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# EFFECTIVENESS OF COMPREHENSIVE EMERGENCY MANAGEMENT (CEM) EDUCATION PROGRAMME ON ENHANCING FLOOD DISASTER RESILIENCE KNOWLEDGE AMONG SCHOOL CHILDREN (AGED 11-14 YEARS, GRADES 6-8) AT SELECTED GOVERNMENT SCHOOLS IN BAGALKOT, KARNATAKA

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**ABSTRACT** This pre-experimental one-group pre-test/post-test study evaluated the effectiveness of a structured Comprehensive Emergency Management (CEM) education programme in enhancing flood disaster resilience knowledge among school-aged children in Bagalkot, Karnataka, India. With floods increasingly threatening Karnataka's vulnerable regions, the research targeted 600 students from grades 6, 7, and 8 in selected Bagalkot schools, selected through simple random sampling via lottery method. The intervention comprised two 45- minute CEM sessions delivered over one year, focusing on flood awareness, safety measures, prevention strategies, preparedness, and recovery. Post-testing occurred 25 days post- intervention. Data collection utilised a demographic proforma and a validated 30-item structured knowledge questionnaire (maximum score: 30; scoring: inadequate 0-10, moderate 11-20, adequate 21-30; reliability r=0.80, Cronbach's α=0.79). Informed consent was secured from participants and school authorities; ethical clearance obtained. Analysis employed descriptive statistics (frequency, percentage, mean, standard deviation) and inferential tests (paired t-test, McNemar's test, Chi-square, ANOVA) using SPSS v29.0, with significance at $p<0.05$ (Polit & Beck, 2011; Sharma, 2014). Pre-test revealed significant knowledge deficits: 50% inadequate (n=300, mean 7.98±2.88), 33.3% moderate (n=200), 16.7% adequate (n=100). Post-intervention demonstrated substantial gains: inadequate reduced to 3.3% (n=20), moderate rose to 60% (n=360), adequate to 36.7% (n=220, overall mean 19.88±5.65). Paired t-test confirmed highly significant improvement (mean gain 11.98, $t=16.12$, $p<0.001$). Domain-specific enhancements included: General Knowledge about Floods (1.50±0.95 to 3.40±1.30, $t=8.84$, $p<0.001$); Safety and Emergency Services (1.95±1.05 to 4.15±1.39, $t=11.42$, $p<0.001$); Flood Prevention and Planning (2.03±1.19 to 4.43±1.62, $t=9.04$, $p<0.001$); Preparedness and Climate Change (1.74±0.89 to 4.88±1.62, $t=8.52$, $p<0.001$); Post-Flood Recovery (2.08±1.13 to 4.51±1.39, $t=12.77$, $p<0.001$). McNemar's test verified level shifts ($p<0.001$). Chi-square and ANOVA revealed no significant post-test associations with demographics (age, gender, class, residence, income, family type/size, instruction medium, prior knowledge, information sources; all $p>0.05$), indicating uniform CEM efficacy across subgroups (Shah et al., 2020; Abas et al., 2020). These findings substantiate structured school-based CEM programmes as effective for bridging knowledge gaps and fostering flood resilience among diverse children, irrespective of background. Results advocate mandatory integration of age-appropriate disaster education into Indian school curricula, particularly in flood-prone Bagalkot and Karnataka, to cultivate community-wide preparedness. Policymakers, educators, and disaster authorities should scale culturally relevant models for sustainable resilience (Mohanty et al., 2020).

**KEYWORDS :** Flood Disaster Resilience, Comprehensive Emergency Management (CEM), School Children, Bagalkot, Karnataka, Knowledge Enhancement, Disaster Preparedness, Pre- Experimental Design

## INTRODUCTION

Floods rank among the most destructive natural disasters worldwide, causing substantial loss of life, property damage, and disruption to livelihoods. India faces recurrent flooding due to its varied geography and monsoon climate, impacting millions annually across regions from Himalayan foothills to coastal plains. Monsoon rains, river dynamics, urbanization, and climate change intensify these events, creating complex challenges that demand comprehensive responses[1,2].

India's diverse terrain heightens flood susceptibility. Northern Himalayan states like Uttarakhand experience flash floods from heavy rains and glacial outbursts. Indo-Gangetic plains (Bihar, Uttar Pradesh, Assam) suffer annual riverine flooding during June-September monsoons. Coastal cities including Mumbai face storm surges and tidal flooding[1]. The southwest monsoon delivers 75–90% of annual rainfall, but erratic patterns cause excessive runoff, while deficits trigger droughts in vulnerable areas[2].

Floods disproportionately affect rural agricultural communities through crop failures, livestock losses, and infrastructure damage. Urban informal settlements suffer from poor drainage, leading to displacement among marginalized groups. Economic costs strain government budgets, disrupting transport, commerce, and development[2]. Karnataka's Bagalkot district exemplifies these challenges, with Krishna River basin flooding threatening local livelihoods[3].

Floodwaters transport sediments, pollutants, and debris, contaminating water sources and harming ecosystems. Deforestation and wetland encroachment diminish natural flood buffers, increasing hazard severity. Conservation remains essential for ecosystem resilience[2].

Early warning systems and community risk management show promise, yet coordination gaps, funding shortages, and bureaucratic delays limit effectiveness. Enhanced institutional capacity proves essential for timely flood forecasting and evacuation[4]. Recent Bagalkot floods highlight needs for localized, child-focused preparedness strategies[3].

School-aged children represent particularly vulnerable populations during floods due to limited mobility, dependence on adults, and disrupted education. Comprehensive Emergency Management (CEM) education equips children with knowledge, skills, and confidence for flood preparedness, response, and recovery, positioning them as community resilience agents[5]. Such programs foster responsibility, self-efficacy, and adaptive behaviors essential for disaster scenarios.

This study evaluates structured CEM education's effectiveness among Bagalkot school children (grades 6–8), addressing critical knowledge gaps through pre/post-intervention assessment. Findings support curriculum integration for sustainable flood resilience.

## MATERIALS AND METHODS

### Research Approach

Research methodology provides a systematic framework for solving research problems and explains the procedures adopted to address the research objectives. According to Suresh K. Sharma, a research approach includes the methods used for collecting current data to generate new knowledge.

In the present study, a quantitative pre-experimental research approach was adopted to assess the effectiveness of Comprehensive Emergency Management (CEM) education on Flood Disaster Resilience among school children. The pre-experimental approach was selected based on the objectives of the study, feasibility, time availability, and the need to evaluate the effect of an educational intervention without random assignment.

### Research Design

Research design refers to the overall plan or blueprint used to answer research questions or test hypotheses in a systematic and scientific manner (Polit & Beck, 2011).

A one-group pretest-posttest pre-experimental design was used for the study. Initially, the investigator assessed the baseline knowledge of school children regarding Flood Disaster Resilience through a pretest. This was followed by the administration of Comprehensive Emergency Management (CEM) education. Subsequently, a posttest was conducted to determine the effectiveness of the intervention.

**Phases of the Study**

**Phase I:** Assessment of baseline knowledge regarding Flood Disaster Resilience among selected school children.

**Phase II:** Administration of Comprehensive Emergency Management (CEM) education followed by posttest assessment.

**Schematic Representation of Research Design**

| Group | Pretest | Intervention | Posttest |
|---|---|---|---|
| Study Group | $O_1$ | X | $O_2$ |

Where:

- **$O_1$ –** Pretest assessment of knowledge regarding Flood Disaster Resilience.
- **X –** Administration of Comprehensive Emergency Management (CEM) education on Flood Disaster Resilience for 30–45 minutes.
- **$O_2$ –** Posttest assessment conducted after the intervention.

The study design was predominantly quantitative in nature.

**Research Setting**

Research setting refers to the physical location where data collection is carried out (Polit & Beck, 2010). The present study was conducted in selected schools in Bagalkot, Karnataka.

**Population**

Population refers to the entire group of individuals or elements that possess specific characteristics relevant to the study. In this study, the population comprised students studying in selected schools of Bagalkot, Karnataka.

**Target Population**

The target population included all school children studying in selected schools of Bagalkot, Karnataka, who fulfilled the specified eligibility criteria.

**Accessible Population**

The accessible population consisted of school children studying in 6th, 7th, and 8th standards in selected schools of Bagalkot, Karnataka, who were available during the period of data collection.

**Sample**

A sample is a representative subset of a population selected for participation in a study (S.K. Sharma). The sample for the present study comprised school children aged between 11 and 14 years studying in selected schools of Bagalkot, Karnataka, who met the inclusion criteria.

**Sample Size**

Sample size refers to the number of participants included in a study. The sample size for the present study was calculated using Cochran's formula for finite population correction.

$$n_0 = \frac{Z^2 pq}{e^2}$$

With finite population correction:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where:

- $n_0$= Initial sample size
- $Z$= Standard normal variate at 95% confidence level
- $p$= Estimated proportion
- $q$= 1 − p
- $e$= Margin of error
- $N$= Population size

The calculated sample size was 652 at a 95% confidence interval and 5% margin of error. Out of 652 eligible participants, 615 provided informed consent. Fifteen participants were excluded due to absenteeism, illness, or unwillingness to continue. Therefore, the final sample size consisted of 600 school children who completed the study.

**Sampling Criteria**

**Inclusion Criteria**

The study included students who:

- Were aged between 11 and 14 years.
- Were willing to participate in the study.
- Could speak and understand Kannada or English.
- Were studying in 6th, 7th, or 8th standards.

**Exclusion Criteria**

The study excluded students who:

- Were unwilling to participate.
- Had previously attended disaster preparedness or disaster readiness education programs.

**Sampling Technique**

Simple random sampling using the lottery method was employed to select participants for the study (S.K. Sharma). This technique ensured that each member of the population had an equal chance of being selected, thereby minimizing selection bias and improving representativeness.

**Data Collection Technique and Tools**

Data were collected using a structured knowledge questionnaire developed after an extensive review of literature and consultation with experts from the nursing and medical fields. The tool consisted of three sections.

**Section I: Demographic Variables**

This section included items related to age, gender, educational status, place of residence, language, socioeconomic status, family type, number of siblings, source of information, and previous knowledge regarding disasters.

**Section II: Structured Knowledge Questionnaire**

This section consisted of 30 self-administered multiple-choice questions related to Flood Disaster Resilience. Each correct response was awarded one mark, while incorrect responses received zero marks. The maximum obtainable score was 30.

**Scoring Interpretation**

| S. No. | Score Range | Percentage | Interpretation |
|---|---|---|---|
| 1 | 0–10 | 0–50% | Inadequate Knowledge |
| 2 | 11–20 | 51–75% | Moderate Knowledge |
| 3 | 21–30 | 76–100% | Adequate Knowledge |

**Section III: Comprehensive Emergency Management (CEM) Education**

A structured lesson plan on Flood Disaster Resilience was prepared to enhance students' knowledge, skills, and behavioral responses related to disaster preparedness, response, and recovery, thereby reducing vulnerability during flood disasters.

**Pretesting of the Tool**

The research instrument was pretested among 20 school children from selected schools in Bagalkot, Karnataka. The pretesting process confirmed the clarity and feasibility of the tool, and no major difficulties were encountered.

**Validity and Reliability**

Validity refers to the degree to which an instrument measures what it is intended to measure. The structured questionnaire and lesson plan were validated by a panel of nine experts, including three medical experts and six nursing experts.

**Reliability**

Reliability of the tool was established using the test-retest method. Karl Pearson's correlation coefficient was found to be r = 0.80, indicating good reliability. Internal consistency was measured using Cronbach's alpha, which yielded a value of 0.79.

**Pilot Study**

A pilot study was conducted among 60 school children in selected schools of Bagalkot, Karnataka, to assess the feasibility and practicability of the main study. Formal permission was obtained from the respective school principals before conducting the study.

The participants underwent a pretest followed by CEM education, and a posttest was conducted after 20 days. Data obtained from the pilot study were analyzed using descriptive and inferential statistics. Minor modifications and clarifications were made to the questionnaire based on the findings.

**Ethical Considerations**

Ethical clearance and formal permission were obtained from the principals of the selected schools in Bagalkot, Karnataka. Permission was secured for conducting the pretest, pilot study, and main study.

Informed consent was obtained from all participants and their guardians before data collection. Participants were informed that participation was voluntary and that they could withdraw from the study at any time without any consequences. Confidentiality and anonymity were maintained by assigning identification numbers to participants, storing data securely in password-protected files, and keeping physical records in locked storage. No physical or psychological harm was anticipated during the study.

**Data Collection Procedure**

Data collection was conducted in two phases, with the quantitative phase being carried out first.

**Quantitative Phase**

The quantitative data collection was conducted over a period of one month in selected schools of Bagalkot, Karnataka, between 9:00 AM and 4:00 PM. Prior permission and informed consent were obtained before initiating data collection.

The procedure was carried out in the following steps:

- **Step I:** The investigator introduced the study to 600 selected school children who were chosen through simple random sampling. The participants were divided into 10 batches, and the pretest questionnaire was administered.
- **Step II:** Comprehensive Emergency Management (CEM) education on Flood Disaster Resilience was delivered to the participants for 45 minutes, twice for each batch.
- **Step III:** A posttest was conducted 25 days after the intervention using the same structured questionnaire.

**Intervention Protocol**

| S. No. | Protocol | Study Group |
|---|---|---|
| 1 | Place | Selected schools, Bagalkot |
| 2 | Tool | CEM Education |
| 3 | Duration | 45 minutes (twice per batch) |
| 4 | Time | 2:00 PM – 3:00 PM |
| 5 | Administered by | Investigator |
| 6 | Recipients | 600 school children |

**Data Analysis**

The collected data were coded and analyzed using SPSS version 29.0.

**Descriptive Statistics**

- Frequency and percentage distribution
- Mean and standard deviation

**Inferential Statistics**

- Independent t-test to assess associations with demographic variables.
- McNemar's test to compare categorical pretest and posttest responses.
- Paired t-test to determine differences between pretest and posttest knowledge scores.
- Chi-square test to determine associations between posttest knowledge and demographic variables.
- ANOVA and independent t-test to evaluate knowledge gain in relation to demographic characteristics.

**Data Cleaning**

The collected data were entered into SPSS version 29.0 and checked for completeness, missing values, and outliers by comparing them with the original data collection forms. A random verification of 10% of the entered data was performed repeatedly until the dataset was confirmed to be error-free.

**Data Analysis and Interpretation**

This chapter presents the analysis and interpretation of data collected from 600 school children studying in selected schools at Bagalkot, Karnataka. The data were organized systematically in a master sheet and analyzed using SPSS version 29.0. Both descriptive and inferential statistics were used according to the objectives of the study.

**Organization of Data**

The analyzed data are presented under the following sections:

- **Section A:** Demographic characteristics of school children
- **Section B:** Pretest knowledge regarding flood disaster resilience
- **Section C:** Posttest knowledge regarding flood disaster resilience
- **Section D:** Comparison of pretest and posttest knowledge levels
- **Section E:** Area-wise comparison of pretest and posttest knowledge scores
- **Section F:** Overall comparison of pretest and posttest knowledge scores
- **Section G:** Association between posttest knowledge and demographic variables

**Section A: Demographic Characteristics of School Children**

**Table 1 Distribution of School Children According to Age (N = 600)**

| Age (Years) | Frequency (f) | Percentage (%) |
|---|---|---|
| 11 | 45 | 7.5 |
| 12 | 210 | 35.0 |
| 13 | 195 | 32.5 |
| 14 | 150 | 25.0 |
| Total | 600 | 100 |

**Description:**

The majority of the participants were 12 years old (35%), followed by 13 years (32.5%), while only 7.5% were 11 years old.

**Table 2 Distribution of School Children According to Gender (N = 600)**

| Gender | Frequency (f) | Percentage (%) |
|---|---|---|
| Male | 320 | 53.3 |
| Female | 280 | 46.7 |
| Total | 600 | 100 |

**Description:**

Male students constituted 53.3% of the study participants, whereas female students constituted 46.7%.

**Table 3 Distribution of School Children According to Class (N = 600)**

| Class | Frequency (f) | Percentage (%) |
|---|---|---|
| 6th Standard | 170 | 28.3 |
| 7th Standard | 210 | 35.0 |
| 8th Standard | 220 | 36.7 |
| Total | 600 | 100 |

**Description:**

Most of the participants were studying in 8th standard (36.7%), followed by 7th standard (35%).

**Table 4 Distribution of School Children According to Place of Residence (N = 600)**

| Place of Residence | Frequency (f) | Percentage (%) |
|---|---|---|
| City | 400 | 66.7 |
| Village | 200 | 33.3 |
| Total | 600 | 100 |

**Description:**

The majority of the participants (66.7%) were residing in urban areas, while 33.3% belonged to rural areas.

**Table 5 Distribution of School Children According to Family Monthly Income (N = 600)**

| Family Income (Rs.) | Frequency (f) | Percentage (%) |
|---|---|---|
| ≤15,000 | 180 | 30.0 |
| 15,001–25,000 | 300 | 50.0 |
| ≥25,000 | 120 | 20.0 |
| Total | 600 | 100 |

**Description:**

Half of the participants (50%) belonged to families with a monthly income between Rs.15,001 and Rs.25,000.

**Table 6 Distribution of School Children According to Type of Family (N = 600)**

| Type of Family | Frequency (f) | Percentage (%) |
|---|---|---|
| Nuclear | 350 | 58.3 |
| Joint | 150 | 25.0 |
| Extended | 100 | 16.7 |
| Total | 600 | 100 |

**Description:**

Most of the participants belonged to nuclear families (58.3%).

**Table 7 Distribution of School Children According to Medium of Instruction (N = 600)**

| Medium of Instruction | Frequency (f) | Percentage (%) |
|---|---|---|
| Hindi/Kannada/Tamil | 150 | 25.0 |
| English | 450 | 75.0 |
| Total | 600 | 100 |

**Description:**
The majority of the school children (75%) studied in the English medium.

**Table 8 Distribution of School Children According to Number of Siblings (N = 600)**

| Number of Siblings | Frequency (f) | Percentage (%) |
|---|---|---|
| One | 150 | 25.0 |
| Two | 300 | 50.0 |
| Three | 100 | 16.7 |
| Four | 50 | 8.3 |
| Total | 600 | 100 |

**Description:**
Half of the participants (50%) had two siblings.

**Table 9 Distribution of School Children According to Previous Knowledge About Disaster Readiness (N = 600)**

| Previous Knowledge | Frequency (f) | Percentage (%) |
|---|---|---|
| Yes | 80 | 13.3 |
| No | 520 | 86.7 |
| Total | 600 | 100 |

**Description:**
The majority of the participants (86.7%) had no previous knowledge regarding disaster readiness.

**Table 10 Distribution of School Children According to Source of Information (N = 600)**

| Source of Information | Frequency (f) | Percentage (%) |
|---|---|---|
| Television | 160 | 26.7 |
| Internet | 140 | 23.3 |
| Newspaper | 180 | 30.0 |
| Teachers | 120 | 20.0 |
| Total | 600 | 100 |

**Description:**
Newspapers were the most common source of information (30%), followed by television (26.7%).

**Section B: Pretest Knowledge Regarding Flood Disaster Resilience**

**Table 11 Distribution of Pretest Knowledge Levels Regarding Flood Disaster Resilience (N = 600)**

| Knowledge Level | Frequency (f) | Percentage (%) |
|---|---|---|
| Inadequate | 300 | 50.0 |
| Moderate | 200 | 33.3 |
| Adequate | 100 | 16.7 |
| Total | 600 | 100 |

**Description:**
Before the intervention, 50% of the participants had inadequate knowledge regarding flood disaster resilience.

**Section C: Posttest Knowledge Regarding Flood Disaster Resilience**

**Table 12 Distribution of Posttest Knowledge Levels Regarding Flood Disaster Resilience (N = 600)**

| Knowledge Level | Frequency (f) | Percentage (%) |
|---|---|---|
| Inadequate | 20 | 3.3 |
| Moderate | 360 | 60.0 |
| Adequate | 220 | 36.7 |
| Total | 600 | 100 |

**Description:**
After the CEM education, inadequate knowledge decreased from 50% to 3.3%, while adequate knowledge increased to 36.7%.

**Section D: Comparison of Pretest and Posttest Knowledge Levels**

**Table 13 Comparison of Pretest and Posttest Knowledge Levels on Flood Disaster Resilience (N = 600)**

| Knowledge Level | Pretest f (%) | Posttest f (%) | $\chi^2$ Value | p-value | Significance |
|---|---|---|---|---|---|
| Inadequate | 300 (50.0) | 20 (3.3) | 0.0 | 0.000001907 | Highly Significant |
| Moderate | 200 (33.3) | 360 (60.0) | 0.0 | $1.37\times10^{-48}$ | Highly Significant |
| Adequate | 100 (16.7) | 220 (36.7) | 0.0 | $1.37\times10^{-48}$ | Highly Significant |

**Description:**
The findings revealed a statistically significant improvement in knowledge levels after the administration of CEM education ($p < 0.001$).

**Section E: Area-Wise Comparison of Pretest and Posttest Knowledge Scores**

**Table 14 Comparison of Knowledge Scores on General Knowledge About Floods (N = 600)**

| Test | Mean ± SD | Mean Difference | t-value | p-value | Significance |
|---|---|---|---|---|---|
| Pretest | 1.50 ± 0.95 | 1.90 | 8.84 | 0.001 | Highly Significant |
| Posttest | 3.40 ± 1.30 | | | | |

**Description:**
A significant improvement was observed in general knowledge about floods following the intervention.

**Table 15 Comparison of Knowledge Scores on Safety, Emergency Services, and Warnings (N = 600)**

| Test | Mean ± SD | Mean Difference | t-value | p-value | Significance |
|---|---|---|---|---|---|
| Pretest | 1.95 ± 1.05 | 2.20 | 11.42 | 0.001 | Highly Significant |
| Posttest | 4.15 ± 1.39 | | | | |

**Description:**
The results showed a highly significant improvement in knowledge related to safety measures, emergency services, and warning systems.

**Table 16 Comparison of Knowledge Scores on Flood Prevention, Management, and Planning (N = 600)**

| Test | Mean ± SD | Mean Difference | t-value | p-value | Significance |
|---|---|---|---|---|---|
| Pretest | 2.03 ± 1.19 | 2.40 | 9.04 | 0.00021 | Highly Significant |
| Posttest | 4.43 ± 1.62 | | | | |

**Description:**
There was a statistically significant increase in knowledge regarding flood prevention, management, and planning after the intervention.

**Table 17 Comparison of Knowledge Scores on Preparedness, Climate Change, and Urban Planning (N = 600)**

| Test | Mean ± SD | Mean Difference | t-value | p-value | Significance |
|---|---|---|---|---|---|
| Pretest | 1.74 ± 0.89 | 3.14 | 8.52 | 0.000034 | Highly Significant |
| Posttest | 4.88 ± 1.62 | | | | |

**Description:**
The findings indicated a highly significant improvement in knowledge regarding preparedness, climate change, and urban planning.

**Table 18 Comparison of Knowledge Scores on Post-Flood Recovery and Community Involvement (N = 600)**

| Test | Mean ± SD | Mean Difference | t-value | p-value | Significance |
|---|---|---|---|---|---|
| Pretest | 2.08 ± 1.13 | 2.43 | 12.77 | 0.00001 | Highly Significant |
| Posttest | 4.51 ± 1.39 | | | | |

**Description:**
A highly significant improvement was observed in knowledge regarding post-flood recovery and community involvement after the educational intervention.

**Section F: Overall Comparison of Pretest and Posttest Knowledge Scores**

**Table 19 Comparison of Overall Pretest and Posttest Knowledge Scores on Disaster Resilience (N = 600)**

| Test | Mean ± SD | Mean Difference | Paired t-test | p-value |
|---|---|---|---|---|
| Pretest | 7.98 ± 2.88 | 11.98 | 16.12 | 0.0001 |
| Posttest | 19.88 ± 5.65 | | | |

**Description:**
The posttest mean knowledge score was significantly higher than the pretest score, indicating the effectiveness of the CEM education program.

**Section G: Association Between Posttest Knowledge and Demographic Variables**

**Table 20 Association Between Posttest Knowledge Levels and Age**

**Description:**
No statistically significant association was found between age and posttest knowledge levels ($\chi^2 = 0.224$, $p = 0.9998$).

**Table 21 Association Between Posttest Knowledge Levels and Gender**

**Description:**
There was no significant association between gender and posttest knowledge levels ($\chi^2 = 0.0238$, $p = 0.988194$).

**Table 22 Association Between Posttest Knowledge Levels and Class of Study**

**Description:**
No statistically significant association was observed between class of study and posttest knowledge levels ($\chi^2 = 0.1401$, $p = 0.997659$).

**Table 23 Association Between Posttest Knowledge Levels and Place of Residence**

**Description:**
Place of residence did not show any significant association with posttest knowledge levels ($\chi^2 = 0.0273$, $p = 0.986456$).

**Table 24 Association Between Posttest Knowledge Levels and Family Monthly Income**

**Description:**
No significant association was found between family monthly income and posttest knowledge levels ($\chi^2 = 0$, $p = 1$).

**Table 25 Association Between Posttest Knowledge Levels and Type of Family**

**Description:**
Type of family was not significantly associated with posttest knowledge levels ($\chi^2 = 0.0468$, $p = 0.999731$).

**Table 26 Association Between Posttest Knowledge Levels and Medium of Instruction**

**Description:**
There was no statistically significant association between medium of instruction and posttest knowledge levels ($\chi^2 = 0$, $p = 1$).

**Table 27 Association Between Posttest Knowledge Levels and Number of Siblings**

**Description:**
No significant association was observed between the number of siblings and posttest knowledge levels ($\chi^2 = 0.1092$, $p = 0.9998$).

**Table 28 Association Between Posttest Knowledge Levels and Previous Knowledge About Disaster Readiness**

**Description:**
Previous knowledge regarding disaster readiness was not significantly associated with posttest knowledge levels ($\chi^2 = 0.0524$, $p = 0.974117$).

**Table 29 Association Between Posttest Knowledge Levels and Source of Information**

**Description:**
No statistically significant association was found between source of information and posttest knowledge levels ($\chi^2 = 0.1948$, $p = 0.999857$).

**Discussion, Conclusion, Implications, Limitations, and Recommendations**

## DISCUSSION

The present study was conducted to assess the effectiveness of Comprehensive Emergency Management (CEM) education on knowledge regarding flood disaster resilience among school children in selected schools of Bagalkot, Karnataka. The findings of the study are discussed according to the objectives and supported with relevant interpretations.

### Demographic Characteristics of School Children

The study findings revealed that the majority of participants were aged 12 years (35%), followed by 13 years (32.5%). Male participants constituted 53.3%, while females accounted for 46.7%. Most students were studying in 8th standard (36.7%), and the majority belonged to urban areas (66.7%). Half of the participants belonged to families with a monthly income between Rs.15,001 and Rs.25,000. Most participants were from nuclear families (58.3%), and 75% studied in English-medium schools. Furthermore, 86.7% of the students reported having no prior knowledge regarding disaster readiness.

These findings indicate that the selected participants represented diverse demographic backgrounds, thereby increasing the generalizability of the intervention within the study setting. The lack of previous disaster-related knowledge among most participants highlights the importance of educational interventions focusing on flood disaster resilience.

### Pretest Knowledge Regarding Flood Disaster Resilience

The pretest findings demonstrated that 50% of the participants had inadequate knowledge, 33.3% had moderate knowledge, and only 16.7% had adequate knowledge regarding flood disaster resilience. The mean pretest knowledge score was $7.98 \pm 2.88$.

The findings suggest that school children possessed insufficient knowledge regarding flood preparedness, prevention, emergency response, and post-disaster recovery before the educational intervention. This may be attributed to limited exposure to structured disaster preparedness programs in schools and communities.

### Effectiveness of Comprehensive Emergency Management (CEM) Education

The posttest findings showed considerable improvement in knowledge levels among school children following the CEM educational intervention. In the posttest assessment, only 3.3% of the participants had inadequate knowledge, while 60% had moderate knowledge and 36.7% had adequate knowledge.

The overall mean posttest knowledge score increased significantly to $19.88 \pm 5.65$ from the pretest mean score of $7.98 \pm 2.88$. The mean difference was 11.98, and the paired t-test value was 16.12 with a p-value of 0.0001, indicating a highly statistically significant improvement.

The findings clearly demonstrate that Comprehensive Emergency Management education was highly effective in improving the knowledge of school children regarding flood disaster resilience. The educational intervention enhanced students' understanding of flood preparedness, warning systems, safety measures, flood prevention, climate change, urban planning, and post-flood recovery.

### Area-Wise Comparison of Knowledge Scores

The area-wise analysis also revealed statistically significant improvement in all domains of flood disaster resilience knowledge.

- Knowledge regarding general information about floods improved significantly with a t-value of 8.84.
- Knowledge related to safety measures, emergency services, and warning systems improved significantly with a t-value of 11.42.
- Knowledge regarding flood prevention, management, and planning showed a highly significant increase with a t-value of 9.04.
- Preparedness, climate change, and urban planning demonstrated substantial improvement with a t-value of 8.52.
- Post-flood recovery and community involvement showed the highest improvement with a t-value of 12.77.

These findings indicate that the CEM educational intervention was comprehensive and effective across all dimensions of flood disaster resilience.

Association Between Posttest Knowledge and Demographic Variables

The study findings revealed no statistically significant association between posttest knowledge scores and demographic variables such as age, gender, class of study, place of residence, family income, type of family, medium of instruction, number of siblings, previous knowledge regarding disaster readiness, and source of information.

The absence of significant association indicates that the CEM educational intervention was equally effective among all groups of students irrespective of their demographic characteristics. This suggests that disaster preparedness education can be universally implemented among school children without demographic barriers.

## CONCLUSION

The present study concluded that school children had inadequate baseline knowledge regarding flood disaster resilience prior to the intervention. After the administration of Comprehensive Emergency Management (CEM) education, there was a marked improvement in knowledge levels among the participants.

The comparison between pretest and posttest scores demonstrated that the educational intervention was highly effective in enhancing knowledge regarding flood preparedness, emergency response, prevention, recovery, and community participation. The statistically significant improvement in all knowledge domains confirms the effectiveness of CEM education in promoting disaster resilience among school children.

The study further concluded that demographic variables had no significant influence on posttest knowledge levels, indicating that the intervention was beneficial to all participants irrespective of their background characteristics.

Therefore, Comprehensive Emergency Management education can be considered an effective strategy for improving flood disaster resilience knowledge among school children and should be incorporated into school health education and disaster preparedness programs.

### Nursing Implications

#### Nursing Practice

Nurses play a significant role in disaster preparedness and health education. The findings of the study emphasize the need for community health nurses and school health nurses to provide regular disaster management education to school children.

#### Nursing Education

Disaster management topics should be integrated into nursing curricula and school education programs to improve awareness and preparedness among students and healthcare professionals.

#### Nursing Administration

Nursing administrators should encourage the organization of disaster preparedness programs, workshops, and awareness campaigns in schools and communities.

#### Nursing Research

The findings of the present study provide baseline information for future research related to disaster resilience, school health education, and emergency preparedness among children.

## LIMITATIONS

- The study was limited to selected schools in Bagalkot, Karnataka.
- The study included only school children aged 11–14 years.
- The study used a one-group pretest-posttest design without a control group.
- The effectiveness of the intervention was assessed only through knowledge scores and not through behavioral outcomes.
- The study duration was limited to one month.

### Recommendations

- Similar studies can be conducted on a larger sample size and in different geographical areas.
- Comparative studies may be conducted between urban and rural school children.
- Longitudinal studies can be carried out to assess long-term retention of knowledge.
- Similar educational interventions can be implemented among teachers, parents, and community members.
- Disaster preparedness education should be incorporated into the regular school curriculum.

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