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Article

Sustainability education in elementary schools—An explorative empirical study of chances and challenges based on a teacher survey in Germany

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Abstract: Sustainability has become increasingly important in recent decades and has become a key concept in various areas of society. The early integration of sustainability principles into education is of crucial importance, as the elementary school years represent a decisive phase in children's development. During this phase, fundamental values, attitudes, and behaviors are formed that will have a significant impact on later lives and the relationship with the environment. Elementary school offer a unique opportunity to reach people from different social backgrounds and thus impart a common basic knowledge that can serve as a basis for shaping a sustainable society. Elementary schools are therefore an ideal place to introduce children to the principles of sustainability and sensitize them to the challenges of the 21st century. The aim of the study is to explore the current state of sustainability education in elementary school. It takes a closer look at whether elementary school students are old enough to be confronted with sustainability, what methods already exist and what the challenges are in implementing sustainability education. The basis for the study is an online survey conducted at 60 different elementary school in the state of Baden-Wuerttemberg in Germany. In conclusion, while there is room for improvement, the survey results suggest a growing awareness of the significance of sustainability education in elementary schools. The findings call for targeted efforts to enhance curriculum integration, teacher training, and resource provision to promote a more sustainable and environmentally conscious generation of students in Baden-Wuerttemberg.

Keywords: sustainability education; early childhood education; sustainable conscious generation; elementary schools; teacher survey

1. Introduction

The topic of sustainability has become increasingly important in recent decades and has become a key concept in various areas of society. The early integration of sustainability principles into education is of crucial importance, as the elementary school years represent a decisive phase in children's development. During this phase, fundamental values, attitudes, and behaviors are formed that will have a significant impact on later lives of the children and their relationship with the environment. Elementary school offer a unique opportunity to reach people from different social backgrounds and thus impart a common basic knowledge that can serve as a basis for shaping a sustainable society. Elementary school are therefore an ideal place to introduce children to the principles of sustainability and sensitize them to the challenges of the 21st century. The challenge lies in crafting an effective sustainability education program for children, along with ensuring that teachers are equipped with the requisite knowledge.

The aim of the study is to explore the current state of sustainability education in elementary schools. It takes a closer look at whether elementary school students are old enough to be confronted with sustainability, what methods already exist and what the challenges are in implementing sustainability education.

2. Literature review

2.1. Focus and method of the literature review

The literature analysis serves to examine the current state of knowledge (Barry, Merkebu and Varpio, 2022). This study uses information from various literature sources that were compiled as part of the literature analysis. The systematic selection and identification of possible literature sources makes it possible to recognize what has already been researched, which opinions and positions have already been formed and where there are still possible gaps that could be closed with this study (Snyder, 2019).

When selecting literature sources, in addition to relevance, quality care is taken to use only publications from journals with a double-blind review process which can be found in the listings either of the Resurchify information portal (www.resurchify.com) or of the VHB Jourqual 3 collection (https://vhbonline.org/en/vhb4you/vhb-jourqual/vhb-jourqual-3). The literature review primarily examines publications from the last seven years (2018–2024).

2.2. Sustainability education and pedagogy

The majority of consumers are not aware of the effects of their actions because they have never learned and the effects are not within reach (Alam, 2022). Steadily more people are growing up in big cities, which reduces the connection to nature and makes people feel less connected to nature. But the connection to nature is seen as a key factor in the fight against climate change and the preservation of the biosphere. Research results show that people who have already established a relationship and connection with nature in early childhood, through experiences and adventures, are more committed to the preservation and protection of nature in adulthood than those who have had little contact with nature. Childhood has a significant influence on the importance of nature and the environment in a person’s life (Chawla, 2020). Therefore, the task of sustainability education is to inform and educate people about how they can better understand, protect, and influence their living space and the environment, with the aim of giving hope. It is important to sensitize people, but care must be taken not to spread fear (Määttä et al., 2020). Achieving a social transformation towards sustainability can be significantly influenced by education (Shutaleva et al., 2020). This requires a teaching approach based on a comprehensive understanding of how people, communities, the natural environment, and the entire biosphere are interconnected and how well-being depends on all these parts. One of the great difficulties in education is to find effective ways to communicate sustainability issues and to convey the related problems as comprehensibly as possible (Määttä et al., 2020). Sustainability topics such as reducing waste or saving energy have to be integrated into the curriculum or set up in independent projects

(Zhenwen et al., 2020). Sustainability education can be the key to a more sustainable society (Nousheen et al., 2020). Children should be educated at an early age about the impact of their actions on the environment and their future lives in order to encourage them to actively participate (Trott, 2019).

The school is the ideal place where people from different social classes come and learn together. This is the only space where it is guaranteed that all people can be reached with the information (Ladson-Billings, 2021). According to the United Nations Agenda 21 (a political program for environmental development, which has been developed by the UN in 1992), which sets the implementation of sustainability topics in the classroom as a goal, many ecological topics such as desertification, pollution, protection of ecosystems and loss of biodiversity, but also economic topics such as consumption, sustainable energy and sustainable industrialization are not or only to a limited extent considered (Yli-Panula et al., 2020). Due to the sheer number of topics to be covered, it is clear that the creation of a new curriculum is essential. Existing subjects can be supplemented with sustainability topics. Natural sciences, but also social sciences and languages are best suited for this (Sukma et al., 2020). Without redesigning the curriculum, it is very difficult to implement large projects, as there is little time left over in addition to the actual timetable (White et al., 2018). Educational institutions have always served as a decisive instrument in implementation and innovation processes. Teachers in particular play a decisive role as pioneers for change processes in schools. Their ability to perceive change, their motivation and their willingness and ability to enter a dialog with their students have proven to be decisive for the implementation of innovations in numerous contexts. The importance of teachers in change processes has long been recognized in schools (Ampartzaki et al., 2021; Timm and Barth, 2020). Adapting the curriculum does not yet guarantee the path towards a sustainable society. In order to achieve social change through education, it is essential that teachers have the appropriate skills to teach sustainability and climate change in an age-appropriate way. Studies have shown that students' learning progress depends to a large extent on the effectiveness of the teacher (Ampartzaki et al., 2021; Nousheen et al., 2020; Timm and Barth, 2020). Implementation fails primarily due to the knowledge and skills of teachers. For the majority of teachers, sustainability has not yet been a topic in their training and to date, hardly any further training on sustainability education has been offered. The focus of training has so far only been on methods to improve students' performance and not on how to best prepare them for future social events and goals (Nousheen et al., 2020). It must be mentioned that appropriate further training for teachers seems essential, as they act as role models for their students. Children at this age are guided by such role models and imitate their behavior (Sukma et al., 2020).

The topic of climate change and sustainability cannot be treated like any other subject; because hardly any other subject is associated with so many negative emotions. Here, it is particularly important to address children's feelings and convey ways in which an alternative future could look like if something fundamental changes in society. Teachers are faced with the challenge of giving hope and encouraging children to take the initiative, which can generate positive feelings (Trott, 2019). A carefully designed and thoughtful educational process must be developed in which students learn from multiple perspectives that lead to an actual

change in mindset (Belleï et al., 2019). Sustainability education must not only take place on a cognitive level, through the pure transfer of knowledge. In order to generate a holistic change in knowledge, action and values, social, emotional and technical skills must also be addressed (Chan et al., 2020).

Choosing the right teaching method is important to ensure that the topics are properly received and understood by the elementary school students (Ampartzaki et al., 2021). One of the best teaching methods has proven to be an interactive outdoor lesson in the immediate vicinity of the school. This allows the children to analyze their familiar surroundings so that they can better understand the causes and consequences of their actions with regard to environmental protection and thus develop solution-oriented thinking. In addition to an understanding of the environment, the students' physical and mental health is also promoted. Another positive aspect is that this teaching method can be easily and cheaply integrated into everyday school life if the school's own green spaces are used for this purpose. For example, children could be actively involved in ecological gardening in their own school garden. In particular, those who do not have their own garden or similar at home would benefit from this (White et al., 2018). In addition to a practical approach to nature, there is also knowledge that can only be taught in theory. Especially with children, it is important to impart knowledge in as exciting a way as possible in order to stimulate their interests. Storytelling has been used since time immemorial to pass on knowledge, experiences and cultural values and is considered one of the oldest teaching methods. The stories are created through myths, legends and facts combined with emotions. They are considered informative and created a connection between generations at the time. The digital transformation has opened up a whole host of new possibilities in the field of education, and digital storytelling is one of them. With digital storytelling, stories can now be presented visually in a playful and colorful way, which is particularly appealing to children (Tzima et al., 2020). In Taiwan, a teaching method was investigated that combines theory, creativity and active learning with the help of augmented reality technology. A study analyzed the effectiveness of this teaching method using the example of butterfly feeding. The children were able to explore the topic acoustically and visually with the help of a developed augmented reality (AR) application and also experience tactile stimulation. They searched for nectar plants in the real world and were then able to virtually observe butterflies feeding on their mobile device through augmented reality, which would not be possible in such detail in the real world. This opens up completely new possibilities and solves traditional learning obstacles and effectively promotes learning outcomes. It was found that the user-friendliness of the AR application influenced the learning outcomes and acceptance of the method. In addition, it was emphasized that information technology in rural areas provides an enhanced learning experience and can increase student motivation and participation (Lo et al., 2021). In a small study Ampartzaki et al. (2021) have elaborated the importance of certain characteristics that might ensure the failure or success of sustainability related education, such as e.g.,:

- presenting sustainability related content in a coherent way and in connection what is already known,

- leaving room for creativity and opportunity to children to find answers for their own questions,
- finding ways to connect with topics that are intrinsically relevant for children and
- helping them to reflect and process new information.

Also, Nousheen et al. (2020) stress the importance of new teaching methods to achieve a deeper understanding, learning experience and possibly a deeper awareness about sustainability in students. Focusing on desired outcomes (Ampartzaki et al., 2021) or "traditional" teaching approaches that mainly deliver input from the teachers' side seem to be not appropriate in the context of sustainability learning (Nousheen et al., 2020). Embracing conflicts as part of the learning experience and as vehicle to develop skills in communication, teamwork and engagement, is found to be crucial by Konrad et al. (2019). The role of computer-based learning opportunities to individualize learning experiences and progress for children might be another interesting aspect which needs to be further studied (Papadakis et al., 2023).

2.3. Research gap and research questions

The literature review emphasizes the growing importance of sustainability education, particularly in the early years, to create awareness of environmental responsibility and to provide young children with the knowledge and skills to address environmental challenges (Ampartzaki et al., 2021; Nousheen et al., 2020; Timm and Barth, 2020). Although the value of such education is widely recognised, its implementation on elementary school level remains inconsistent. There are various reasons for this: sustainability topics are often not fully integrated into curricula, and many teachers do not have sufficient training in this area. As a result, elementary school students often do not have the necessary basis to develop sustainable attitudes and behaviour. In the regions of Baden-Wuerttemberg in Germany, which is increasingly adapting its education systems to global sustainability goals, it remains unclear to what extent and with what quality sustainability education is being implemented in elementary schools (Ministerium für Kultus, Jugend und Sport Baden-Wuerttemberg, 2024). While literature highlights the benefits of a consistent beginning of sustainability education, debates remain about the appropriate age for introducing complex environmental topics, how well teachers are prepared to address these topics, and the challenges of integrating sustainability into the curriculum. These uncertainties highlight a significant research gap, as there is limited empirical evidence on the current state of sustainability education in elementary schools. The following five research questions (RQ1, RQ2, RQ3, RQ 4 and RQ 5) are designed to address this gap by examining the existing landscape of sustainability education in Baden-Wuerttemberg's elementary schools:

RQ1: Are children on elementary school level aware of sustainability?

RQ2: Are elementary school students ready to deal with sustainability at their age?

RQ3: To what extent does sustainability exist in elementary school curricula?

RQ4: How well are teachers trained in sustainability on elementary school level?

RQ5: What are the challenges of integrating sustainability into the curriculum of elementary schools?

3. Methods

This study is based on an online survey to collect new information (Singh and Sagar, 2021). It was conducted at 60 different elementary school in the state of Baden-Wuerttemberg in Germany; at least 10 elementary school from all the major cities in Baden-Wuerttemberg were selected. In the beginning the elementary schools were called to ask for consent to participate. The calls turned out to be very time consuming, so that the calls were skipped and the elementary schools were contacted by email. It was sent a direct request and the survey link to head teachers, secretaries and, if possible, directly to the teachers' emails. In the email, the teachers were politely asked to take part in the online survey and to forward the survey link to other elementary school teachers to increase the reach. With this method of "snowball sampling" the hidden or hard-to-find participants could be better reached. Snowball sampling has created trust in the surveyed group and has saved time (Handcock and Gile, 2011). Since this approach can lead to a representation bias, these limitations were taken into account when interpreting the results. Using this methodology, a total of 77 elementary school teachers were reached, of which 51 elementary school teachers completed the survey. Data was collected in November and December 2023. Before taking part, all participants were informed about the aims and procedures of the study. Each participant gave its personal consent to be part of the study. Strict anonymity and confidentiality were guaranteed throughout the entire data collection and analysis.

The survey was conducted using the survey tool Survio (www.survio.com). This was an aid in the creation, implementation, and evaluation of the online survey (Wu et al., 2022). The online questionnaire included a total of 9 questions with mainly closed questions and three text-based question. With an online survey one can reach many people in a short time, which has a considerable time advantage. In addition, the respondents have the opportunity to decide individually how much time they take for the survey and can thus deal with the questions more intensively, because in a personal survey the respondents might feel under pressure. (Aityan, 2022). The survey here took two to five minutes to complete. The responses of the survey participants were collected and evaluated using the survey tool Survio (www.survio.com).

4. Results

To get into the topic in the survey, the participants were confronted with the question if sustainability is already a topic at their elementary school. This question was intended to provide an overview of how present the topic of sustainability already is in schools. The data shows that 57.7% of the respondents stated that sustainability is very rarely addressed in elementary school. This number is significant and illustrates that there may be a need for action in terms of integrating sustainability topics into the curriculum. In contrast, 23.1% of the teachers stated that sustainability is very much discussed at elementary school. This is a positive sign

and shows that some schools have already taken steps to integrate the topic sustainability at school. These schools could serve as role models and prove that it is possible to promote environmental education in elementary school education. Only 5.8% stated that sustainability is not addressed at school (**Figure 1**).

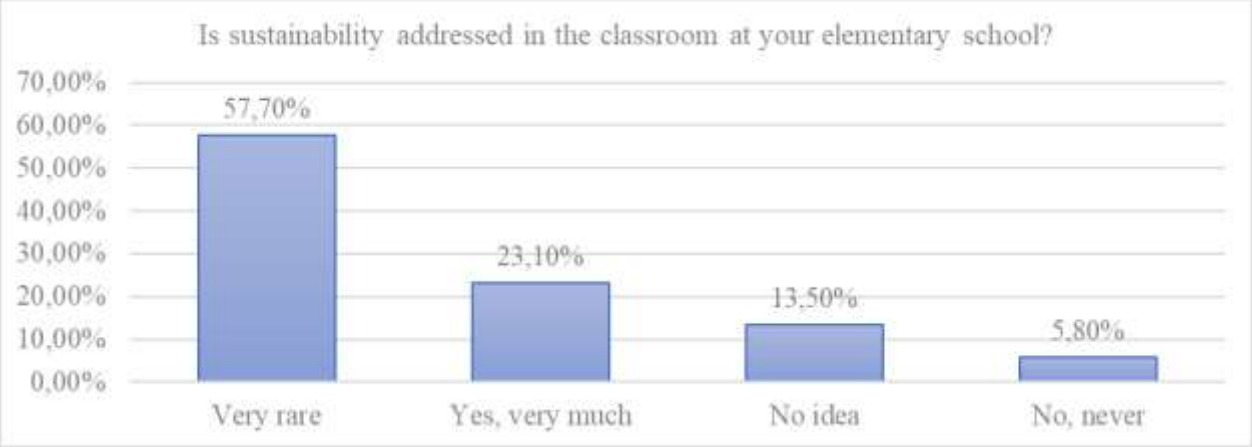

Figure 1. Sustainability addressed in the classroom.

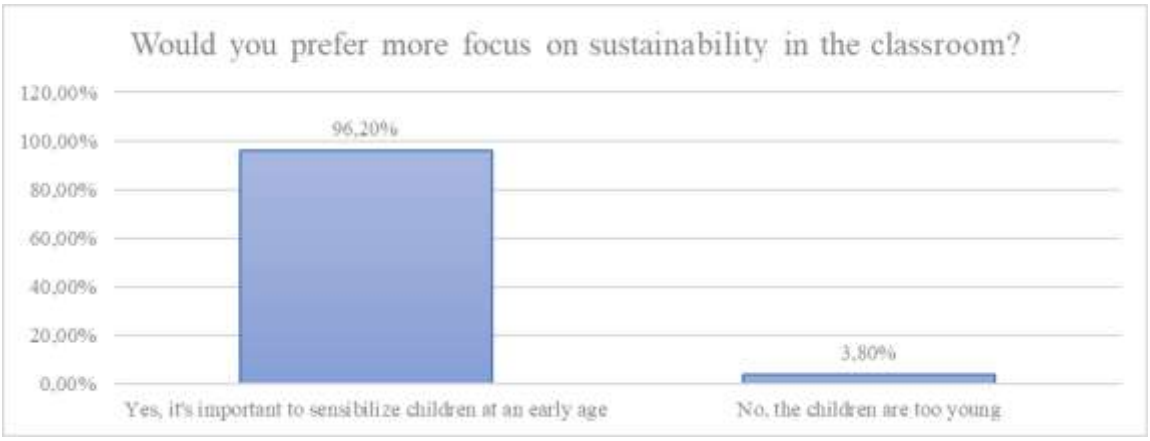

Figure 2. Preferences for more focus on sustainability.

The second question was intended to provide an overview of how elementary school teachers assess elementary school students' knowledge of sustainability. The majority of elementary school teachers surveyed, 77.4%, stated that elementary school children's knowledge of sustainability is low. On the positive side, however, 17% of the teachers' state that children's knowledge of sustainability is high. Whether this knowledge is a result of successful sustainability education or was imparted through other influences cannot be answered here. Another alarming result is that 5.7% of the teachers surveyed stated that elementary school students have no knowledge at all about sustainability. Following this an important question is whether elementary school students are ready to deal with a topic like sustainability properly at their age. To find out, the elementary school teachers were asked in the third question whether they would like to have more focus on sustainability when teaching in the classroom. An impressive result is that 96.2% of the elementary school teachers surveyed answered that it is very important to sensitize children to the topic of sustainability at a young age. This result indicates broad agreement and

support for the integration of sustainability topics into the curriculum. On the other hand, only 3.8% of the teachers surveyed stated that children are still too young to deal with sustainability issues (**Figure 2**).

The fourth question asks which school subjects treat the topic of sustainability. Geography is the most frequently mentioned subject with 42.1%. This shows that sustainability topics are often included in geography lessons. And this this makes sense since these subjects are naturally linked to topics such as environment, geography and ecological contexts. 27.6% of respondents stated that there were no specific subjects explicitly dedicated to sustainability in their elementary school. This could signify a lack of appropriate curriculum or resources to integrate sustainability into the curriculum. It could also mean that the topic is integrated into various subjects but not explicitly named. 13.2% of respondents named "Other" as a subject dedicated to sustainability. This leaves room for interpretation and can indicate school-specific initiatives or courses that do not fit into the standard categories. Similarly, 13.2% of respondents named biology as a subject dedicated to sustainability. This is understandable as biology is closely linked to ecological and environmental issues. The remaining 3.9% stated that they have no idea what subject sustainability is included in. This could show a lack of knowledge about the curriculum or school activities around sustainability and therefore an information gap.

The results of the survey show further (fifth question), that 40%, stated that they only use regular teaching materials to transmit concepts of sustainability. 43.6% of the teachers occasionally use special teaching materials to transmit concepts of sustainability. And only 10.9% of the teachers reported using always specific textbooks and teaching materials to teach sustainability concepts. This shows that although specific resources for the topic of sustainability concepts exist, they are used by a minority of teachers. 5.5% of respondents reported using "Other" as teaching materials. This can signify a variety of approaches, possibly indicating creative teaching methods or teacher initiative. The limited use of specific special teaching materials indicates a need for more targeted materials.

Concerning projects or activities in the school program that address environmental or sustainability topics 48.1% of the teachers' state that they occasionally organize environmental initiatives (sixth question). That shows that almost half of the surveyed teachers teach at schools where they are engaged in environment/sustainability projects or activities at least once in a while. This suggests that there is some awareness of environmental issues and that schools are making an effort to take appropriate initiatives. On the other hand, there are 26.9% of the teachers who teach in schools that have no such projects or activities at all. The fact that 21.2% of the teachers have at their school regular environmental/sustainability projects and activities shows a solid commitment to integrating sustainability in school life. This could show a deeper engagement with environmental issues and sustainability; it can be that these schools are taking a more sustainable approach to their educational work (**Figure 3**).

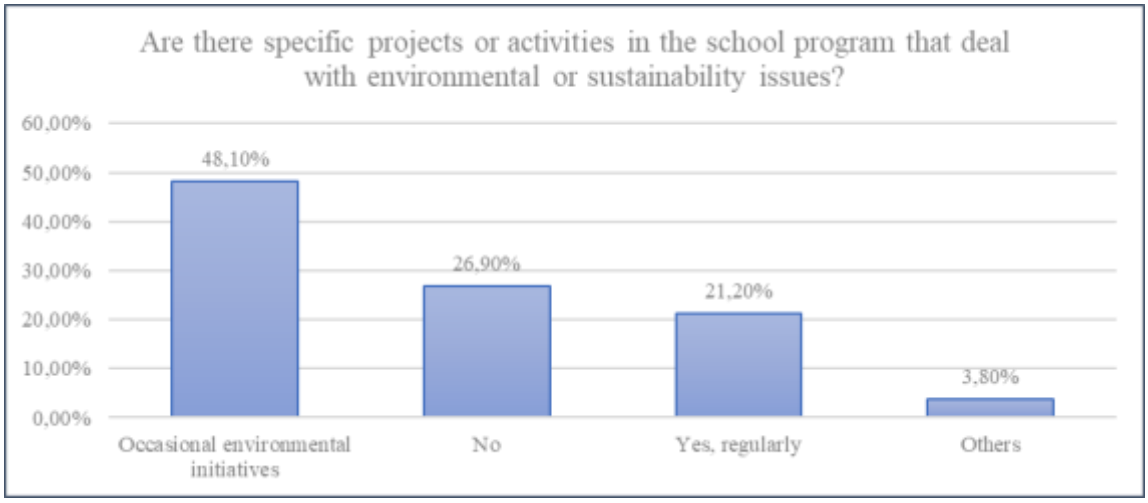

Figure 3. Specific sustainability projects or activities.

In the next step (seventh question) it was asked, if teachers encourage children to act sustainably in daily school life. The results show that the majority of the elementary school teachers surveyed (70.6%), state that they raise awareness among elementary school students but do not use rewards for sustainable behavior. This signifies that the majority of teachers see some responsibility for raising elementary school students' awareness of sustainability. At the same time, the reluctance to use rewards could indicate that teachers do not see sustainability as something that should be primarily extrinsically rewarded, but as an intrinsic value that children should adopt for ethical reasons. 23.5% of teachers stated that sustainability is not specifically emphasized. 5.9% of the teachers who reported actively promoting sustainability and using rewards are a smaller but still important group. These teachers appear to rely more heavily on positive incentives to motivate students to practice sustainability. This approach can be effective in increasing students' engagement, especially when they are young and may not fully understand the importance of sustainability.

The survey also looked at whether teachers receive sufficient training to broader their knowledge of sustainability (eighth question). The collected data shows that 60.8%, the majority of teachers surveyed, occasionally have access to training on sustainability. This is a positive sign as it shows that at least a large proportion of teachers have the opportunity to increase their knowledge of sustainability, even if not on a regular basis. However, it is striking that 35.3%, more than a third of respondents, stated that they are not offered any training on this topic at all. This signifies a potential gap in professional development, given the growing importance of sustainability issues in our society. The survey also shows that 3.9% of teachers regularly receive offers of training on sustainability. While this is a positive development, the number of teachers benefiting from regular offers is still low. It is obvious that there is a need for increased provision of sustainability training and development for elementary school teachers (**Figure 4**).

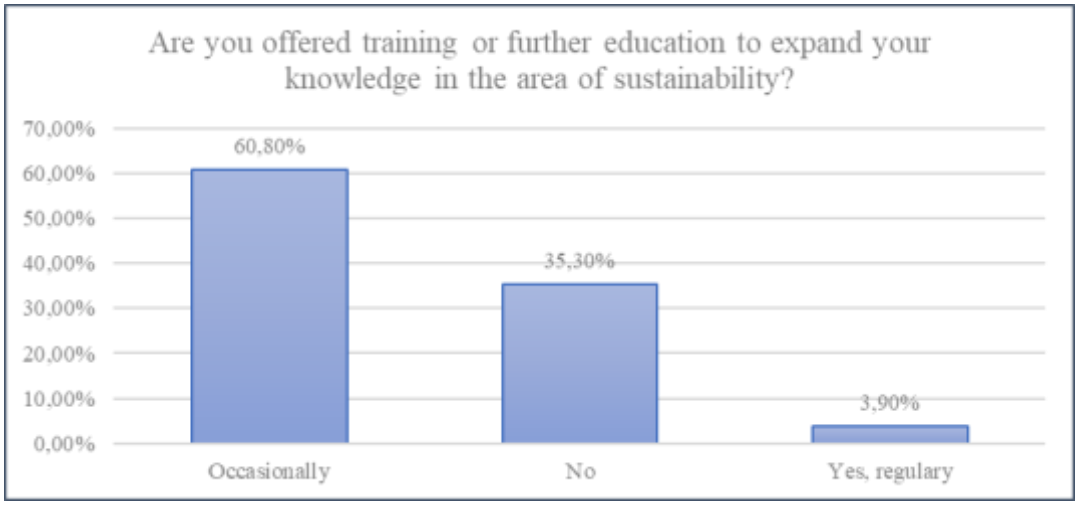

Figure 4. Offered training or further education in sustainability.

The final question (ninth question) in the survey looked at the challenges and obstacles to integrating sustainability into the curriculum. The results revealed that the most frequently mentioned factor of 42.4% is the budget and limited resources for sustainability programs. This is a significant barrier as schools often have to work with limited financial resources. Integrating sustainability may require additional spending on teaching materials, training or extracurricular activities. This finding highlights the need to encourage education authorities and policy makers to allocate more resources to sustainability initiatives in schools. The second most cited factor, at 31.8%, is the lack of appropriate teaching resources and materials. Teachers need high quality teaching materials to effectively integrate sustainability into the classroom. It is important that educational publishers and organizations support teachers with the necessary resources to facilitate sustainability education. The fact that 13.6% of the surveyed teachers mentioned ‘other’ challenges highlights the variety of potential barriers they may face. These ‘other’ challenges should be explored further to understand exactly what specific difficulties arise and how they can be overcome. Finally, resistance from teachers and parents to sustainability initiatives was mentioned by 12.1% of respondents. This is an interesting result as it points to the importance of acceptance and support within the school community. There may be a need to educate both teachers and parents and raise awareness of the benefits of sustainability education to minimize resistance (**Figure 5**).

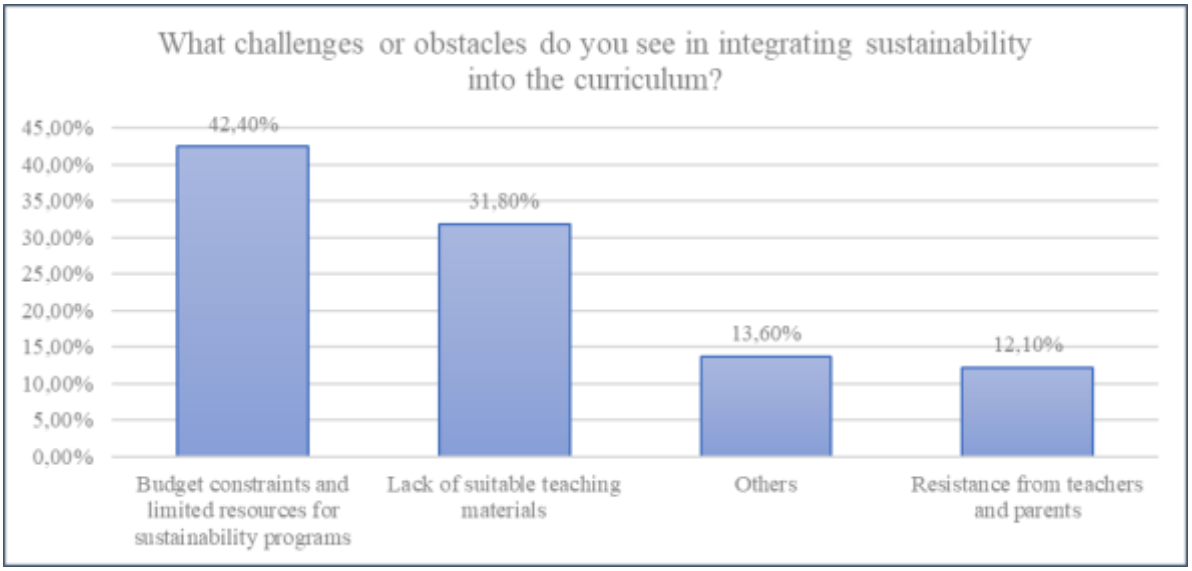

Figure 5. Challenges in integrating sustainability into the curriculum.

5. Conclusion

5.1. Discussion

Based on the study results, the previously identified five research questions (RQ1, RQ2, RQ3, RQ4 and RQ5) can be answered, resulting in a holistic view of the current state of sustainability education in elementary schools of Baden-Wuerttemberg. The data indicate limited awareness of sustainability among elementary school students (RQ1). 77.4% of all respondents rate the children´s knowledge as low. This result signals that current efforts may not be sufficient to provide children with basic knowledge of sustainability. This is a significant finding that could show a possible lack of education in this area. It could be that sustainability education may not be sufficiently emphasized in elementary school or that there are difficulties in adequately teaching this topic. It may also be an indication that children are hardly taught about this topic at home either, further emphasizing the importance of school. The small proportion of teachers (17%) who rate students' awareness as high raises again questions about external influences, such as from the parents, or isolated successful educational practices. The result that 5.7% of the teachers surveyed stated that elementary school students have no knowledge at all about sustainability is alarming. It shows that there may be schools where sustainability education is neglected or that children may not be adequately prepared for this important topic. Overall, these results show that sustainability education in elementary school can play a crucial role and that there is room for improvement. 96.2% of the surveyed teachers confirm that sustainability topics are appropriate for elementary school children (RQ2). This high level of support shows that teachers recognize the value of introducing sustainability concepts early in a child's educational journey. On the other hand, only 3.8% of the teachers surveyed stated that children are still too young to deal with sustainability issues. This percentage is low and shows that only a small minority of teachers believe that sustainability issues should not be taught appropriately in elementary school. The

data shows that 57.7% of the respondents stated that sustainability is very rarely addressed in elementary school. This number is significant and illustrates that there may be a need for action in terms of integrating sustainability topics into the curriculum (RQ3). However, the fact that sustainability plays a major role in at least some schools (23.1%) shows that an effective implementation is possible and these schools could serve as role models for a general and more systematic sustainability approach. Even if geography and biology are mentioned as subjects connected to sustainability, 27.6% of the surveyed teachers state that there are no specific subjects explicitly dedicated to this topic, which is another indicator for a systematic gap in sustainability education. In addition, a significant proportion of schools demonstrate engagement with environmental and sustainability topics through occasional (48.1%) or regular (21.2%) projects outside the general curriculum. The results show that teachers are often not adequately trained in sustainability topics (RQ4). 60.8% of the respondents indicate that they only receive occasional trainings on this topic, whereas 35.3% have no access at all. This highlights a large gap in the training of the teachers, which in turn can have a negative impact on sustainability education for the children. Only 3.9% report regular trainings, which signifies that sustainability is not yet a priority. In order to improve the quality and consistency of sustainability education, it is important to expand the range of training options for teachers and offer them more frequently. The main challenges regarding the integration of sustainability aspects into the curriculum of elementary schools are limited budgets (42.4%) and a lack of corresponding teaching materials (31.8%) (RQ5). This highlights the need for more financial and material support to facilitate sustainability education. In addition, 12.1% mention the resistance from teachers and parents as another challenge pointing to additional socio-cultural challenges in implementing sustainability aspects. Teacher resistance might be connected to the fear of additional workload and a lack of familiarity with sustainability topics, while the resistance of parents can result from different views on the appropriateness of such topics for young children. These concerns can be addressed through an increased awareness and clear communication about the benefits of sustainability education to gain more support from both teachers and parents.

Nevertheless, as other studies (Ampartzaki et al., 2021; Ladson-Billings, 2021; Nousheen et al., 2020; Timm and Barth, 2020) suggest several measures can be taken to integrate sustainability content into education on the hand and to build competencies both on the side of teachers as well as on the side of the students. Timm and Barth (2020) suggest to integrate sustainability education stepwise as integral part into teachers' education. Building competencies is a crucial part to transfer knowledge in a successful way to children, as well as choosing the adequate learning objectives and tools or methods to transfer them to children. Despite that finding age-appropriate content and methods of learning plays an important part as well (Ampartzaki et al., 2021; Timm and Barth, 2020).

Thus, the findings of this study show alignment with findings of these other studies (Ampartzaki et al., 2021; Ladson-Billings, 2021; Nousheen et al., 2020; Timm and Barth, 2020). The results mirror in a way the transformation processes the education system is currently undergoing in order to align with sustainability education goals as e. g. set by the United Nations. They show pathways for

improving sustainability education in elementary schools in Baden-Wuerttemberg and show that sustainability education is a stepwise approach and learning experience for both teachers and students. Research and education approaches should focus on equipping personnel with the adequate competencies and on giving time to develop these competencies in themselves.

5.2. Limitation and future research

Given the limited sample size of 51 answers and the use of snowball sampling method, the empirical data cannot be seen as representative for the state of Baden-Wurttemberg. Therefore, it would be advisable for future research to aim for a broader data foundation. The scientific work has focused on the extent to which sustainability is already addressed at elementary schools in the state of Baden-Wuerttemberg. Future research should now focus on other federal states in Germany, Europe or worldwide to find out whether there are statewide differences. In addition, it would also be important to look at the different curricula and explore to which extend sustainability education is present there and whether it can be prioritized even more. Budget constraints and limited resources were identified as most significant barriers. Therefore, exploring specific strategies to address these challenges represents another direction for future research.

5.3. Practical implications

In summary, the research findings provide valuable insights into the current state of sustainability education in elementary schools in Baden-Wuerttemberg. The survey revealed that sustainability is not consistently integrated into the curriculum, with a significant pro-portion of respondents indicating limited coverage. However, it is encouraging to see that some schools are actively promoting sustainability through various initiatives and projects. Furthermore, elementary school teachers recognize the importance of sustainability education and express a strong desire to sensitize children to this topic from a young age. This consensus among teachers suggests a potential opportunity for educational authorities to prioritize and support the integration of sustainability topics into the curriculum. Despite the willingness of many teachers to raise awareness of sustainability, there is a need for increased access to training and professional development in this area. A substantial portion of respondents reported limited or no opportunities for sustainability focused training, highlighting the need for more comprehensive teacher education in this regard. Challenges and barriers to sustainability education include budget constraints, a lack of appropriate teaching resources, and potential resistance from teachers and parents. These challenges underscore the importance of allocating resources, providing necessary materials, and fostering acceptance within the school community to facilitate the successful integration of sustainability into elementary school education. In conclusion, while there is room for improvement, the survey results suggest a growing awareness of the significance of sustainability education in elementary schools. The findings call for targeted efforts to enhance curriculum integration, teacher training, and re-source provision in elementary schools to promote a more sustainable and environmentally conscious generation of students in Baden-

Wuerttemberg. The results of this survey have important implications for educational policy and practice. It shows that there is a clear consensus among elementary school teachers that sustainability education should have a high priority in the curriculum. This could lead to school authorities and educational institutions promoting and supporting the integration of sustainability topics into the curriculum.

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