Exploring the impact of homework assignments on achievement and attitudes in science education

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Abstract
The aim of this study is to review the effects of homework in science education studies in the electronic database. Moreover, journals published in the electronic database were searched using the same keyword. 21 studies were chosen related to the effects of homework in the science education context and analyzed by means of standards obtained from the related literature. A qualitative thematic review was used in this study. All articles were downloaded and read by the researchers. Each researcher studied together to determine themes. The themes were decided as students’, teachers’, and parents’ views about homework assignments and the positive and negative effects of homework assignments on achievement, and attitudes. Results were reviewed in terms of the effects of a homework assignment in science education studies. Some implications of these results were proposed for determining and developing the effects of homework assignments in science education studies.

Keywords: effects of homework assignment, homework in science education

INTRODUCTION

A lot of memorization and conceptual understanding is needed in the study of science. Homework can aid students in reviewing what they have learned in class and improving their memory of it (Prabha, 2020). However, a student may suffer negative effects and become overburdened if they have too much homework. Right amount of homework must be given, and teachers must make sure it is not too monotonous or repetitive.

Homework can have both positive and negative effects on science education according to Cooper and Valentine (2001). On the positive side, homework can help students gain a deeper understanding of the material they are studying. It can also give them practice in applying what they have learned. On the negative side, homework can be a source of stress and frustration, especially if it is not well-designed or if it is given in excess. In addition, homework can take away from time that could be spent on more enjoyable activities such as playing outside or spending time with family or friends.

While assigning homework can help students remember what they have learned in class, it can also be detrimental to their comprehension of science. Students may become discouraged and begin to dislike science if they are given too much or too challenging homework (Kryukova et al., 2022; Platonova et al., 2022). Due to this, they may have difficulty in class and ultimately give up on science. As students look for ways to complete work more quickly, having too much homework can also encourage cheating. When assigning homework, it’s critical for teachers to strike a balance between time commitment and aptitude (Ellsworth & Buss, 2000).

According to Herreid and Schiller (2013), homework has been shown to have a positive effect on student achievement in science, especially when it comes to problem-solving and critical thinking skills and homework can also help students to learn how to manage their time and resources effectively.
Contribution to the literature

- This study can provide a comprehensive summary of the current research in the field of homework assignments including the main findings, key studies and important developments.
- This study can highlight the most important findings and developments in exploring the impact of homework assignments on achievement and attitudes in science education showing what is already known and what needs further investigation.

Homework generally refers to tasks given to pupils by their teachers to be completed outside regular class hours. There has been criticism of homework given in science education, with arguments that it increases the academic workload of pupils and detracts from science being seen as an enjoyable activity according to Ramdass and Zimmerman (2011). Homework in science education has been criticized for its potential to increase the academic workload of students and detract from the enjoyment of science. Some argue that homework can also lead to a better understanding of the material.

Homework is a widely used educational practice that has been shown to be effective in promoting students’ learning and academic achievement in many subject areas including science (Cooper, 2010). However, the effects of homework in science education have been subject to debate among educators and researchers. A systematic review by Trautwein and Köller (2014) found that homework has a positive effect on students’ academic achievement in science although the effect size was relatively small. They also found that the effectiveness of homework in science education depends on several factors including the type of homework assignment, the amount of homework assigned and the students’ attitudes toward science and engagement.

Tamim et al. (2011) reviewed the effects of homework on students’ academic achievement related to science education in elementary and middle school. Homework has a positive effect on students’ science achievement particularly in middle school according to Tamim et al. (2011). However, it was also concluded that the effects of homework on science achievement were smaller than the effects on other subjects such as mathematics and language arts.

The aim of this study is to review the effects of homework in science education studies in the electronic database. The purpose of conducting a systematic review on the effects of homework in science education is to gather and synthesize existing research on this topic. The review aims to provide a comprehensive understanding of how homework assignments affect students’ academic performance, conceptual understanding and attitudes towards science. Researchers can identify gaps in the literature and generate new research questions by analyzing the strengths and weaknesses of previous studies. Ultimately, the goal of this systematic review is to inform educators and policymakers about the role of homework in science education and provide evidence-based recommendations for best practices in homework assignment design and implementation.

The systematic review related to the effects of homework in science education aims to address several key problems related to this topic. One problem is the lack of consensus among educators and researchers about the effectiveness of homework in promoting students’ learning, achievement and attitudes toward science. Another problem is the variability in the design and implementation of homework assignments in science education making it difficult to draw generalizable conclusions from previous studies. Additionally, previous reviews of the literature have been limited in scope or have focused on a specific aspect of homework in science education, such as homework frequency or type. This systematic review seeks to address these problems by providing a comprehensive and up-to-date analysis of the literature on the effects of homework in science education, identifying key factors that influence its effectiveness, and providing evidence-based recommendations for best practices in homework assignment design and implementation.

METHOD

This study is a systematic review related to the effects of homework in science education in the last ten years. Effects of the homework assignment and homework in science education were used as keywords through the ERIC electronic database. Keywords were searched and 268 articles were found by selecting full-text and peer-reviewed articles. Finally, 21 articles were selected after reviewing all articles according to their contents. These 21 articles were reviewed one by one in detail. A qualitative systematic review was used in this study. All articles were downloaded and read by the researchers. Each researcher studied together to determine themes. The themes were decided as students’, teachers’, and parents’ views about homework assignments and the positive and negative effects of homework assignments on achievement, and attitudes.

Table 1 summarizes the authors of the articles, the profile of the participants, and the research design. Table 1 shows that most of the data collection tools were quantitative tools such as the Likert test, survey, questionnaires, and scale. On the other hand, the interview was used extensively as a qualitative data collection tool. Both quantitative and qualitative tools
were used in some of the studies. These studies were called “mixed” studies.

Table 2 summarizes aims of selected studies. These aims are related to the effects of homework assignments in science education and science education participants’ views and opinions about homework assignments.

**THEME 1: STUDENTS’, TEACHERS’ & PARENTS’ VIEWS ABOUT HOMEWORK ASSIGNMENT**

To evaluate positive or negative effects of homework in science education, it is first necessary to examine stakeholders’ ideas and opinions about homework. For this purpose, as the first theme, the opinions and thoughts of all participants in literature on homework in science education were addressed in detail.

Most of the studies showed that students’, teachers’, and parents’ views about homework assignments were multidimensional with respect to some variables. For example, Deveci and Onder (2013) found that female students’ function scores were higher than those of male students when the scores for the function, attitude, and behavior subscales were investigated by gender. Besides this, students who allotted more time for reading, homework, and research scored higher on each subscale than those who did not. The behavior of students who spent more time watching TV, playing computer games, or taking private classes was worse than that of students who spent less time engaging in these activities. Also, Deveci and Onder (2013) concluded that by completing these homework assignments, students can comprehend subject matter better, develop their research, reading, observation, experimentation, and writing skills, learn about natural phenomena and living things, finish tests more quickly, and gain knowledge of current events.

On the other hand, Sayan and Mertoglu (2020) stated that most teachers believe that assigning homework is necessary and do not support its prohibition. For repetition and reinforcement, teachers frequently give homework assignments. The most frequently assigned types of homework are project assignments and research presentation assignments. Teachers assign homework, which students can complete primarily at home while spending zero-one hour with their friends. For reinforcement, repetition, and learning, teachers claim that homework is the most beneficial. Most of the teachers in the study were found to not be using portfolios. Concentration, reluctance, and a lack of knowledge, according to the study’s participating teachers, are the main factors that influence student motivation. In another study, Fatma (2014) discovered that students’ opinions on homework did not significantly differ, but they did vary according to class levels in terms of factors like gender or parents’ educational backgrounds. Additionally, a sizeable portion of students thinks that science homework does not develop their critical thinking and creativity skills. The students also mentioned that they were more careful and gave their homework more time because it would help them do well on the high school entrance exam. According to Tas et al. (2014), teachers assigned homework for several reasons, such as knowledge acquisition, skill development, and updating parents on their children’s progress. According to structural equation modeling, small class sizes made teachers more likely to value homework; these teachers were also more

<table>
<thead>
<tr>
<th>Authors</th>
<th>Country</th>
<th>Profile of the participants</th>
<th>Research design</th>
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<tbody>
<tr>
<td>Batman et al. (2022)</td>
<td>Northern Cyprus</td>
<td>7 teachers</td>
<td>Qualitative</td>
</tr>
<tr>
<td>Chen et al. (2022)</td>
<td>Taiwan</td>
<td>18 teachers</td>
<td>Mixed</td>
</tr>
<tr>
<td>Deveci and Onder (2013)</td>
<td>Turkey</td>
<td>1,539 students</td>
<td>Quantitative</td>
</tr>
<tr>
<td>Deveci and Onder (2015)</td>
<td>Turkey</td>
<td>1,584 students</td>
<td>Quantitative</td>
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<tr>
<td>Deveci et al. (2013)</td>
<td>Turkey</td>
<td>764 parents</td>
<td>Quantitative</td>
</tr>
<tr>
<td>Dolean and Lervag (2022)</td>
<td>Norway</td>
<td>440 students</td>
<td>Quantitative</td>
</tr>
<tr>
<td>Duru and Cogman (2017)</td>
<td>Turkey</td>
<td>621 students</td>
<td>Quantitative</td>
</tr>
<tr>
<td>Fan et al. (2022)</td>
<td>China</td>
<td>1,349 students</td>
<td>Quantitative</td>
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<td>Fatma (2014)</td>
<td>Turkey</td>
<td>705 students</td>
<td>Quantitative</td>
</tr>
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<td>Haq et al. (2020)</td>
<td>Pakistan</td>
<td>100 teachers</td>
<td>Quantitative</td>
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<td>Kukliansky et al. (2016)</td>
<td>Israel</td>
<td>25 teachers</td>
<td>Mixed</td>
</tr>
<tr>
<td>Kurt and tas (2019)</td>
<td>Turkey</td>
<td>328 students</td>
<td>Quantitative</td>
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<tr>
<td>Maharaj-Sharma &amp; Sharma (2016)</td>
<td>Australia</td>
<td>34 students</td>
<td>Mixed</td>
</tr>
<tr>
<td>Mešić et al. (2021)</td>
<td>Bosnia and Herzegovina</td>
<td>39 students</td>
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<td>Ratniyom et al. (2016)</td>
<td>India</td>
<td>76 pre-service teachers</td>
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<td>Salame &amp; Hanna (2020)</td>
<td>USA</td>
<td>163 participants</td>
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<tr>
<td>Sayan and Mertoglu (2020)</td>
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<td>100 teachers</td>
<td>Mixed</td>
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<tr>
<td>Tas et al. (2014)</td>
<td>Turkey</td>
<td>168 teachers</td>
<td>Quantitative</td>
</tr>
<tr>
<td>Tas et al. (2016)</td>
<td>Turkey</td>
<td>618 students</td>
<td>Quantitative</td>
</tr>
<tr>
<td>Unhorho &amp; Young (2022)</td>
<td>Taiwan</td>
<td>162 students</td>
<td>Quantitative</td>
</tr>
<tr>
<td>Yildiz and Sahin (2017)</td>
<td>Turkey</td>
<td>669 students</td>
<td>Quantitative</td>
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</table>
likely to communicate with parents about homework, which helped students complete their assignments.

Batman et al. (2022) showed that homework assignments were designed to help students review and retain the material they had learned in class. They did not give the students any homework that could be considered extension work or work that would help them develop higher-order thinking skills. All the teachers agreed that homework helps with grades and the college entrance exam, which is a requirement to enroll in secondary school in Northern Cyprus, in addition to the fact that homework helps students succeed. Both primary and secondary school students...
reported that they prefer task-based homework, such as projects or designing something, over longer-duration assignments like reading and writing according to Duru and Cogmen (2017). Students in primary schools enjoy math homework the most, while those in secondary schools prefer science assignments. When asked which types of homework they like or dislike, students cited emotional factors (liking/disliking, boring/enjoyable, feelings about the teacher, feeling qualified or unqualified). The homework was given out for practice, according to the parents. For primary school students, not wanting to do their homework, and for secondary school students, unclear tasks, they claimed is the most common issue. Moreover, Maharaj-Sharma and Sharma (2016) stated that teachers are inconsistent about collecting and marking homework and that sometimes the homework tasks are either regurgitation, irrelevant to the current class topic, or overly challenging and thus go beyond what is covered in classroom learning. Most students perceived homework as an unnecessary chore from which no meaningful learning emerged. Furthermore, Deveci et al. (2013) found that civil servants in the occupational category had lower function scores than self-employed, farmers, workers, artisans, and retired people. In the category of the level of education, university graduates were found to have lower function scores than primary school, secondary school, and high school grads. It was also discovered that high earners in each related group had function scores that were lower than those of other members in the monthly income group. In another study, Tas et al. (2016) showed that students’ perceptions of the quality of their homework and the feedback they received were related to aspects of homework self-regulation that were, in turn, related to science achievement. The objective of this study was to create and validate science homework scale, a tool that measures middle school students’ perceptions of homework policies and self-regulation in science assignments.

**THEME 2: POSITIVE & NEGATIVE EFFECTS OF HOMEWORK ASSIGNMENTS ON ACHIEVEMENT & ATTITUDES**

Based on the idea that homework assignments in science education can have significant effects on academic achievement, attitude, motivation, and other perceptions, studies related to the effects of homework assignments on some variables in the literature were examined. Firstly, the findings of Yildiz and Sahin’s (2017) study showed that the students’ attitudes toward completing online homework for science lessons were favorable. According to Haq et al. (2020), homework has a significant impact on student’s achievement and varies depending on the age of the students. Moreover, Fan et al. (2022) demonstrated that the eight-item version of the homework creativity behaviors scale had acceptable validity and reliability; homework creativity explained less variation in academic achievement than homework completion and homework time and homework creativity explained more variation in general creativity than homework completion and homework time. Contrary to popular belief, completing homework and having creative homework has a positive impact on students’ overall creativity. Similarly, Dolean and Lervag (2022) revealed a notable immediate effect of homework quantity on writing proficiency (but not on math proficiency). Only for the group that had dedicated a reasonable amount of homework to practicing writing skills were the effects of writing homework still evident four months later. This study supports giving elementary school students a moderate amount of writing homework by demonstrating that the extra opportunities for practice provided by homework can have different short- and medium-term effects on their academic achievement. According to Salame and Hanna (2020) students’ perceptions, attitudes, learning experiences, comprehension, and learning outcomes were all positively impacted by online homework. Additionally, it gave students more time to complete tasks, which benefited their achievement, engagement with the subject matter, and meaningful learning. Finally, according to data, online homework helped students improve their active participation in class, study skills, and comprehension. Furthermore, Ratniyom et al. (2016) showed that the implemented treatment had a significant positive impact on the performance of pre-service science teachers and that the online homework was a useful tool for boosting students’ understanding of basic organic chemistry. Investigations were made into the relationships between the grade on the online homework and the different course components. Between the students’ online homework grades and the normalized gain as well as between the online homework grade and their post-test results, there were moderate and statistically significant correlations. As a result, the online homework score results were used to predict student test scores. Their performance in the introductory organic chemistry chapter and their overall grades were found to be statistically significantly correlated. This implied that students’ learning behaviors improved when they finished their online homework.

In another study, Uanhoro and Young (2022) found that students had a favorable opinion of badges based on a questionnaire that was distributed to study participants near the end of the investigation. These results support earlier research by other researchers who found that badges can be used to encourage student behaviors with only minor course structure changes. The discovery that badges may not be particularly helpful to motivate students toward difficult tasks, however, further supports earlier research. In a previous study of
CONCLUSION & RECOMMENDATIONS

When the studies are analyzed, it is seen that homework has many complex and multidimensional effects on science education. In addition, the opinions, thoughts, and perspectives of the participants about homework also shape these effects.

This review study examined previous research on the effects of science homework assignments in science education. In some of the studies, the opinions of all stakeholders (students, parents, and teachers) about homework in science education were examined and it was concluded that many variables could affect these opinions (Batman et al., 2022; Deveci & Onder, 2013, 2015; Deveci et al., 2013; Duru & Cogmen, 2017; Fatma, 2014; Maharaj-Sharma & Sharma, 2016; Sayan & Mertoglu, 2020; Sorakin et al., 2022; Tas et al., 2014, 2016).

On the other hand, some studies focused on the positive or negative effects of homework on science education and provide explanations about the sources of these effects (Chen et al., 2022; Dolean & Lervag, 2022; Fan et al., 2022; Haq et al., 2020; Kukliansky et al., 2016; Kurt & Tas, 2019; Mešić et al., 2021; Oschepkov et al., 2022; Qarkaxhja et al., 2021; Ratniyom et al. 2016; Salame & Hanna, 2020; Uanhoro & Young, 2022; Yildiz & Sahin, 2017; Zhdanov et al., 2022). Through homework, teachers should encourage students to develop necessary skills such as the ability to understand and read different representations, as well as how to translate between them. As a result of using homework in such a manner, teachers may be able to strengthen the link between homework and the learning of science by using homework in this manner. Therefore, it was suggested further research to develop and evaluate an intervention program aimed at enriching science teachers’ perspectives on homework.

When designing homework assignments in science classes, it can be helpful to consider variables such as gender, grade level, and time spent on different activities. The metacognitive abilities of self-regulation, critical thinking, creativity, and time management can all be enhanced by science homework assignments. Teachers need to exercise caution when it comes to both the quantity and quality of science homework. The results of this review could also have some useful applications. For example, there should be creativity in homework and homework creativity may simultaneously contribute to academic success and general creativity, making it a valuable learning objective.

This study is limited to Eric’s database. Given the limitations of this work, more academic databases and search engines such as Scopus, Web of Science, and Google Scholar should be explored. This was done to conduct a broader and more detailed background search for relevant literature related to the effects of homework in science education. The study was also limited to 21 articles for review. Several articles can be reviewed in return and systematically reviewed to answer the developed research questions.

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**Ethical statement:** Authors stated that ethical permission was not required since humans and animals were not used in this literature review. However, ethical guidelines were followed throughout the study.

**Declaration of interest:** No conflict of interest is declared by authors.

**Data sharing statement:** Data supporting the findings and conclusions are available upon request from the corresponding author.

**REFERENCES**


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