Peer Influencing on Climate Literacy: A Social Network Analysis Among School Teachers in District Rajanpur

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Abstract

This study explores the role of peer influencing in promoting climate literacy among school teachers, using a social network analysis approach. It aims to identify key influencers and assess opportunities to integrate climate literacy into educational practices effectively. The research locale is District Rajanpur, where a sample of 200 teachers was selected through a multistage sampling technique. Initially, Tehsil Jampur was randomly chosen, followed by the selection of 40 schools (20 girls' and 20 boys' schools), and finally, five teachers from each school were sampled using convenient sampling. The findings highlight the dynamics of teachers' social networks, pinpointing influential individuals capable of spreading climate knowledge effectively. Recommendations are provided for personalized interventions to enhance teachers' understanding of climate science, ensuring the effective communication of climate-related concepts in classrooms.

Keywords: Peer Influence, Climate Literacy, Social Network Analysis, Educational Practices, Teacher Networks.

Introduction

Climate change is one of the most pressing global challenges of the twenty-first century, impacting ecosystems, economies, and communities. Education is widely recognized as a powerful tool to address climate issues by fostering climate literacy–an understanding of climate science and its implications for society. School teachers play a vital role in promoting climate literacy among students, as they serve as knowledge providers and role models. However, the effectiveness of their teaching often depends on their own understanding and attitudes toward climate issues. In the context of District Rajanpur, a region vulnerable to climate-related challenges such as floods and droughts, equipping teachers with adequate climate literacy is crucial. Peer influence and social relationships among teachers significantly shape their knowledge-sharing practices and learning behaviors. Social network analysis (SNA) provides a unique approach to mapping these relationships, offering insights into how peer interactions contribute to the dissemination of climate-related knowledge.

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According to the UNESCO defines literacy as "the ability to identify, understand, interpret, create, communicate, compute and use printed and written materials associated with varying contexts enabling individuals to achieve their goals to develop their knowledge and potential and to participate fully in their community and wider society". Literacy can also be defined as competence or knowledge in a specific area (Johnson, 2018). Climate literacy plays an important role in promoting pro-environmental behaviour among students. As soon as students grasp the reasons and consequences of climate change, they gain a better awareness of how their actions affect the environment. This consciousness motivates them to embrace eco-friendly habits, like minimizing waste, saving energy, and growing trees. Teachers can promote climate awareness by integrating environmental issues into the curriculum and planning events such as recycling initiatives and nature-focused projects (Srivastava, 2024).

Global climate change is one of the greatest challenges that modern society faces. A climate change impacts are increasingly evident, improving the climate literacy of future scientists and the general population becomes more important (Veron et al., 2016). Climate literacy comprises knowledge, skills, and attitudes that enable individuals to counteract the global threat of anthropogenic climate change. Teachers' knowledge and pedagogy are main predictors of students' learning outcomes, but teachers are insufficiently prepared in the interdisciplinary field of climate literacy (Leve et al., 2023).

Given that the implementation of reforms is one of the greatest and constant challenges for schools, research communities have improved methods to probe policy implementation processes. Analyses of teachers' social networks are critical to these endeavors because it is teachers who implement new practices in classrooms; and as they do so, teachers seek local knowledge and respond to local norms embedded in their collegial networks (Frank et al., 2014). Climate change is expected to have unprecedented global impacts, requiring collective action to mitigate its effects and adapt to a changing world. Increased flooding and droughts, rising sea levels and reduced food security all seem likely (Valdez et al., 2017). Concern for school climate and its impact on students and learning environments has been a focus in education for over a century. Teachers play a crucial role in supporting various aspects of child development, including social, emotional, cognitive, academic, and behavioral skills (Simorangkir et al., 2024).

Classroom behavior problems are a longstanding major stressor for teachers. Despite the prevalence of this stressor, teachers' perceptions of classroom behavior problems vary significantly, both within the same school and between schools (LeBlanc et al., 2007). Social network analysis serves as an effective method to examine the connections between teachers and staff within a school. It aids in illustrating the relationships among people, revealing who engages with whom and the frequency of those interactions (Hawe and Ghali, 2008). Knowledge is an asset that increases when others share it, and its sharing and dissemination leads to synergy and growth of individual and collective knowledge. In fact, the dissemination of knowledge is the process of communication between two or more people, which includes the transfer and acquisition of knowledge. In knowledge dissemination, the focus is on human capital and interpersonal interactions. Today, social networks have become a valuable platform to facilitate knowledge sharing and communication, not only at a personal or individual level, but also for organizations (Jabbari et al., 2024).

South Punjab is a vast region which has a high risk of climate change with districts like Rajanpur and Dera Ghazi Khan living on the brink of troubles. Rajanpur, in fact, is most climate-sensitive in Punjab. It ranks among the top 5 districts with the highest sensitivity (0.7) and the lowest ability to adapt (0.1). This is majorly because of the high number of children, the elderly, and the patients suffering from diarrhea and respiratory infections. Moreover, the district is also considered one of the least resilient areas because of the lack of facilities of education, health, water, and sanitation (Govt. of Punjab, 2023). District Rajanpur, the

southernmost district of Punjab, is highly vulnerable to climate risks, particularly from the Indus River. Each May, as Himalayan snow melts, the river swells to about 15–20 kilometers wide in the summer. The Kacha Zone, closest to the riverbed, faces frequent monsoon floods in July and August, impacting low-lying areas in Jampur, Rajanpur, and Rojhan tehsils. In 2022, the Pakistan Meteorological Department reported an average rainfall of 293 mm in Rajanpur, exceeding the previous five-year average. Persistent rains in the Koh–e–Suleman catchment area caused severe flooding, affecting 80% of the district and 60% of its population. Additionally, in August 2022, the hill torrents Kaha and Chachar released around 184,841 cusecs of water, exacerbating the flooding situation (Govt. of Punjab, 2018; Hashmi, 2023). The study on climate literacy among teachers in Rajanpur district is crucial for addressing urgent environmental challenges. Vulnerable to climatic effects like floods, uneven rains and heatwave, Rajanpur needs informed responses to climate change. Teachers as influential community leaders, play a key role in shaping climate awareness and fostering adaptive behaviors. Equipping them with climate science knowledge and effective communication skills enhances local awareness, promotes sustainability, and strengthens resilience against climate impacts. This initiative supports national priorities for climate education and regional efforts towards sustainable development and disaster resilience, crucial for navigating and mitigating climate challenges in Rajanpur.

Statement of the Problem

Despite the importance of climate literacy, there is a lack of research exploring the role of peer influence in shaping teachers' understanding and attitudes toward climate issues in District Rajanpur. Teachers often rely on their professional networks for sharing knowledge, but the dynamics of these networks remain understudied. This gap hinders efforts to design effective interventions aimed at improving climate literacy among teachers. By using SNA to analyze peer influence, this study seeks to identify key influencers, understand communication patterns, and propose strategies to enhance collaborative learning and climate literacy among school teachers in the district.

Objectives of the Study

To explore the role of peer influence in shaping climate literacy among school teachers in District Rajanpur using social network analysis.

1. To map the social network of teachers as key influencers for climate literacy.
2. To identify strategic opportunities and effective approaches for integrating climate literacy into educational practices among teachers.
3. To suggest recommendation for tailored interventions to enhance teachers' understanding of climate science for effective climate-related concepts communication in classrooms.

Hypothesis

H_1: Higher the teachers' qualification; more likeliness to integrate climate literacy in curriculum
H_2: More the formal education used as knowledge source; more likeliness to face challenges in integrating climate literacy at school
H_3: More climate change effect quality of life; more will be increase in temperature
H_4: More the climate change effect quality of life; more occurrences of heatwave
H_5: More the climate change effect quality of life; more will be change in rainfall
H_6: More the climate change effect quality of life; more will be occurrence of floods
H_7: More climate change topic discussion with coworkers; higher peer opinion influence understanding on climate literacy
H_8: Higher teacher integration climate literacy in curriculum; higher changes made in curriculum to respond climate change

Literature Review

Malhi et al. (2008) investigated the possibility that extensive deterioration of Amazonian forests could result from global climate change. Remarkably, they observed a twofold relationship between the global ecosystem service of sequestering carbon, which is highly esteemed globally, and the regional transpiration services that are essential for preserving the local climate. This interaction offers a chance to maintain Amazonia's ability to withstand climate change while also advancing its development and conservation initiatives.

According to Bangay and Blum (2010) education may play a major role in addressing climate change and advancing more general sustainable development objectives that take into account social, economic, and environmental factors. They promoted educational assistance that included pedagogical strategies, curricula, assessment systems, and learning environments that promote high-quality learning, in addition to curricular content and enrollment initiatives. Their strategy places a strong emphasis on acquiring particular information and abilities while boosting people's and communities' ability to deal with unforeseen circumstances and quick changes in the political, economic, and environmental spheres. They contended that, in order to address climate change within the context of sustainable development, a comprehensive strategy that prioritizes long-term quality of life over immediate profits is needed.

Adedeji et al. (2014) found that climate change is one of our time's most important concerns, putting a pressure on both societies and the environment. Its consequences, including as altered weather patterns endangering food production and rising sea levels raising the risk of catastrophic flooding, are worldwide and unparalleled in magnitude. Without fast and significant action, future adaptation to these impacts will become increasingly difficult and costly. Their thorough overview covers the principles of global climate change, its associated words, causes, effects, and potential remedies, emphasizing the critical need to act immediately to avert an irreversible accumulation of greenhouse gases and reduce global heat. To properly address climate change, unprecedented cooperation is required not only across countries but also across different levels.

Dal et al. (2015) stressed the importance of teachers' understanding and awareness of environmental concerns like as climate change in developing larger social understanding, particularly among younger generations. They emphasized the necessity of educational efforts that improve teachers' knowledge, comprehension, and awareness, as well as the need to measure their influence on achieving effective educational results. Mochizuki and Bryan (2015) pointed out that despite increasing recognition of education's role in addressing climate change challenges, the education sector remains underutilized as a strategic resource for both mitigation and adaptation efforts. Many countries have not yet developed a cohesive framework for climate change education (CCE), which aims to prepare and make education systems responsive to climate change challenges. There is an urgent need for policymakers to gain a better understanding of the systemic effects of climate change in order to strengthen climate responses through education.

Liu et al. (2015) shared that climate change education has received increased attention due to its timeliness and necessity. To improve climate change education, it is critical to understand teachers' attitudes toward GCC. This study investigated the association between teachers' attitudes and understanding of GCC. More importantly, given that teachers' instructional decisions are intimately tied to their attitudes and knowledge, this study went one step further and investigated how attitudes and knowledge may relate to teachers' classroom teaching regarding GCC. The ultimate purpose of professional development for teachers is to improve student learning. To achieve this purpose, professional development programs must focus on beginning changes in the beliefs, attitudes, and perceptions of teachers.

Goldenberg and Klavir (2017) investigated the relationship between school atmosphere, classroom environment, and teaching quality, finding that these factors are inextricably linked.

They discovered that alumni of Excellence Programs have fewer linkages in these areas and are less susceptible to external effects. This resilience appears to stem from their remarkable abilities, personal goals, and the unique characteristics of their teacher training programs. These elements contribute to enhancing the ability to withstand adversities, increment the commitment to the professional pursuits and promote their willingness to continue the journey of excellence in teaching.

As mentioned by Meilinda et al. (2017) human behavior that impacts sustainability of the environment and the complex interaction between the warming of our planet's atmosphere is responsible for climate change. They stressed the need of adding human factors into science curricula to encourage positive attitudes towards sustainability. Three perceptions were found in the study: Interactions that lead to greenhouse warming and climate change; excitation of the greenhouse effect and climate change; and resources that enhance the production of acid rain and adverse climate variation. With relation to climatic change, teachers tend to focus on global warming alone and do not go deeper to explore other facets of climatic change. The ones that focused on critical thinking dismissed the effectiveness of educational campaigns concerned with shifting people's attitudes, defining the media as a more influential factor.

Graczyk (2020) highlighted that climate science is not simple and that getting some fundamental notions would be beneficial when fighting climate change is. It is therefore important to differentiate between climate and weather since they are often used interchangeably. Weather may be defined as the minute and temporary climatic states like temperature, cloud, and wind that are a sign of current atmospheres. Climate, however, involves mean and trends over a period for instance annual mean temperature over a certain region and therefore offers an overall picture of climatic conditions on earth over time.

According to Javed \ (2020), climate change is a universal issue which affects societies in the global level. For Pakistan, it is necessary to introduce international environmental standards because the country's population and the land are now highly sensitive to climate change. A very important role is played by media organizations by giving coverage of climate change top priority and taking it to the top of their agenda. Hence, they should provide awareness through detailed news, images, stories, and printed as well as digital columns. Currently, Pakistan's media coverage on climate change is not as developed as that of the societies of the developed industrialized countries; they report on it only after an occurrence of disaster. For enhancing public awareness and its preventive measures, it is necessary to enhance the periodic reporting of climate issues.

In their study, Rousell and Knowles (2020) sought to discover whether climate change education needs to connect with other social justice issues and discourses that can adequately address climate issues. They assert the value that the prior literature failed to investigate frequently of engaging, cross-disciplinary, inventive, and affective ways of boosting climate learning. The authors argue for developing effective strategies and methods for climate change education that would directly involve children and young people in their attempts to work through intellectual, emotional, moral and political aspects of climate change problem.

According to Ennes et al. (2021) teachers are essential in helping the public develop climate literacy. Educating the public about climate issues is essential, especially in light of the urgency of climate change and its wide-ranging effects. One special opportunity to advance climate literacy is through incorporating climate change education into upper secondary settings. But a lot of upper secondary instructors shy away from teaching climate change because they find the topic uncomfortable or don't think it fits within their curriculum. Teachers' confidence in teaching this crucial subject should be increased by addressing the obstacles to their participation in climate change professional development (CCPD).

According to Simons (2021) climate change is a serious worldwide threat that will have disastrous effects on vulnerable, marginalized, and poor groups. Environmental education now

involves understanding of climate change and extends beyond the type of learning that involves tourists going around natural sites and being taught ecological issues and concepts to embracing principles of social and environmental justice.

Hussain et al. (2022) identified Pakistan as heavily impacted by climate change, as evidenced by issues such as floods, droughts, cyclones, famine, and other natural disasters that cause misery for its people. The government has taken steps to strengthen technical responses and lessen the consequences of these catastrophes. They stressed the importance of increasing citizen participation in climate adaptation and mitigation programs. Collaboration between government agencies, groups, and the general public is required to design and implement policies intended at limiting human impact in natural areas such as forests, oceans, and grasslands.

According to Huoponen (2023) effective environmental education (EE) is essential in light of the acceleration of climate change and environmental deterioration. Teachers have not provided a comprehensive perspective, despite the fact that many theoretical models have been put forth to increase the effectiveness of EE. According to the data, a large number of seasoned EE teachers think that most pupils do not acquire operational environmental literacy. This study looks into potential obstacles to achieving this literacy that may be related to the school and the students. Furthermore, behavioral literacy strategies—which teachers believe should be prioritized to guarantee the efficacy of EE are frequently absent from the EE that they give.

Rushton et al. (2023) investigated how young people express their emotions regarding climate change, focusing on negative feelings such as anxiety about the future and frustration with insufficient youth action. However, positive emotions like as optimism for the future and a sense of environmental stewardship through action were also present. Drawing on substantial environmental education research, the paper emphasizes the need for climate change education to go beyond scientific understanding and include pedagogies that address the emotional components of dealing with climate change. It underlines the critical need for comprehensive and meaningful climate change education as a core component of formal education for all young people.

Methodology

The current research study is a quantitative cross-sectional design. The research population recruited for this study included male and female teachers working in schools in District Rajanpur, Pakistan. Teachers working in schools were selected according to the selection criteria of the study, teachers were invited to take part in the study and based on their willingness they were included. The research locale was District Rajanpur. The probability sampling technique was used as the researcher has set criteria for sample selection. For this instance, sample of 200 respondents (teachers) were selected through multistage sampling technique. At first stage, 1 tehsil Jampur was chosen randomly, at second stage, total 40 schools (20 girls and 20 boys schools) were randomly selected, at the third stage, 5 teachers from each selected school through convenient sampling technique in the research study as respondents.

Results and Discussion

This chapter presents the investigation's analysis and findings. The primary purpose of this study was to measure the peer influence of school teachers on climate literacy and to examine teachers' social networks. This chapter is divided into two main sections: univariate and bivariate analysis.

Table 1: Frequency distribution of the respondents of socio–economic characteristics

	Frequency	Percentage
Age of respondent		
30–35	49	24.5
36–40	81	40.5
41–45	42	21.0
46 and above	28	14.0
Total	**200**	**100.0**
Gender of respondent		
Male	65	32.5
Female	135	67.5
Total	**200**	**100.0**
Marital Status of respondent		
Married	108	54.0
Unmarried	71	35.5
Separated	16	8.0
Divorced	4	2.0
Widowed	1	0.5
Total	**200**	**100.0**
Education level of respondent		
Intermediate	61	30.5
Bachelor's Degree	40	20.0
Master’s Degree	76	38.0
M.Phil/ PhD	23	11.5
Total	**200**	**100.0**
Teaching Experience (in years)		
3 to 7 years	84	42.0
8 to 11 years	81	40.5
12 to 15 years	29	14.5
16 and above	6	3.0
Total	**200**	**100.0**
Family Type		
Nuclear	80	40.0
Joint	120	60.0
Total	**200**	**100.0**
Total number of family members		
2–4	81	40.5
5–8	117	58.5
9–12	2	1.0
Total	**200**	**100.0**
Family income from all sources		
10,000–20,000	75	37.5
20,001–25,000	111	55.5
25,001–30,000	8	4.0
35,001 and above	6	3.0
Total	**200**	**100.0**
Contribution in household income		
5,000–10,000	72	36.0
10,001–15,000	93	46.5
15,001–20,000	2	1.0
20,001 and above	33	16.5
Total	**200**	**100.0**

Knowledge about climate change		
Yes	200	100.0
No	0	0.0
Total	**200**	**100.0**
Primary source of knowledge about climate change		
Formal education	20	10.0
Peer discussion	48	24.0
Social media	35	17.5
Internet	32	16.0
Others	65	32.5
Total	**200**	**100.0**

The age distribution of respondents indicates that the majority fall within the 36–40 years age group, comprising 40.5% of the population, followed by the 30–35 years age group at 24.5%. This is significant as individuals in their mid–30s to early 40s often hold influential roles in society, such as being mid–career professionals, parents, or community leaders, which may shape their views on critical issues like climate change and sustainability. There is also a somewhat higher share of respondents who fall within these age brackets, which may mean that the views represented in the survey are ones that are most salient to this age range. According to the survey, age may determine attitudes towards climate change and sustainability where young and middle-aged adults seem to have a higher concern and propensity towards adopting environmentally sustainable behaviors as compared to older adults (Hornsey et al., 2016; Lee et al., 2020). In this regard, a relatively high representation of the 36–40 age group of respondents may indicate high levels of engagement in sustainability and climate action since this age group continues to make decisions in workplaces and households, making it likely to advocate for climate literacy as well as environmental programs. Further, the responses from respondents, aged 46 and above, account for only 14%, it could be that the elderly have differing concerns or they are not as concerned with the topics covered in the surveys as a lighter social trend points towards young people being more environmentally conscious. Among this table, a fairly skewed gender distribution of the respondents (67.5% of them are female while 32.5%) Peyton Manning is a well-known football player who had a bout with cervical arthritis 5% male. This may suggest that the majority of the participants were females which is quite expected and may have an impact on the studies especially in parcel that seem to be a gender driven concern such as climate change, sustainability, and education among others. Studies have confirmed that gender is a key factor which can affect the perception and action towards the environment. According to several publications, women are more concerned with the environmental problems such as climate change than their male counterparts and women are more proactive in environmental conservation activities than men (Zelezny et al., 2000). The similar study results can be explained taking into account that the sample consists of women only which might mean that there is an increased interest in sustainability and climate change which results in higher positive attitudes toward EE and awareness programs in the study. It is also evident from this table, through the result showing that 54% of the respondents are married while 35%. 5% are unmarried. A smaller portion is single, separated (8%), divorced (2%) or a widow(er) (0.5%). Respondents/ Participants are also mostly single while such people may be different from married ones in terms of behavior or priority. Lack of variation in conserving definitions is also an evidence suggesting that such theory could be less common in this sample pool or the effect is small than in the general female populace experiencing lower rates of depression. The distribution of marital status of respondents can influence the outcome of the survey because duties or coping strategies of the employees depend on their marital status concerning climate change and sustainable development. For instance, the different level of perceived self–interest in climate change above can also be

influenced aspects like marital status where people who are married with children are likely to consider future impacts of climate change in their family and off springs this will help in determining their attitude towards any environmental policies and education will be influenced (Bowers et al., 2014). It is also evident from this table the respondents have the following educational background: Master's Degree (38%), Intermediate (30%). Another good ratio of the respondents also has an M. Phil/PhD, which comprises of 11.5% of the response, and 20.0% of them hold a Bachelor's Degree. The availability of people with only Intermediate and Bachelor's educational level suggest that the sample is quite diverse in the number of participants that have different views and knowledge on climate–related topics. It is vital to consider variation in education to make findings as generalised as possible or possible to capture the diverse opinion of the general public and to ensure climate literate campaigns targeted specific education level audiences. This distribution also shows that a large number of those surveyed had attained some level of education and many of them had attained an advanced level of education. Since majority of the respondents hold a Master's Degree, it may increase the level of education the sample which in turn determines the perception and attitude towards climate change and sustainability. Education in most cases is positively correlated such that increased education level implies more awareness of environmental issues and a higher inclination towards environmentally friendly actions (Dunlap et al., 2000; Kollmuss & Agyeman, 2002). According to the education level of respondents, the result of the survey can be better explained and accurate intervention measures for promoting climate change education. For instance, teaching agendas in environmental classes may require enhancement to fit the different learning abilities and to ensure that various points are presented in the most comprehensible manner to the various customers of climate change information. It is also evident from this table most of the respondents fall in the category of 3 to 11 years of teaching experience with 42% of response. 0% having 3–7 years and 40% having 0–3 years experiences respectively. 5% having 8–11 years. Fewer still have 12–15 years (14.5%), while a mere 3% of the respondents have teaching experience of sixteen years and above. From this distribution it can be noted that the staff sample includes more fair number of relatively experienced teachers with several years of teaching experience. This group of respondents is likely to have compiled a great deal of information regarding education practices, with regard to climate literacy inculcation included. Most of the participants have 3–11 years of teaching experience, which to certain extent provides a firm ground of practical work experience that in turn can define respondents' perceptions or practical application of educational approaches including climate change education. Studies show that, developed teachers seem to have broad knowledge as far as practices when it comes to curriculum development and teachability are concerned and as such they are in a much better place to tender informed supplies of the applicability of the strategies at hand (Sachs, 2003). Among this table, a higher percentage of respondents that is 60% live in joint families whereas 40% live in nuclear families. This distribution apparent can be attributed to the fact that most of the respondents live in joint family hence it is an important factor in shaping the behaviour and perception of the respondents in the sample. Earlier it was seen that in joint families more than two generations live together, thus the perception about education and environmental issues may also be affected in one or the other way. For example, the availability of older family members might affect respondents' perception towards sustainability and climate change and therefore increase the variation of observations. The joint family systems may also contribute to communal problem solving and decision making process which may include concerns for the environment and climate change. However, individuals who come from nuclear families, which include only the direct family members, are likely to encounter different effects. These human beings might have different climate education and sustainability concern and prospects compared to human beings in systems of joint families (Ramesh & Sarma, 2015). It is also evident from table 1 the

majority of respondents come from families with 5–8 members which comprises 58%, 5% of the sample. This came second with families that comprised of two to four members constituting forty percent (40.5%). Regarding the number of members in respondents' families, only a small portion of the respondents have families with 9 to 12 individuals with 1% of the respondents. The fact that most of the families are represented by families containing 5–8 members can be explained by the fact that many families have similar sizes in many regions and where joint family systems are dominant. It is important to note that family size can also bring positive influences that concern use of shared resources and interaction with other people regarding such aspects as climate change, or sustainability. Families with more members, such as those with 9–12 members, are less common in this sample. This smaller representation might reflect specific regional or cultural family size norms. In regions with larger families, the collective experience of climate change impacts might be more pronounced, influencing how climate-related information is received and acted upon. This table data indicates that a majority of respondents come from families with a monthly income between 20,001 and 25,000, representing 55.5% of the sample. The second largest group earn between 10,001 and 20000 monthly, are 37.5%. A very small proportion of the respondents falls in the higher income category of 35000 and above; 4% earning between 25001 and 30000 and 3% earning 35,001 or more. This distribution implies that most of the respondents are from low to mid income earner families. These incomes can affect their ability to make some changes concerning climate change and sustainable practices such as the ability to acquire resources and opportunities. This is considered crucial in order for policy interventions to be shaped bearing in mind the economic systems that families belong to but especially so to appreciate the kind of support that families in the varying income levels require. Among this table details 46.5% of the respondents share 10,001–15,000 as their contribution to the household income. Such respondents who are contributing 5,000 to 10,000 making up 36% of the total. Contribution from 15001–20000 is insignificant and hardly counts for 1%. Whereas, 16.5% of the total respondents' contribution is of 20001 or more in their family monthly income. This distribution reveals that a large proportion of the respondents earned relatively moderate to small proportion of income. It can change their financial condition and affect the ability of investing in changes to adapt to climate or implementing sustainable actions. Thus, it is important to comprehend these contributions in order to evaluate the economic constraints, and to develop the support systems pertaining to the financial capacities of various income providers. It is also evident from this table, all respondents (100%) have knowledge about climate change. This uniformity suggests a high level of awareness among the surveyed group. The comprehensive knowledge about climate change among respondents is promising, as it implies that climate-related education and awareness initiatives have effectively reached this population. The table reveals diverse sources of knowledge about climate change among respondents. Formal Education is the slightest source to be mentioned in the study with only 10% respondents mentioned it. What this shows is that although obtaining formal education is important in the issue of climate change, there might be other types of channels that may operate more or are even more reachable for many people. Peer discussion is next as an important source for 24% of respondents. This goes to show the extent to which word of mouth and word of mouth associations influence the distribution of climate information. Internet is another source followed by social media, as 17.5% and 16% of respondents respectively. Such platforms are present as enhancing roles of digital platforms to deliver readily available and timely information on climate change. "Others" is the most written of the primary source with a total of 32.5% most mentioned responses and described as the primary source among the available sources of information. This may include any available group of people interested in the subject like the community carpenters, local environmental groups or any media source not included in the other mentioned categories. The availability of climate change information from diverse

sources suggests that there is need to adopt using of multiple modes in disseminating information for effective coverage and impact.

Hypothesis 1: Higher the teachers' qualification; more likeness to integrate climate literacy in curriculum.

Table 2: Association between education level and teachers integrate climate literacy into their lessons

Education	Teachers integrate climate literacy into their sons			Total
	To great extent	To some extent	Not at all	
Inter	56	5	-	61
Bachelor	39	1	-	40
Master	68	8	-	76
M.Phil/PhD	20	3	-	23
Total	**183**	**17**	**-**	**200**
$\chi^2 = 2.870$; DF = 3	**$\gamma = 0.193$; $\alpha = 0.05$**			

The data reveals a relationship between teachers' qualifications and their extent of integrating climate literacy into the curriculum. Teachers with various qualifications show differing levels of integration: 56 out of 61 Intermediate qualified teachers integrate climate literacy to a great extent; 39 out of 40 Bachelor's degree holders integrate climate literacy to a great extent; 68 out of 76 Master's degree holders integrate climate literacy to a great extent whereas 20 out of 23 M.Phil/ PhD holders integrate climate literacy to a great extent. The Chi-square value of 2.870 with 3 degrees of freedom indicates that the association between teachers' qualifications and the extent of integrating climate literacy is not highly significant, although there is a noticeable trend. The Gamma coefficient of 0.193 suggests a weak positive association, implying that higher qualifications might be associated with a greater extent of integrating climate literacy, but the relationship is not strong. These results suggest that while teachers with more advanced qualifications tend to integrate climate literacy to a greater extent, the difference is not statistically robust. This indicates that factors other than qualifications, such as access to resources, training, or institutional support, might also play significant roles in how climate literacy is integrated into the curriculum (Davis & Krajcik, 2005).

Hypothesis 2: More the formal education used as knowledge source; more likeliness to face challenges in integrating climate literacy at school.

Table 3: Association between formal education as source of climate literacy and teachers faced challenges in integrating climate literacy into teaching

Formal Education	Teacher faced challenges in integrating climate literacy into teaching			Total
	To great tent	To some tent	Not at all	
To great extent	103	2	13	118
To some extent	50	19	2	71
Not at all	11	0	0	11
Total	**164**	**21**	**15**	**200**
$\chi^2 = 34.592$; DF = 4	**$\gamma = 0.217$; $\alpha = 0.05$**			

The data reveals a significant association between using formal education as a primary source of climate literacy and the challenges faced in integrating climate literacy within schools. Among the 200 teachers surveyed, those who rely heavily on formal education as their primary source of climate literacy (118 teachers) overwhelmingly report facing significant challenges (103 teachers). Conversely, only 71 teachers who use formal education to some extent face similar challenges, and a very small number of those who do not rely on formal education report facing challenges. The Chi-square value of 34.592 with 4 degrees of freedom indicates a strong statistical association, which is statistically significant at the 0.05 level. The Gamma coefficient of 0.217 reflects a moderate positive association, suggesting that as the reliance on formal education as a source of climate literacy increases, the likelihood of facing significant challenges in integrating climate literacy also increases. These findings suggest that while formal education is a critical component of climate literacy, it may also present challenges when integrated into school curricula. Factors contributing to these challenges might include outdated materials, lack of training for educators, or inadequate support structures within schools. This highlights the need for additional resources and support to help teachers overcome these barriers and effectively integrate climate literacy into their teaching practices (Bolstad and Lindström, 2012).

Hypothesis 3: More climate change effect quality of life; more will be increase in temperature.

Table 4: Association between climate change effects on quality of life and raising temperatures in Rajanpur

Climate change effects on quality of life	Raising temperatures in Rajanpur			Total
	To great extent	To some extent	Not at all	
To great extent	85	88	8	181
To some extent	8	11	0	19
Not at all	0	0	0	0
Total	**93**	**99**	**8**	**200**
$\chi^2 = 1.226$;	DF = 2	$\gamma = 0.044$; $\alpha = 0.05$		

The data examines the relationship between the perceived impact of rising temperatures on quality of life and the extent to which climate change affects individuals in Rajanpur. From 200 individuals surveyed, 181 reported that their quality of life was greatly affected by climate change, with 85 perceiving rising temperatures to a great extent and 88 to some extent. A smaller group of 19 individuals reported that their quality of life was somewhat affected, with 8 perceiving rising temperatures to a great extent and 11 to some extent. However, the statistical analysis suggests that the association between these variables is weak. The Chi-square value of 1.226 indicates that the observed association may not be statistically significant. Additionally, the Gamma coefficient of 0.044 suggests a very weak positive association, implying that as the perception of rising temperatures increases, the perceived impact on quality of life slightly increases, but this relationship is not strong. These findings suggest that while rising temperatures are recognized as a component of climate change, their direct impact on quality of life may not be universally perceived.

Hypothesis 4: More climate change effect quality of life; more occurrences of heatwave.

Table 5: Association between climate change effects on quality of life and heatwave in Rajanpur

Climate change effects on quality of life	Heatwaves in Rajanpur			Total
	To great extent	To some extent	Not at all	
To great extent	86	92	3	181
To some extent	10	8	1	19
Not at all	0	0	0	0
Total	**96**	**100**	**4**	**200**
χ^2 = 1.473;	**DF = 2**	**γ = -0.058; α = 0.05**		

The data illustrates the association between the perceived impact on quality of life and the occurrence of heatwaves in Rajanpur. Of the 200 individuals surveyed, 181 reported that their quality of life was greatly affected, with a nearly equal distribution between those experiencing heatwaves to a great extent (86) and to some extent (92). A smaller group of 19 individuals reported that their quality of life was somewhat affected, with most of them also experiencing heatwaves to varying extents. The statistical analysis, however, suggests that the relationship between these variables is not particularly strong. The Chi-square value of 1.473 with 2 degrees of freedom indicates that the association might not be statistically significant, and the Gamma coefficient of -0.058 points to a very weak negative association. This suggests that the occurrence of heatwaves does not strongly correlate with the perceived impact on quality of life, and the direction of this relationship is slightly negative, indicating that as heatwave occurrence increases, the perceived impact on quality of life does not increase in a linear or straightforward manner. These study results suggest that heatwaves form a fairly large greenspace environmental stress load but that the effect they may have on quality of life may be tolerated or noticed in varying degrees by different people (Brien & Leichenko, 2000). Various factors, such as individual resilience, access to coping mechanisms, or the frequency and intensity of heatwaves, could influence how people perceive their quality of life in relation to these events. The weak statistical association suggests that other factors, possibly socio-economic or environmental, may play a more significant role in determining how heatwaves affect quality of life.

Hypothesis 5: More climate change effect quality of life; more will be change in rainfall.

Table 6: Association between climate change effects on quality of life and change in rainfall

Climate change effects on quality of life	Heatwaves in Rajanpur			Total
	To great extent	To some extent	Not at all	
To great extent	116	50	15	181
To some extent	16	3	0	19
Not at all	0	0	0	0
Total	**96**	**100**	**4**	**200**
χ^2 = 3.538;	**DF = 2**	**γ = -0.514; α = 0.05**		

The data indicates a relationship between the extent to which individuals perceive their quality of life as being affected and changes in rainfall patterns. Among the 200 individuals surveyed, 181 reported that their quality of life was greatly affected, with 116 of these individuals also experiencing significant changes in rainfall. Meanwhile, 19 individuals reported that their

quality of life was somewhat affected, with 16 of these also noticing substantial changes in rainfall. However, the statistical analysis suggests that this relationship is not straightforward. The Chi-square value of 3.538 with 2 degrees of freedom indicates a weak association that might not be statistically significant. Furthermore, the Gamma coefficient of -0.514 points to a moderate negative association, suggesting that as the perception of changes in rainfall increases, the perceived impact on quality of life does not necessarily increase, and might even decrease. This could be due to various factors, such as individual or community resilience, adaptive capacities, or differing perceptions of what constitutes a significant change in rainfall. These findings highlight the complexity of the relationship between environmental changes, such as rainfall patterns, and their perceived impact on quality of life. While changes in rainfall are often linked to climate change and can have significant effects on livelihoods and well-being, individual perceptions of these changes and their impacts can vary widely (Adger, 2003). The moderate negative association and the lack of strong statistical significance suggest that other factors, such as socioeconomic conditions or access to resources, may play a critical role in how changes in rainfall affect quality of life.

Hypothesis 6: More climate change effect quality of life; more will be change in rainfall.

Table 7: Association between climate change effects on quality of life and occurrence of floods

Climate change effects on quality of life	**Occurrence of floods in Rajanpur**			**Total**
	To great extent	**To some extent**	**Not at all**	
To great extent	110	56	15	181
To some extent	13	6	0	19
Not at all	0	0	0	0
Total	**123**	**62**	**15**	**200**
$\chi^2 = 1.740$; DF = 2		**$\gamma = 0.227$; $\alpha = 0.05$**		

The data explores the association between the perceived impact on quality of life and the occurrence of floods. Of the 200 individuals surveyed, 181 reported that their quality of life was greatly affected, with 110 of these individuals also experiencing floods to a great extent. A smaller group of 19 individuals reported that their quality of life was only somewhat affected, with most of these individuals also experiencing floods to some extent. Nonetheless, the statistical results show that the relationship between these variables is not very significant. The Chi-square value of is 1.740 with 2 degree of freedom meaning that the relationship of these variables might not be statistically significant. Furthermore, the Gamma coefficient obtained was 0.227 the magnitude of the fishbone symbols a very small positive relationship meaning high frequency of floods is slightly associated to high perceived reduction in quality of life. These results indicate that although flood has an effect on quality of life, not everyone really feels and acknowledges it. Some of the factors that might affect this perception include; the level of flood intensity and recurrence, one's coping abilities, and the available resources and help. Although initial casual analysis of the given cross-tabulation table reveals definite statistical relationship, the actual correlation coefficient is rather low, suggesting the probable presence of third variables that moderate the effects of floods on quality of life (Cuttler et al., 2003).

Hypothesis 7: More climate change topic discussion with coworkers; higher peer opinion influence understanding on climate literacy.

Table 8: Association between climate change topics are frequently discussed with their workmates and their peers' opinion influence their understanding about climate literacy

Climate change topics are discussed with coworker	Peers' opinion influence their understanding about climate literacy			Total
	To great extent	To some extent	Not at all	
To great extent	166	16	-	182
To some extent	17	1	-	18
Not at all	-	-	-	-
Total	**183**	**17**	**-**	**200**
χ^2 = 0.220;	**DF = 1**	**γ = -0.242; α = 0.05**		

The data (table 8) indicates a relationship between the extent to which teachers discuss climate change topics with their coworkers and how much peer opinions influence their understanding of climate literacy. Of the 200 teachers surveyed, 182 frequently engage in discussions about climate change, with 166 of these teachers indicating that peer opinions significantly shape their understanding of climate literacy. Conversely, 18 teachers discuss these topics to a lesser extent, with only 1 reporting a considerable influence from peer opinions. Despite these observations, the statistical analysis suggests that this association is not particularly strong or significant. The Chi-square value of 0.220 with 1 degree of freedom implies that the observed distribution could be due to random variation rather than a meaningful relationship. Additionally, the Gamma coefficient of -0.242 suggests a weak negative association, indicating that increased discussion of climate change topics does not necessarily correlate with a stronger influence of peer opinions on understanding climate literacy.

Hypothesis 8: Higher teacher role in promoting climate literacy; higher teacher collaboration for climate literacy among students.

Table 9: Association between teachers play important role in promoting climate literacy in school and teachers collaborate to enhance climate literacy among students

Teachers play important role in promoting climate literacy in school	Teachers collaborate to enhance climate literacy among students			Total
	To great extent	To some extent	Not at all	
To great extent	177	0	0	177
To some extent	1	1	21	23
Not at all	-	-	-	-
Total	**178**	**1**	**21**	**200**
χ^2 = 190.2;	**DF = 2**	**γ = 1;**	**α = 0.05**	

The table presents the association between the role of teachers in promoting climate literacy and their collaboration for climate literacy among students. The data reveals a strong association between the role of teachers in promoting climate literacy and their collaboration efforts to enhance climate literacy among students. Out of 200 teachers surveyed, 177 who actively promote climate literacy to a great extent also collaborate significantly with others to advance this cause. A negligible number (1) of teachers who promote climate literacy to some extent also collaborate to a great extent, while a majority (21) of them do not collaborate at all. The statistical analysis supports this observation, with a Chi-square value of 190.2 and a Gamma coefficient of 1, indicating a perfect positive relationship. This implies that the more

leadly the teachers advocate for climate literacy, the more they are willing to engage others towards achieving this end. The findings can, therefore, be concluded to be statistically significant at the 0.05 degree which indicates that, indeed, this relationship is not random. This finding is in line with previous research done indicating that teachers with high levels of commitment in environmental education more often engage in collaborative activities to improve their teaching approaches and effectiveness (McKeown & Hopkins, 2003). Furthermore, the data points to a high level of positive correlation, thus indicating that it would be necessary to promote social interaction among educators as the way to promote climate literacy in curriculum. Previous studies have established that the teachers need to engage in collective professional development in order to use innovations in classroom practice effectively (Hammond et al., 2017). As such, schools and other educational institutions should possibly establish the manners of promoting teachers' cooperation as a way to improve the effects of climate literacy.

Summary

Education about climate has become a key factor that enables people to counter the climate change problem around the world. One of the greatest challenges of the twenty-first century, climate change, should be responded not only through politics and economics but also through providing information and knowledge for people and societies. That is why climate literacy is vital for society as it helps to understand the climate change causes, consequences, and ways to address it; also, to promote a green mindset that is required to ensure sustainability. Thus, educational systems worldwide need to enhance courses that would help people understand climate change. Teachers occupy an important place in the process of raising climate literacy, as schools act as the location in which the latter takes place. However, teachers as the key actors in knowledge delivery when it comes to climate change are many times poorly equipped for this task through inadequate pre-service and in-service education and a shortage of instructional resources. This gap therefore underlines the need for a revolutionary change in the content as well as approaches to education to ensure that educators are trained accordingly. In Pakistan key strategic documents including the National Climate Change Policy 2021 and the National Education Policy 2017 highlight the need for enhancing climate literacy. The policies focus on the need to step up expenditure on climate change and teacher training because education is central to any sustainability agenda. This can be seen as part of a larger concern about how important it is that teachers increase their ability to address climate change in schools, and how far these policies represent an appreciation of that need. Out of these, social networking has been considered a useful approach towards the sharing of information and teachers' collaboration. Besides being a valuable source of professional development it also provides occasions to establish supportive professional networks among teachers. Borrow reveal that peers within these networks play a huge role in the level of climate literacy among teachers and how much they can incorporate climate education into their respective learning institutions. Interacting with co-workers on the issues of climate improves the concept's appreciation and utilization in teaching approaches. This is evident in case of District Rajanpur to understand the changes that peer discussions influence in terms of climate literacy of teachers. Most of the teachers agree that sources of peer interactions play a big role on their perceived knowledge and teaching practices on climate change. By working together with peers, one is able to address some of the challenges that they may face including shortages of resources and inadequate training. The purpose of climate literacy is to take climate change more seriously as being incorporated into education systems. Hence the role of the teacher in this process, collaborative peer network improves the efficiency of the teachers. When it comes to tackling the difficulties in climate education and even explaining the opportunities that lie in the social

networking to improve the educational systems, it is possible to state that the students will be ready to start perceiving and combating the climate issues.

Findings

- Majority 40.5% of the respondents fall within the 36-40 years age group
- Majority 67.5% of the respondents were females
- Majority 54% of the respondents are married
- Majority 38.0% of the respondents hold a Master's Degree
- Majority 42.0% of the teachers having 3-7 years of teaching experience
- Majority 60% of the respondents live in joint families
- Majority 58.5% of the respondents belong to families with 5-8 members
- Majority 55.5% of the respondents come from families with a monthly income between 20,001 and 25,000 rupees
- Majority 46.5% of the respondents contribute between 10,001 and 15,000 to their household income
- 100% respondents have knowledge about climate change

Conclusion

Promoting education for climate is essential for nurturing people's capabilities that enable to meet the climate change demands. With the use of climate change education escalating with time, it is very apparent that education systems shall take on the challenge of imparting Climate Change literacy education for the promotion of sustainable behaviors. Teachers are at the heart of this new focus on education for environmental sustainability and therefore their capacity to mainstream climate topics is critical towards the emergence of a generation that has a feel for climatic realities. The District Rajanpur has found that the peer interaction matters a lot for the teacher's climate literacy which means collaborative professional setting is imperative. Teachers who spent more time talking to their peers about climate change are more likely to include climate literacy into their classes. A look at this peer influence has inclined the importance of nurturing supportive networks among educators to promote enhancement of climate education. However, there are areas of concern such as a shortage of resources, and lack of professional development and Program/Unit Support. The above concerns should thus be accorded attention and effort since they are vital fundamentals in enhancing climate education. It is here, by investing in effective teacher training, enhanced and effective materials, and strong social connections can be made to give throughout these educational systems improved and effectual preparation for students to combat climate change. The current study conducted on District Rajanpur also showed that peer cooperation is essential to understand climate change information hence the need for constructive endeavors to enhance climate knowledge among the future generation.

Suggestions

1. The government should introduce specialized training programs on climate science for teachers.
2. Schools should organize workshops and seminars to help teachers effectively communicate climate-related concepts.
3. The community should support schools by providing resources for climate education, such as books and digital tools.
4. Teachers should collaborate with environmental experts to deepen their understanding of climate issues.

5. Educational institutions should include climate science as a core subject in teacher training curriculums.

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