure Statement: The authors declare no conflicts of interest. There is no conflict of interest in this study.

Turnitin Result: Turnitin result is 12%.

Limitations: The research was conducted only on general experiment self-efficacy in science and biology education, and studies on sub-fields of experiment self-efficacy (such as microscope use self-efficacy, chemistry laboratory self-efficacy) were excluded from the research within the scope of the systematic literature review. In this study, some studies could not be accessed and the data coverage remained limited due to the inadequacy of filtering in the search infrastructure of the National Thesis Center.

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Appendix. Studies Included in the Systematic Literature Review

No	Publication	Purpose	Participant	Method	Data Collection Tools
1.	Akkış, (2024)	Investigation of Variables Affecting Biology Laboratory Self-Efficacy.	Pre-service Science Teacher (N=40)	Quantitative Research (Pre-Post Test Control Group Experimental Design)	Biology Self-Efficacy Scale Biology Laboratory Anxiety Scale
2.	Cramman et al. (2024)	An Examination of Their Views on Practical Science Experiences.	From students who started their education in the fields of Biological Sciences, Chemistry, Physics and Natural Sciences at two universities (N=275)	Mixed Method (Exploratory Sequential)	Focus groups (Qualitative) Online survey (Quantitative)
3.	Kolil et al. (2023)	Examining the Relationship between Experimental Self-Efficacy and Laboratory Performance	Chemistry Students (N = 684), Physics And Biology Chemistry Students (N = 439)	Quantitative Method (Correlation)	Experimental Self-Efficacy Scale
4.	Robledo et al. (2023)	Examining the Effect of Performance on Knowledge and Self-Efficacy	Teacher (N=10) Student (N=836)	Mixed Method (Pre-Post-Test Quasi-Experimental Design)	Self-Efficacy Scale Survey
5.	Larry & Wendt (2022)	Examining Variables Predicting Experimental Self-Efficacy	High School Students (N=388)	Quantitative Method (Regression)	Science Self-Efficacy Questionnaire - Questionnaire on Teacher Interaction
6.	Çeliker (2021)	Examining the Effect of the Scenario Method on Experiment Performance	Pre-service Science Teacher (N=108)	Quantitative Method (Pre-Post-Test Experimental Design)	Biology Self-Efficacy Scale Critical Thinking Disposition Scale
7.	Yılmaz et al. (2021)	Examining the Effect of Performance on	Pre-service Biology Teacher (N=26)	Qualitative Method (Single-	Survey Interview Form

No	Publication	Purpose	Participant	Method	Data Collection Tools
		Experimental Self-Efficacy		Case Holistic Case Study)	
8.	Martin et al. (2021)	Adaptation of Self-Efficacy Scale, Examination of Variables Affecting Laboratory Self-Efficacy	Biology Student	Quantitative Method (Pre-Post-Test Experimental Design, Factor Analysis)	Self-Efficacy Scale Survey
9.	Kolil et al. (2020)	Development of an Experimental Self-Efficacy Scale	Chemistry Students (N=1225)	Quantitative Method (Scale Development)	Experimental Self-Efficacy Scale
10.	Atik & Doğan, (2020)	Examining the Effect of Experiment Process Management on Experiment Self-Efficacy	Pre-service Primary School Teacher (N=44)	Mixed Research (Single-Group Pre-Post-Test Experimental Design, Interview)	Experimental Self-Efficacy Scale Interview Form Focus Group Interview
11.	McLean et al. (2020)	Examining the effects of online decision tree on self-efficacy and motivation	Medical sciences students (N=120)	Mixed method interview	Scale Survey
12.	Yılmaz (2018)	Adaptation of the Experimental Self-Efficacy Scale	Pre-service Biology Teacher and Pre-service Science Teacher (N=333)	Quantitative Method (EFA-CFA Factor Analysis)	Experimental Self-Efficacy Scale
13.	Randler et al. (2016)	Examining the Effect of Performance on Experimental Self-Efficacy	Pre-service Biology Teacher (N=135)	Quantitative Method (Pre-Post-Test Experimental Design)	Self-Efficacy Scale Emotional Schedule Anxiety Inventory
14.	Reinboth et al. (2016)	Examining the Effect of Performance on Experimental Self-Efficacy	High School Students (N=18)	Quantitative Method (Pre-Post-Test Experimental Design)	Scale Survey
15.	Widiyawati & Sari, (2019)	Examining the Relationship between Laboratory Self-	Pre-service Science Teacher (N=12)	Quantitative Method (Scale Development,	Laboratory Self-Efficacy Scale

No	Publication	Purpose	Participant	Method	Data Collection Tools
		Efficacy and Science Process Skills		Correlation)	
16.	Velez et al. (2015)	Examining Variables Affecting Science Laboratory Self-Efficacy	High School Students (N=173)	Quantitative Method (Longitudinal Correlation)	Science Laboratory Self-Efficacy Scale Motivated Strategies for Learning Questionnaire (MSLQ) Learning Climate Questionnaire (LCQ)
17.	Gezer (2014)	Examining the Effect of Laboratory Use on Skills	Pre-service Science Teacher (N=66)	Mixed Method (Scale, Interview)	Self-Efficacy Perception Scale, Laboratory Anxiety Scale, Scientific Process Skills Test, Reflection Skills Questions
18.	Ekici (2009)	Adaptation Study of the Biology Self-Efficacy Scale	High School Students (N=465)	Quantitative Method (Scale Adaptation)	Biology Self-Efficacy Scale
19.	Smist & Owen, (1994)	Examining the Relationships Between Attitude and Achievement in Science Self-Efficacy	High School Students (N=500)	Quantitative Method (Correlation, Use of Scale)	Science Attitude Scale Science Self-Efficacy Scale