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TEACHERS' ATTITUDES & BARRIERS TO IMPLEMENTING CLIMATE CHANGE EDUCATION IN SECONDARY SCHOOLS

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ABSTRACT

This study aimed to investigate the teachers' attitudes toward incorporating climate change education in secondary schools. It was a descriptive study with quantitative research design. Two hundred secondary school teachers were selected through a stratified sampling technique. For data collection, a five-point self-developed Likert scale was used. Data was analyzed over SPSS 20. Descriptive and inferential statistics were used. It was found that most of the participants agreed about the importance of climate change in education, but they face barriers to implementation. The main challenges found were insufficient resources, training, and a crowded curriculum. The professional development participation particularly anticipated positive attitudes towards the climate change education. There was no significant difference in attitude towards the climate change based upon gender. A significant association was found between the subject taught and attitude towards climate change education. Findings highlight the need for targeted support, including improved resources, training, and curriculum integration, to enhance teachers' capacity and confidence in delivering climate change education.

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INTRODUCTION

The intergovernmental panel on climate change, 2021 define climate change as long-term changes and temperature and weather patterns adjustments. It is a major worldwide issue that presents serious risks to environment, the economy, and people (Landrum, Cook & Green, 2022). According to National Aeronautics and Space Administration (NASA, 2022), there is overwhelming scientific agreement that human activity, specifically combustion of fossil fuels and deforestation, is causing

Earth's climate system to undergo historical changes. There is a growing demand for comprehensive education on climate change to give future generations the knowledge and abilities they will need to tackle this complex issue. The climate change is an objective necessity for global action, and education is one of the ways to prepare future generations to prevent this problem. Education on climate change (CCE) in the schools is important in raising awareness and achieving changes in people's behaviour. However, one must understand that accepting or implementing CCE is highly dependent on the attitude of the teachers in this respect and how they plan to incorporate this into their curriculum. The climate change education should be encouraged and fostered by education providers and officers.

This can be achieved by inspiring school to cultivate an environment with focus and commitment towards environmental education, provision of policy and resources for implementing the climate change, and implementing climate change into standard curricula and frameworks (Monroe, Plate, Oxarart, Bowers & Chaves, 2017). Climate change education and, consequently, implementation of same can hardly be done without input of teachers. As Hestness, McGinnis and Riedinger (2014) pointed out, it means that their practices as teachers and effectiveness of climate change education largely depend on their perception, conception & attitudes about this phenomenon. As emphasized by existential studies, there is a probability that teachers with a clear perception of climate change and a positive attitude towards environmental education will be likely to include issues related to climate change in their curriculum (Anderson, Field & Monroe, 2022). Education plays significant role in enhancing awareness and understanding of climate change aversions. For this reason, climate change has integrated into school curricula so that students can be equipped to become informed citizens who can make sustainable decisions (Anderson, 2012). UNESCO (2019), climate change education should be cohesive at different levels of learning so that society becomes highly resistant and informed.

Monroe et al. (2017) observe that schools are critical in developing the students' thinking, passing climate information, and engaging them in active solutions. Critical thinking being a twenty-first century has been focused in national and international literature for twenty-first-century learners (Jamil, Mehmood & Aziz, 2024; Jamil, Mehmood & Noorani, 2024; Jamil, Mehmood & Shah, 2024; Jamil, Muhammad & Aslam, 2024; Jamil & Muhammad, 2019; Jamil, Muhammad & Qureshi, 2021; Naseer, Muhammad & Jamil, 2022; Ngozi & Hyacinth, 2021; Onsee & Nuangchalerm, 2019). Bernard and Walker (2016) supported the need to consider teachers' attitudes on climate change as one of key aspects determining their ability and willingness to integrate climate change issues into their teaching. Hestness et al. (2014), teachers' beliefs about climate change education could affect how they teach the subject, the extent to which they incorporate it into their lessons and the strategies adopt during the process. People must possess positive attitudes to achieve an effective climate change education for the engagement and productivity (Stevenson, Nicholls & Whitehouse, 2017). The global climate change is accepted as relevant, and inclusive education incorporates this into the school curriculum, which is broadly recognized as vital, yet there remains a raft of challenges.

Lack of resources and training for educators constitutes a chief barrier. Hestness et al. (2014) argued that from the above discussion, it could be argued that a lack of professional development has left

many educators feeling inadequate when it comes to teaching complex scientific concepts that relate to the climate change. The implementation of climate change education largely relies on teachers. Besides, there is limited room for expanding already crowded curricula, and prevailing culture of standardized testing in many schools and colleges discards any attempt that has the potential to occupy classroom time (Kirk et al., 2014). Moreover, a method by which an instructor teaches her beliefs and impressions might inform the course about climate change. According to a study, these teachers think climate change is a politically sensitive issue or that they have concerns regarding the effects of people on the climate by teaching it (Wise, 2010). Secondly, the outcomes of this research can help enlighten education leaders and policymakers about the resources needed to facilitate the mainstreaming of climate change subjects in our curriculum. Thus, by shedding light on the issues and the challenges instructors face, this research can contribute to developing specific measures to help educators overcome these challenges and ensure students' improvements in climate knowledge.

Research Questions

1. What is the teachers' perspective upon integrating climate change education in schools?
2. What are the perceived barriers that are associated with the climate change education?
3. What is association amid subject taught and attitude toward climate change education?
4. What is the effect of different factors on attitude towards the climate change education?

LITERATURE REVIEW

The purpose of integrating climate change into contemporary curriculum is to equip the students with the knowledge and skills that will enable them to understand problems and deal with them as posed by the changes in climate. Life skills are also being focused on the literature (Jamil, Chohan & Tabassum, 2024; Jamil, Hassan & Godil, 2024; Jamil, M., Jabeen, M., & Moin, 2024). Montague, Landhäusser, McNickle and Jacobs (2022) suggest that it addresses climatology of climate change, its impacts on humans and ecosystems and management and response measures. Climate change must be addressed in school curriculum to foster learning in environment and encourage voluntary engagement in pro-environment causes (Anderson, 2012). Studies have explored educators' beliefs on how they teach climate change, which has explained several features that affect these beliefs. Teachers' self-organised beliefs are found to be significant in willingness to teach climate change education: the climate change beliefs, climate change knowledge confidence, and climate change perceived relevance (Wise, 2010). Stevenson et al. (2017) found that teachers believed in climate change and its impact on future generations supported the idea of climate change education more in their classrooms.

Teachers' perception of climate change teaching and the factors determining these attitudes have been subject of several research. Hestness et al. (2014) surveyed 22 science teachers to determine their beliefs and practices concerning climate change instruction. Although they acknowledged the importance of making the students aware of climate change, the study revealed several barriers that most teachers faced, including resource constraints and low self-efficacy. Another study by Stevenson et al. (2017) concerns how American teachers' opinions about the climate change may connect to classroom practices. Teaching methods were shown to be highly sensitive to instructors'

individual beliefs about climate change, as identified by study. To introduce climate change into lessons, teachers were likelier to do so for those who tacit human contribution to phenomenon and its relevance to the students. Thus, more of these attitudes should be changed so that climate change education can be implemented, and instructors can get the support they require. The present study contributes to the growing body of literature on climate change education by informing teachers about their attitudes and antecedents related to them. Wise (2010) conducted a study to explore the diverse strategies and challenges that the Colorado science teachers met while trying to teach the climate change.

The outcome showed a difference in the teachers' knowledge about the science regarding climate change, their perceived support from administration, and their access to professional development that influenced their attitude toward teaching climate change. As seen from teachers' experiences, some barriers must be overcome to achieve effective school climate change education. Professional development programmes that highlight issue of climate change can improve teachers' confidence and skills in teaching the subject (Hestness et al., 2014). These courses should entitle educators to use the most current scientific advancements, teaching-learning methodologies, and teaching-learning aids for interdisciplinary teaching. Some studies carried out in the recent past help to illustrate the socialization of teachers concerning climate change, where these teachers' attitudes can be cited as varying depending on factors like beliefs and knowledge and sociopolitical features that define a given society. Individual values remain a strong influence, as beliefs remain important tools. Further, Herman, Zeidler and Newton (2022) identified that the belief in climate change is associated with CCE and teachers who believe in the climate change are more likely to include it in their teaching.

However, individuals with concerns, social suspicion, those who regard climate change as political issue may afford minimal devotion. Special knowledge concerning subjects determines people's attitudes. The teachers understand CCE well, which has made them feel confident and positive towards implementing the system. But Lombardi and Sinatra, in their latest study conducted in 2021, highlighted that even within science teachers, there are differences in their attitude based on their knowledge and perceptions about climate science aspects and content Nancy graphics and their preparedness to teach interdisciplinary and complex concepts. Today, more attention has been paid to such aspects as cultural and regional ones. For instance, O'Brien, Selboe and Hayward (2022) synthesized the effects of regional political climates on teachers' perceptions of CCE in the United States. This research showed that in socially conservative areas, teachers were less likely to offer CCE not because of student interest but due to potential community and political backlash. The position of education in combating climate change is significant, and schools act as central places for climate change awareness and modelling of responsive behaviours. The latest research stipulates the increasing concern for the integral significance of CCE as an information type in inclusive education.

For example, the report by IPCC (2021) insists educational systems must incorporate CCE with more organization and asserts that it is vital to equip students for the future environmental dilemmas. However, a study by Anderson et al. (2022) shows that CCE needs to be integrated into various

subjects, including humanities and social sciences, instead of limiting CCE to sciences only. This interdisciplinary approach allows for not only a better understanding of the issue in question by the learners but also allows them to consider the social, economic, and political sides of climate change. Even nowadays, climate change education is known to be essential, though the several challenges prevent it from being incorporated into the school curriculum. One of the challenges is the absence of necessary supplies and opportunities for personal and professional development of the teachers. Thus, lack of effective professional development and access to scarce and high-quality teaching resources have left educators ill-equipped to effectively teach about climate change (Hestness et al., 2014). Climate change appears to be another contentious issue. Another problem is the duality of the points being made regarding climate change. It is because there are some topics that the educators may feel they cannot address in their classrooms due to their political or social sensitivity, like climate change.

Unfortunately, this hesitation is often caused by lack of institutional support and a general absence of clearly delineated rules for the pedagogy of climate change (Wise, 2010). To extinguish these barriers, a collective endeavour must ensure teachers receive the support, training and resources they require to confidently and effectively educate their students on the climate change. Current research also reveals that there are still major constraints to properly utilising CCE, most of which are connected to teachers' perceptions and practice environment. Lack of resources continues to be an all-pervading problem. Cook and Lewandowsky (2021) revealed that teachers are unaware of the modern or updated materials, teaching aids and resources that might help them teach CCE. This is mainly true in financially starved schools and areas that do not make climate a policy agenda. Another area that remains to be scrutinized is professional development. Slavin (2016) noted that teachers have expressed their vulnerability regarding CCE socio-structurally since they have not been well-prepared for this practice. Landrum et al. (2022), teachers' knowledge and confidence about climate change is established to be partly informed, with only a small percentage trained in the climate science.

It revealed importance of engaging in professional development regularly, wherein participants are updated with the current scientific knowledge on climate change so they can learn more about how to teach this content to students. The curriculum's limitation is now regarded increasingly as a major limitation. Most often, they are among subjects vying for scarce teaching time, which implies that they struggle for teachers' attention. Rickinson et al. (2021), in recent publication, have noted that unless the CCE has been spelt out either as a curricular component that cannot be dropped or as a guidance that must be followed, then the teacher is likely to be left with no room to provide for CCE as part of teaching practice. Sociopolitical factors have remained full in determining teachers' application of CCE. Ballew et al. (2022) observed that teaching in politically conservative areas is likely to encounter resistance from parents and community members, thus leading to reluctance the topic altogether. This highlights that more engagement in supportive policies for CCE and communities will go a long way in addressing the sociopolitical challenges. Variability of teachers' attitudes towards CCE across different regions has been evidenced in number of studies conducted in the recent past.

While in North America, emphasis has been placed on effects of political polarization on teachers' behaviour. Kahan et al. (2022) found that in United States, the teachers' willingness to teach CCE depends on their political stance on climate change, affecting when and how the subject is taught, with different regions having different perceptions of the subject. Several recent European research studies have focused on the effects of education policy on teachers' perceptions. Otto et al. (2021) pointed out that learning with strong policies towards environmental education in Europe, such as Germany and Sweden, suggested that teachers considered CCE important aspect in implementing their educational processes. This also means these teachers have higher institutional support and resources, positively affecting their attitude towards CCE. Specifically, slowly emerging literature deals with the issues and prospects of CCE in various settings in Asian countries. In January 2021, Li et al. also conducted a study on the development of CCE in China. They pointed out that while the assessment of efforts to adopt CCE into education system in China is positive, there remain issues with teacher training and regional differences in education. Also, Jho et al. (2022) led a study in the South Korea.

They identified how, though the country's government is very supportive regarding CCE, teachers are still encountering new problems associated with curriculum congestion and scarce training. To overcome the barriers mentioned earlier, recent studies propose several approaches that could be implemented to boost teachers' perspectives & successfully implement CCE. They cite professional development programs as an important method. The study by Evans et al. (2022) identified that there must be targeted professional development, including workshops and collaborative learning, to increase the confidence and competence of teachers who teach CCE. If such programs are to be developed, they should be long-term structured programs sensitive to dynamic trends in climate science and education practices. Other approaches can also improve CCE, such as engaging the community and stakeholders. Thus, Andersson and Öhman (2022) reveals that when parents, local communities and environmental organizations are engaged in climate education initiatives, CCE support is enhanced, and teachers are better equipped to tackle issue. Such learn-and-do approach can close gap amid awareness learnt in school and practice of environmental stewardship needed in the community.

RESEARCH METHODOLOGY

The study was descriptive, so a quantitative method was used to collect data. The study's target population was all the secondary school teachers teaching in public high schools in Sheikhupura, Punjab, Pakistan. A stratified sampling technique was used to select a sample of 200 teachers comprising 100 male and 100 female teachers. A self-developed survey questionnaire on a five-point Likert scale was used to collect data. Questionnaire was divided into four parts: demographic information, attitudes towards the climate change education, perceived barriers, and professional development. Peer reviews and expert opinions ensured the validity of the questionnaire. The questionnaire was distributed in person, and teachers were given sufficient time to complete it. The collected data was analyzed using descriptive and inferential statistical techniques. The software used for data analysis was SPSS version 26. The descriptive and inferential statistics were used for the data analysis.

Table 1 Demographic Characteristics of Respondents

Demographic Variable	Frequency (n=200)	Percentage
Age		
21-30 years	50	25%
31-40 years	80	40%
41-50 years	50	25%
51-60 years	20	10%
Gender		
Male	100	50%
Female	100	50%

Table 1A Demographic Characteristics of Respondents

Years of Experience		
1-5 years	40	20%
6-10 years	60	30%
11-15 years	50	25%
16-20 years	30	15%
More than 20 years	20	10%
Subject Taught		
Science	70	35%
Humanities	60	30%
Social Sciences	40	20%
Other	30	15%

The sample consisted of 200 secondary school teachers, with an equal representation of male (50%) and female (50%) teachers. The age distribution showed that 25% of the teachers were between 21-30 years, 40% were between 31-40 years, 25% were between 41-50 years, and 10% were between 51-60 years. Teaching experience varied, with 20% having 1-5 years, 30% having 6-10 years, 25% having 11-15 years, 15% having 16-20 years, and 10% having more than 20 years of experience in study.

FINDINGS OF STUDY

The study presents teachers' attitudes toward climate change education, with three statements evaluated on a five-point Likert scale. A majority (40% agree, 30% strongly agree) believe that climate change education is important Mean= (3.80) and Standard Deviation (1.02). While 45% (30% agree, 15% strongly agree) feel confident, and a significant portion (25% neutral, 25% disagree, 10% strongly disagree) do not feel very confident on the point that they feel confident teaching about climate change, i.e., Mean= (3.20) and SD= (1.10). A substantial proportion of the teachers (30% disagree, 20% strongly disagree) feel that resources are inadequate Mean = (2.65) and SD = (1.08).

Table 2 Perceived Barriers to Climate Change Education

Barrier	Frequency	Percentage
Lack of resources	60	30%

Insufficient training	50	25%
Crowded curriculum	45	22.5%
Perceived controversy	25	12.5%
Lack of administrative support	20	10%

The above table outlines teachers' key barriers when implementing climate change education in their schools. The most significant barrier, cited by 30% of teachers, is a lack of resources, indicating that many teachers do not have the necessary materials, tools, or funding to effectively teach this subject. The second most common barrier, reported by 25% of the teachers, is insufficient training, suggesting that quarter of respondents feel unprepared or lack professional development needed to confidently teach climate change topics. Another notable barrier is crowded curriculum, stated by 22.5% of teachers, implying that the existing curriculum is too full to accommodate additional content on climate change. Specific concern over controversy in climate change education is a concern to 12.5% of teachers shown their fears of voicing what they teach in class over controversy that may arise from the students, parents or community. Lastly, lack of administrative support is highlighted by 10 % of the teachers, meaning that there is a lack of adequate support from school administration to support climate change education. The table highlights a range of obstacles that hinder active climate change education, with resource limitations and short training being the most prevalent issues.

Table 3 Participation in Professional Development

Professional Development Activity	Frequency	Percentage
Attended workshops	75	37.5%
Online courses	50	25%
Collaborative teacher networks	40	20%
None	35	17.5%

Participation in professional development activities related to climate change education was moderate. About 37.5% of the teachers attended workshops, 25%. Participated in online courses, 20% engaged in collaborative teacher networks, and 17.5% did not participate in professional development activities.

Table 4 T-Test Comparing Attitudes towards Climate Change Education (Gender)

Gender	Mean	SD	t-value	p-value
Male	3.70	1.05	1.23	0.22
Female	3.85	1.01		

The table shows that female teachers' mean score is higher than male teachers, i.e., 3.85 and 3.70. Female teachers are concerned about climate change education than male teachers. No significant difference was found in attitudes towards climate change education amid male & female teachers ($t = 1.23$, $p = 0.22$).

Table 5 Chi-Square Test

Science	50	20	8.56	0.01
Humanities	30	30		

Social Sciences	20	20
Other	10	20

A significant association was found between subject taught and attitude towards climate change education ($\chi^2 = 8.56$, $p = 0.01$), with science teachers showing more positive attitudes as evident in these results.

Table 6 Regression Analysis Predicting Positive Attitudes Towards Climate Change Education

Predictor Variable	B	SE	Beta	t-value	p-value
Years of Experience	0.05	0.02	0.15	2.50	0.01
Participation in Professional Develop	0.40	0.10	0.30	4.00	0.001
Gender (Male=0, Female=1)	0.10	0.08	0.10	1.25	0.22

Participation in professional development was a significant predictor of positive attitudes towards CCE ($\beta = 0.30$, $p = 0.001$), while years of experience had a positive but less significant effect ($\beta = 0.15$, $p = (0.01)$.

- ✓ The majority of teachers agreed that CCE is important for students (70%). Still, confidence in teaching CC was moderate, with only 45% agreeing or strongly agreeing that they felt confident. Adequacy of resources for CCE was a significant concern, with 50% disagreeing or strongly disagreeing that their school provided adequate resources.
- ✓ The most commonly reported barriers to incorporating CCE were lack of resources (30%), insufficient training (25%), a crowded curriculum (22.5%), perceived controversy (12.5%), and lack of administrative support (10%).
- ✓ The professional development participation in professional development activities related to climate change education was moderate. About 37.5% of teachers attended workshops, 25% participated in online courses, 20% engaged in collaborative teacher networks, and 17.5% did not participate in professional development activities.
- ✓ No significant difference was found in attitudes towards climate change education between male and female teachers ($t = 1.23$, $p = 0.22$). A significant association was found between the subject taught and attitude toward the climate change education ($\chi^2 = 8.56$, $p = 0.01$), with science teachers showing more positive attitudes.
- ✓ Participation in professional development was a significant predictor of positive attitudes towards climate change education ($\beta = 0.30$, $p = 0.001$), while years of experience also had a positive but less significant effect ($\beta = 0.15$, $p = 0.01$).

DISCUSSION & CONCLUSION

The findings highlight several key issues in the incorporation of the climate change education in secondary schools: Despite recognizing the relevance of climate change education, teachers are comparatively less assured about teaching the subject. This gap means one needs to make a special focused effort to improve teachers' content and teaching practices in this area (Monroe et al., 2017). We still face problems of inadequate resources as one of the sources of hindrance. In this section, Kirk et al. (2014) noted that for schools to be effective in the teaching creationism, they must be provided with the correct and proper teaching material, up-to-date scientific information, and the

requisite support from the relevant school authorities. National and local government support is key to creating a conducive environment for CCE programs. UNESCO's (2021) study also shows that a policy environment that compels schools and educators to offer CCE as part of the guaranteed curriculum, coupled with adequate policies that support teachers teaching within the capacity of CCE, is crucial.

Moreover, implementing policies supporting teachers' academic freedom to teach climate change without being restrained by political sentiments is essential in supporting CCE. Lack of training is another problem that has been cited as a major hindrance towards the implementation of National Health policies. Efforts should thus be made to ensure professional development programmes that can facilitate the need for climate change education among teachers for capacity and confidence enhancement (Hestness et al., 2014). The positive attitudes indicate that climate change education is given higher relevance in science teaching. Including topics on climate change across curriculum could assist in redressing this and encourage the students to learn across disciplines (Stevenson et al., 2017). The study revealed that secondary school teachers in Sheikhupura generally recognize the importance of climate change education but face significant barriers to its implementation. Confidence in teaching climate change was moderate, and availability of resources and training was inadequate.

Recommendations

- ✓ Research to identify teachers' attitudes and practices before and after some time in future, particularly after they have undergone professional development programs.
- ✓ Assess the impact of selected staff development approaches on the self-efficacy of teachers to address climate change education.
- ✓ Research ways climate change content can be addressed in specific curriculum areas across the grade levels for instructional connection.
- ✓ Assist students in acquiring knowledge, attitudes, & behaviour concerning climate change through a climate change education program.
- ✓ Examine the part played by policies that impact education and administrative frameworks in enhancing application of climate change education in schools.

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