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Teacher's Inclusion of Flood-Risk Awareness Concepts in The Teaching of Mathematics to Foster Flood Preparedness

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Abstract

Flooding is one of the hot issues in the world today. This issue needs to be translated to the upcoming generation through the school system. The various subjects in the school system are the vehicles through which this could be achieved. It is on this regard that the study examines the level of inclusion of Flood-Risk Awareness concepts in the teaching of mathematics to foster flood preparedness in the Yenagoa Local Government Area of Bayelsa State. Three objectives, research questions and hypotheses guided the study. A descriptive survey design was used for the study. The study population comprised two hundred and thirty-six (236) teachers teaching mathematics in Yenagoa Local Government Area of Bayelsa State for the 2025/2026 academic session. The sample consisted of 236 teachers, and the census sampling technique was used for the study. The instrument used for data collection was a teacher questionnaire on the Inclusion of Flood-Risk Awareness concept in Teaching Mathematics (IFRACTM). The Cronbach coefficient alpha formula was used to determine the reliability index of the instruments, while the validity was ascertained by experts. Data collected were analyzed using mean, standard deviation for teachers' responses on flood inclusion in mathematics teaching and chi-squared and independent t-test were used to test the hypotheses at a 0.05 level of significance. The findings indicated that teachers hardly include the Flood Risk Awareness concept in the teaching of mathematics. The findings of the study also indicated that there was no significant difference between the responses of male and female teachers and those of urban and rural teachers. It was concluded that mathematics teachers should include Flood-Risk Awareness concepts in relevant mathematics lessons.

Keywords: *Flood-Risk Awareness, Flood preparedness, Mathematic Education.*

Introduction

Flooding is one of the most frequent and destructive natural disasters globally, with its increasing occurrence linked to climate change, rapid urbanisation, deforestation, and poor land-use practices. The United Nations Office for Disaster Risk Reduction (UNDRR, 2020) reports that floods account for nearly 40% of natural disasters worldwide, resulting in significant loss of lives, displacement, and economic damage. Flooding refers to the overflow or accumulation of excess water on land that is normally dry, often occurring when rainfall exceeds soil absorption or drainage capacity (Djimesah, Okine, & Mireku, 2018). These conditions lead to severe environmental and socio-economic consequences (Nwachukwu et al., 2018; Onuigbo et al., 2017).

Flood impacts are intensified because many human settlements are in flood-prone areas such as wetlands, coastal zones, and riverbanks, with vulnerability further increased by poor infrastructure, weak flood-management systems, and limited economic capacity (Oyedele et al., 2022). In Nigeria, flood risk has become a critical concern due to the country's geography and climate, with major flood events recorded in 2012, 2018, 2020, and 2022 (Umar et al., 2022).

The secondary school system provides a strategic platform for the transmission of scientific knowledge on global flood-risk issues. Teachers within this sector facilitate this process through structured teaching and learning activities in schools. Through their respective subject areas, teachers can communicate the concepts, causes, impacts, and mitigation strategies associated with flooding. A teacher is a trained professional equipped to impart knowledge and foster the development of skills that enable learners to recognize challenges and respond effectively to real-life situations (Senge, 2000). Mathematics is one of the core subjects delivered within the school curriculum, spanning Basic Education levels (Basic 1–9) and Senior Secondary School levels (SSS 1–3), reflecting its fundamental importance. Education, particularly through subjects such as mathematics, plays a critical role in empowering students with the analytical skills and conceptual understanding necessary to comprehend flood risks and contribute meaningfully to their mitigation. Mathematics, as a fundamental discipline, plays a vital role in understanding and analyzing floods, which are a major consequence of climate change. The application of mathematical concepts in flood prediction, risk assessment, and mitigation strategies underscores its relevance in mathematics education. Integrating flood-related problems into the mathematics classroom can enhance students' problem-solving skills while demonstrating the real-world applicability of mathematical principles in addressing environmental challenges (Steffensen, Hansen, & Hauge, 2016). Several mathematical concepts can be used to explain flood impacts and explore strategies for mitigating their effects. These include data analysis in statistics, probability, modelling, mapping, and measurement. Mathematics provides essential tools for analyzing patterns, interpreting data, and solving problems, making it an ideal subject for embedding flood risk awareness. Agrawal & Singh (2023) observe that by incorporating real-world flood scenarios into mathematics lessons, students can be taught to interpret rainfall patterns, calculate flood probabilities, and understand the implications of flood-related data emplaning that such practical applications make mathematics more relatable and meaningful to learners, thereby promoting deeper engagement with the subject. Tessmer (2013). Examine a mathematics teacher and 53-, 7- and 8-years old students in one of the public primary schools, the participants could define disaster well, provide some examples of disasters, and explain what is needed to be done in the event of an emergencies. Data analysis was conducted descriptively. The results of the teacher questionnaire showed that the mathematics teacher, who taught Year 7 and 8, had often provided mathematical problems in mathematics learning, but she had never read/solved mathematical problems in disaster contexts. The teacher agreed that mathematical problems in disaster contexts should be given in mathematics learning because they can improve students' mathematical literacy and prepare them for global disaster challenges. Abtahi, et.al (2017) examined Teaching Climate Change in Mathematics Classrooms: An Ethical Responsibility. They investigated how issues of climate change incorporated into the teaching and learning of mathematics can be understood as a moral and ethical act. They found that including climate change in mathematics classrooms can be (and is) viewed as an ethical responsibility of mathematics teachers, in their day-to-day practice, but their decision about this issue is complex. Incorporating flood risk concepts into mathematics class fosters critical life skills, such as decision-making and collaborative problem-solving. For example, students can work in groups to design evacuation plans, calculate optimal resource allocation during floods, or assess the economic impact of flood prevention measures. This interdisciplinary approach, supported by Fleetwood-Smith, Tischler, & Robson (2021), not only enhances mathematical proficiency but also builds resilience and preparedness among students. By embedding these concepts, educators can bridge the gap between theoretical knowledge and practical application, ultimately contributing to a safer and more informed society.

Mathematics is taught in secondary schools by both male and female teachers. Gender, defined as the social meanings, roles, and expectations associated with being male or female (Ambe-Uva, Iwuchukwu, & Jibrin, 2008, as cited in Nnenna & Adukwu, 2018), may influence teachers' perspectives and instructional practices. These differences can affect innovative initiatives, such as the integration of flood-risk awareness concepts, which is incorporated into mathematics teaching. Variations in teaching styles, strategies, and classroom interactions between male and female teachers may therefore result in differing responses to the inclusion of flood-risk awareness concepts. Supporting this view, Ahiatrogah (2017) found a statistically significant difference in the teaching skills acquired by male and female distance education students.

A lot of variables may inhibit or hinder effective subject delivery by the teacher. Among them is the school location of the teacher. The school location variable, where the teacher resides, could be urban or rural. One of the crucial factors in terms of the school location variable is the distribution of resources. Urban location has high population density, contains a high variety and beautiful views, including better and more resources for educational purposes while rural location is characterized by low population density containing low variety and isolated views, including poor and less resources for educational purposes. Dash & Barman (2016). investigated the level of teaching effectiveness of secondary school teachers in the district of Purba Medinipur, West Bengal. The descriptive Survey method was used for the study. The result revealed that there was a significant difference among the secondary school teachers regarding their level of teaching effectiveness based on school location.

Statement of the Problem

Mathematics teaching in secondary schools largely emphasizes abstract concepts, with limited connection to real-life environmental challenges such as flooding. Although mathematical topics such as statistics, probability, measurement, mapping, graphical representation, and simple modelling can be used to promote flood-risk awareness and preparedness, these applications are rarely integrated into classroom instruction. This gap limits students' ability to relate mathematical knowledge to environmental realities, especially in flood-prone communities, and reduces opportunities to develop practical problem-solving and safety awareness skills. Consequently, students remain inadequately prepared to understand and respond to flood-related risks. There is therefore a need to examine the extent to which mathematics teachers incorporate flood-risk awareness concepts into their teaching and how such integration can promote flood preparedness among students.

Purpose of the Study

The purpose of this study is to examine teachers' inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness. Specifically, the study sought to:

1. To investigate teachers' inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness.
2. To examine male and female teachers' inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness.
3. To assess teachers' inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness based on location

Research Question

To achieve the objectives outlined above, the study seeks to answer the following research questions:

1. What is the response of teachers' regarding the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness?
2. What is the difference between the responses of male and female teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics in other to foster flood preparedness?
3. What difference exists between the responses of teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness based on Location?

Hypotheses

The following hypotheses were tested at .05 level of significance.

1. There is no significant difference in the responses of teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness.
2. There is no significant difference between the responses of male and female teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness.
3. There is no significant difference between the responses of teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness based on location.

Research Methods

The study adopted a descriptive survey design. The population consisted of 236 mathematics teachers in Yenagoa Local Government Area of Bayelsa State during the 2024/2025 academic session. A census sampling technique was used, as all 236 teachers constituted the sample due to the small population size (Odhoj & Kariuki, 2024). Data were collected using the Teachers' Questionnaire on the Inclusion of Flood-Risk Awareness Concepts in Teaching Mathematics (IFRACTM). The instrument comprised two sections: Section A covered demographic information, while Section B contained 20 items on the inclusion of flood-risk awareness concepts. Responses were measured using a four-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD).

The instrument was face-validated by two experts, one in test, measurement, and evaluation, and an expert in mathematics education. These reviewers examined the items for clarity of language, relevance and adequacy in addressing the study's objectives and research questions. Their feedback and revisions were integrated into the final version of the instrument. To assess its reliability, the instrument was administered to a group of 20 teachers from a school in Otuoke, Ogbia local government area, not included in the study but possessing similar characteristics to those participating in the research. The instrument was administered once to each teacher, and the Cronbach coefficient alpha formula was used to determine the reliability of the instruments. A reliability of .82 was obtained. The questionnaire was administered to each of the sampled teachers who responded to it. They were collected immediately after filling and were scored. The questionnaires were scored 4 points for SA, 3 points for A, 2 points for D and 1 point for SD The ranges of 3.5–4, 2.5–3.4, 1.5–2.4, and 0.5–1.4 were respectively considered for Strongly Agreed, Agreed, Disagree, and Strongly Disagree in the determination of the mean response. Data were analyzed using mean and standard deviation for teacher's responses while, chi-squared and independent t-test were used to analysis the hypothesis at a 0.05 level of significance.

Results

The results are presents based on the research questions and hypotheses.

Research Question One

What is the response of teachers' regarding the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness?

Table 1

Mean Responses of Teachers on Inclusion of Flood-risk Awareness Concept in the Teaching of Mathematics

s/n	Description	N	$\dot{X}$	Decision
1	Real-time flood-risk data are incorporated when dealing with functions and equations.	236	2.22	Disagree
2	Projects are assigned to students to develop algebraic models to predict flood risk.	236	1.87	Disagree
3	Statistical analysis is used to help students understand the probability of flood events.	236	2.46	Disagree
4	Flood-risk data is incorporated in lessons on calculating averages, solving quadratic equations.	236	1.78	Disagree
5	Students are asked to tabulate flood-risk data during statistical lessons.	236	2.06	Disagree
6	Studies of flood frequency are taught in mathematics statistical lessons.	236	2.03	Disagree
7	Real-time flood-risk data are incorporated into exercises on simple equations.	236	1.83	Disagree
8	Group projects are organized for students to compare regional flood-risk data.	236	2.23	Disagree
9	Lessons non-linear models include examples drawn from flood-risk scenarios.	236	2.09	Disagree
10	Real-world flood scenarios are used to illustrate the application of exponential functions.	236	1.74	Disagree
11	Flood-risk data are integrated into lessons on probability.	236	2.03	Disagree
12	Students are taught how to analyze flood-risk data for practical, real-life applications.	236	2.09	Disagree
13	Animations are used to visually demonstrate key flood-risk concepts in the classroom.	236	2.13	Disagree
14	Field trips to flood-prone areas to demonstrate effects of flooding are organized.	236	1.90	Disagree
15	Classroom activities include calculating averages and variances using flood-related data.	236	1.83	Disagree
16	Flood-risk scenarios are used to illustrate the development of mathematical models.	236	2.22	Disagree
17	In class, we interpret charts to draw conclusions about flood risk.	236	2.12	Disagree
18	Students compare graphs from different sources to analyze flood-risk trends.	236	1.87	Disagree
19	Students are taught how to read graphs that display flood-risk information.	236	1.99	Disagree
20	Mathematical simulations are employed to predict potential flood events.	236	2.09	Disagree
	Grand mean	236	2.03	Disagree

As shown in table 1, the scores for each of the items were below 2.50, indicating they disagreed to all the items. Respondents' responses on all the items disagreed. The grand mean is also below 2.50, indicating Disagreement. It can be inferred from the responses that teachers seldom include the concept of flood-risk awareness in the teaching of mathematics.

Research Question Two

What is the difference between the responses of male and female teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics in other to foster flood preparedness?

Table 2

Mean and Standard Deviation of Male and Female Teachers Responses on the Inclusion of flood-risk awareness concepts in Teaching Mathematics.

item	Description	Male			Female			Df	***t***	P< .05
		N	Ẋ	SD	N	Ẋ	SD			
1	Real-time flood-risk data are incorporated when dealing with functions and equations.	141	2.22	1.06	95	2.21	1.06	234	0.07	.95
2	Projects are assigned to students to develop algebraic models to predict flood risk.	141	1.86	0.89	95	1.88	0.90	234	0.22	.83
3	Statistical analysis is used to help students understand the probability of flood events.	141	2.45	1.09	95	2.46	1.10	234	.06	.95
4	Flood-risk data is incorporated in lessons on calculating averages, solving quadratic equations.	141	1.75	0.85	95	1.82	0.81	234	0.52	.61
5	Students are asked to tabulate flood-risk data during statistical lessons.	141	2.04	1.04	95	2.11	0.99	234	0.63	.53
6	Studies of flood frequency are taught in mathematics statistical lessons.	141	1.99	1.02	95	2.09	0.97	234	0.77	.44
7	Real-time flood-risk data are incorporated into exercises on simple equations.	141	1.83	0.85	95	1.83	0.82	234	0.02	.99
8	Group projects are organized for students to compare regional flood-risk data.	141	2.23	0.99	95	2.23	0.99	234	0.02	.99
9	Lessons non-linear models include examples drawn from flood-risk scenarios.	141	2.10	1.02	95	2.08	1.05	234	0.11	.91
10	Real-world flood scenarios are used to illustrate the application of exponential functions.	141	1.70	0.87	95	1.80	0.81	234	0.87	.38
11	Flood-risk data are integrated into lessons on probability.	141	2.01	1.00	95	2.06	0.95	234	0.43	.67
12	Students are taught how to analyze flood-risk data for practical, real-life applications.	141	2.09	0.98	95	2.09	0.96	234	0.08	.94
13	Animations are used to visually demonstrate key flood-risk concepts in the classroom.	141	2.10	1.04	95	2.17	0.96	234	0.51	.61
14	Field trips to flood-prone areas to demonstrate effects of flooding are organized.	141	1.88	0.92	95	1.94	0.92	234	0.47	.64
15	Classroom activities include calculating averages and variances using flood-related data.	141	1.79	0.92	95	1.91	0.88	234	0.99	.32
16	Flood-risk scenarios are used to illustrate the development of mathematical models.	141	2.18	1.03	95	2.12	0.97	234	0.71	.48
17	In class, we interpret charts to draw conclusions about flood risk.	141	2.12	0.97	95	2.13	0.96	234	0.05	.96
18	Students compare graphs from different sources to analyze flood-risk trends.	141	1.78	0.84	95	2.00	0.90	234	1.92	.06

19	Students are taught how to read graphs that display flood-risk information.	141	1.97	1.01	95	2.02	0.98	234	0.37	.71
20	Mathematical simulations are employed to predict potential flood events.	141	2.05	1.00	95	2.16	0.92	234	0.85	.40

As presented in table 2, the mean responses of male teachers are 2.22, 1.86, 2.45, 1.75, 2.04, 1.99, 1.83, 2.23, 2.10, 1.70, 2.01, 2.09, 2.10, 1.88, 1.79, 2.18, 2.12, 1.78, 1.97 and 2.03, while that of their female counterparts are 2.21, 1.88, 2.46, 1.82, 2.11, 2.09, 1.83, 2.23, 2.08, 1.80, 2.06, 2.09, 2.17, 1.94, 1.91, 2.12, 2.13, 2.00, 2.02 and 2.16 for items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 respectively. It can be inferred from the result that female teachers had a higher mean response in all the items when compared to their male counterparts, except for items 1 and 9, where male responses were higher, and items 7 and 12, where their mean responses were equal.

Research Question Three

What difference exist between the responses of teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness based on Location?

Table 3

Mean and Standard Deviation of Teachers Responses on Inclusion of flood-risk awareness concepts in Teaching Mathematics Based on Location.

item	Description	Urban			Rural			Df	***t***	P< .05
		N	Ẋ	SD	N	Ẋ	SD			
1	Real-time flood-risk data are incorporated when dealing with functions and equations.	163	2.26	1.02	73	2.12	1.15	234	0.9	0.37
2	Projects are assigned to students to develop algebraic models to predict flood risk.	163	1.91	0.87	73	1.78	0.95	234	1.01	0.31
3	Statistical analysis is used to help students understand the probability of flood events.	163	2.54	1.06	73	2.27	1.16	234	1.74	0.08
4	Flood-risk data is incorporated in lessons on calculating averages, solving quadratic equations.	163	1.80	0.82	73	1.73	0.85	234	0.78	0.44
5	Students are asked to tabulate flood-risk data during statistical lessons.	163	2.10	1.01	73	1.99	1.05	234	0.66	0.51
6	Studies of flood frequency are taught in mathematics statistical lessons.	163	2.07	0.99	73	1.96	1.02	234	0.77	0.44
7	Real-time flood-risk data are incorporated into exercises on simple equations.	163	1.88	0.82	73	1.73	0.85	234	1.29	0.20
8	Group projects are organized for students to compare regional flood-risk data.	163	2.31	0.98	73	2.07	1.01	234	1.72	0.09
9	Lessons non-linear models include examples drawn from flood-risk scenarios.	163	2.15	1.02	73	1.96	1.06	234	1.34	0.18
10	Real-world flood scenarios are used to illustrate the application of exponential functions.	163	1.78	0.83	73	1.66	0.87	234	1.02	0.31
11	Flood-risk data are integrated into lessons on probability.	163	2.06	0.96	73	1.97	1.03	234	0.60	0.55
12	Students are taught how to analyze flood-risk data for practical, real-life applications.	163	2.13	0.94	73	2.00	1.04	234	0.94	0.35

13	Animations are used to visually demonstrate key flood-risk concepts in the classroom.	163	2.17	0.99	73	2.03	1.08	234	1.01	0.31
14	Field trips to flood-prone areas to demonstrate effects of flooding are organized.	163	1.93	0.89	73	1.85	0.98	234	0.59	0.55
15	Classroom activities include calculating averages and variances using flood-related data.	163	1.84	0.89	73	1.82	0.93	234	0.15	0.88
16	Flood-risk scenarios are used to illustrate the development of mathematical models.	163	2.27	1.03	73	2.12	1.15	234	0.87	0.33
17	In class, we interpret charts to draw conclusions about flood risk.	163	2.18	0.92	73	2.00	1.04	234	1.32	0.19
18	Students compare graphs from different sources to analyze flood-risk trends.	163	1.89	0.84	73	1.82	0.9	234	0.55	0.58
19	Students are taught how to read graphs that display flood-risk information.	163	2.01	0.98	73	1.96	1.02	234	0.34	0.74
20	Mathematical simulations are employed to predict potential flood events.	163	2.12	0.94	73	2.03	1.03	234	0.70	0.48

As presented in table 3, the mean responses of urban teachers are 2.26, 1.91, 2.54, 1.80, 2.10, 2.07, 1.88, 2.31, 2.15, 1.78, 2.06, 2.13, 2.17, 1.93, 1.84, 2.27, 2.18, 1.89, 2.01 and 2.12 while that of their rural counterparts are 2.12, 1.78, 2.27, 1.73, 1.99, 1.96, 1.73, 2.07, 1.96, 1.66, 1.97, 2.00, 2,03, 1.85, 1.82, 2.12, 2.00, 1.82, 1.96 and 2.03 for items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 respectively. It can be inferred from the result that urban teachers had a higher mean response in all the items when compared to their rural counterparts.

Hypothesis One

There is no significant difference in the responses of teachers on the inclusion flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness.

Table 4

Chi-square analyses of responses of Teachers on flood-risk awareness concepts in Teaching Mathematics.

Description	N	SA	A	D	SD	Df	χ^2	P<.05
Real-time flood-risk data are incorporated when dealing with functions and equations	236	45	28	96	67	57	233.32	.00
Projects are assigned to students to develop algebraic models to predict flood risk.	236	22	14	111	89			
Statistical analysis is used to help students understand the probability of flood events.	236	61	36	89	50			
Flood-risk data is incorporated in lessons on calculating averages, solving quadratic equations.	236	15	16	107	98			
Students are asked to tabulate flood-risk data during statistical lessons.	236	35	25	96	80			
Studies of flood frequency are taught in mathematics statistical lessons.	236	32	25	98	81			
Real-time flood-risk data are incorporated into exercises on simple equations.	236	16	17	114	89			
Group projects are organized for students to compare regional flood-risk data.	236	32	53	89	62			
Lessons non-linear models include examples drawn from flood-risk scenarios.	236	34	35	86	81			

Real-world flood scenarios are used to illustrate the application of exponential functions.	236	16	13	101	106
Flood-risk data are integrated into lessons on probability.	236	28	32	95	81
Students are taught how to analyze flood-risk data for practical, real-life applications.	236	26	44	91	75
Animations are used to visually demonstrate key flood-risk concepts in the classroom.	236	36	30	98	72
Field trips to flood-prone areas to demonstrate effects of flooding are organized.	236	19	32	92	93
Classroom activities include calculating averages and variances using flood-related data.	236	20	19	99	98
Flood-risk scenarios are used to illustrate the development of mathematical models.	236	47	25	98	66
In class, we interpret charts to draw conclusions about flood risk.	236	25	50	90	71
Students compare graphs from different sources to analyze flood-risk trends.	236	19	18	112	87
Students are taught how to read graphs that display flood-risk information.	236	30	25	94	87
Mathematical simulations are employed to predict potential flood events.	236	28	37	100	71

Table 4 showed that the calculated chi-square value (233.32) and its corresponding calculated probability value () is .00, which is less than the significance level of (.05). Therefore, the null hypothesis is rejected. This implies that there exists a significant difference in the responses of teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness. It can be inferred that respondents who disagreed with the inclusion of flood risk awareness concepts in the teaching of mathematics to foster flood preparedness are significantly higher than those who agreed.

Hypothesis Two

There is no significant difference between the responses of male and female teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness.

Table 2 showed that the calculated probability values (P-value) for all the twenty items were greater than the significant level (.05). Therefore, the null hypothesis is not rejected. This implies that there exists no significant difference between the responses of male and female teachers on the inclusion of flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness.

Hypothesis Three

There is no significant difference between the responses of teachers on the flood-risk awareness concepts in the teaching of mathematics for flood preparedness based on location.

Table 3 showed that the calculated probability value (P-value) for all twenty items was greater than the significant level (.05). Therefore, the null hypothesis is not rejected. This implies that there exists no significant difference between the responses of teachers on the inclusion flood-risk awareness concepts in the teaching of mathematics to foster flood preparedness based on location.

Discussion of Findings

The findings revealed a significant difference in teachers' responses regarding the inclusion of flood-risk awareness concepts in mathematics teaching to foster flood preparedness. A larger proportion of teachers expressed disagreement with such inclusion, suggesting limited integration of flood-risk concepts in mathematics classrooms. This may be attributed to inadequate sensitisation of teachers and the continued emphasis on abstract mathematics rather than its application to environmental problems. This finding aligns with Abtahi et al. (2017), who reported that integrating environmental change into mathematics teaching is an ethical responsibility of mathematics teachers, and with Steffensen, Hansen, and Hauge (2016), who noted that teachers possess ideas for incorporating environmental issues into mathematics instruction.

The findings further indicated no significant difference between male and female teachers regarding the inclusion of flood-risk awareness concepts in mathematics teaching. Although male teachers recorded slightly higher responses, the difference was not statistically significant, suggesting that both male and female teachers demonstrate similar levels of engagement with environmental issues in mathematics instruction. This finding contradicts Ahiatrogah (2017), who reported a significant gender difference in teaching skills.

Similarly, no significant difference was found in teachers' responses based on school location. While teachers in rural areas showed marginally higher responses than their urban counterparts, the difference was not significant. This suggests that teachers in both urban and rural schools rarely integrate flood-risk awareness into mathematics teaching, possibly due to limited use of problem-solving and problem-based instructional strategies. This finding contrasts with Dash and Barman (2016), who found a significant difference in teaching effectiveness based on school location.

Conclusion

Based on the findings, it was concluded that mathematics teachers showed limited concern for the inclusion of flood-risk awareness concepts in classroom instruction. This pattern was consistent across gender and school location, indicating that both male and female teachers in urban and rural areas rarely integrate flood-risk concepts into mathematics teaching. Given the serious and widespread impact of flooding, there is a need for teachers to deliberately incorporate flood-risk awareness into mathematics lessons to promote students' understanding, preparedness, and preventive action. The study therefore highlights the importance of sensitizing mathematics teachers to the potential of the subject as a tool for integrating flood-risk awareness at the secondary school level.

Recommendations

The following recommendations are made based on the findings:

1. Teachers should include the concepts of flood-risk awareness when teaching mathematics lessons in the classroom.
2. Male and female teachers including urban and rural teachers should incorporate the problems of the environment such as flood-risk into their teaching of mathematics especially as a strategy for real-life experience and problem-based strategies.
3. Seminars and conferences should be held by Mathematics Association of Nigeria and other Educational Organizations to train teachers on the inclusion of flood-risk awareness concept in the teaching of mathematics.

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