A STUDY ON THE EFFECTIVENESS OF INSTRUCTIONAL PACKAGE ON CLIMATE CHANGE WITH REFERENCE TO WATER CONSERVATION PRACTICES AMONG B.Ed. STUDENT-TEACHERS IN BANGALORE CITY

A. Srinivasacharlu, Assistant Professor
New Horizon College of Education
100 Feet Road, Indiranagar, Bangalore-560008

Abstract

Bangalore is India's IT capital and the most third important city next to New Delhi and Bombay. The rising temperature due to climate change has touched 37-38 degree Celsius in 2014 and the city is experiencing an urban heat island effect. Due to this the city is facing drinking water problem. B.Ed. student-teachers are the future secondary school teachers who have the big responsibility in developing water conservation practices among the adolescent students who are future citizens. In the present experimental study, an attempt was made to develop and find out the effectiveness of Instructional Package on Climate Change (IPCC) with reference to water conservation practices among B.Ed. student-teachers in Bangalore. Pre-test, post-test parallel group design was followed for collecting the data by administering Climate Change Practices Scale (CCPS) which also includes also water conservation practices. The data was analyzed by using statistical techniques and interpreted.

Key Words: *Water Conservation Practices, IPCC, CCPS and B.Ed. student-teachers*.

Introduction

More than one billion people in the world still lack access to safe water In addition some observers have estimated that by 2025 more than half of the world population will be facing water-based vulnerability. Therefore, the conservation and optimal utilization of this scarce resource is extremely important for economic development. Reports by Indian Network for Climate Change Assessment, Intergovernmental Panel on Climate Change (IPCC) etc. state that India is recognized to be highly vulnerable to climate change as it is a warm and primarily subtropical country where agriculture and drinking water depend on the monsoons. Climate change has increased intensity of rain fall in certain parts and water scarcity in most of the places. This is having impacts on a range of sectors, including water resource management, Industry, urban planning, and agriculture.

Need and Importance of the Study

Bangalore is India's IT capital and the most third important city next to New Delhi and Bombay. The rising temperature due to climate change has touched 37-38 degree Celsius in 2014 and the city is experiencing an urban heat island effect. Due to this the city is facing drinking water problem. In another 15 years, half of the city's thirst may be slaked. This grim picture comes from a 2015 report by Bangalore Political Action Committee. The current water supply to the city from the Cauvery is just around 1,400 MLD. By 2021, the city faces a deficit of more than 1,000 million liters per day (MLD). This deficit is estimated to increase to 2,311 MLD in 15 years. The report emphasizes recycling water through treatment plants, rainwater harvesting and rejuvenating the city's lakes, which can add up to 500 MLD. Water experts say it's time that water conservation should be made as a habit by the people in Bangalore. B.Ed. student-teachers are the future secondary school teachers who have the big responsibility in developing water conservation practices among the adolescent students who are future citizens of Bangalore. Water conservation practices include a set of eco-friendly practices to manage fresh water as a sustainable resource, to

protect the water environment, and to meet current and future human demand. In the present study an attempt was made to develop and find out the effectiveness of IPCC with reference to water conservation practices among the B.Ed. student-teachers in Bangalore city.

Statement of the Problem

"A Study on the Effectiveness of Instructional Package on Climate Change with reference to Water Conservation Practices among B.Ed. Student-Teachers in Bangalore City."

Objectives of the Study

1. To develop and validate IPCC for the B.Ed. student-teachers.
2. To construct and validate the CCPS for B.Ed. student-teachers.
3. To compare the effectiveness of IPCC and Conventional Method of Teaching Environmental Education (CMTEE) in enhancing water conservation practices among B.Ed. student-teachers.
4. To investigate interaction between 'treatment' and locality, gender and subject with reference to water conservation practices among B.Ed. student-teachers.
5. To investigate whether the B.Ed. student-teachers sustain water conservation practices fostered through IPCC.

Variables of the Study

- Independent Variable : IPCC and CMTEE
- Dependent Variable : Water Conservation Practices
- Moderate Variables : Locality, Gender and Discipline

Operational Definitions

- IPCC: It enables B.Ed. student-teachers to develop the water conservation practices as a part of adapting and mitigating the climate change. It includes User Guide, Self Instructional Materials (SIMs) and Documentaries.
- CMTEE: It covers the topics like environment; causes, effects and control measures for various types of environmental pollution; meaning, importance, objectives and strategies for teaching environmental education at secondary school level.
- Water Conservation Practices: It includes a set of eco-friendly practices to be taken up by B.Ed. student-teachers to manage fresh water as a sustainable resource, to protect the water environment, and to meet current and future human demand.
- Student-Teachers of B.Ed. Colleges: Student-teachers studying at two of the Aided, Urban and Co-Education B.Ed. Colleges in Bangalore affiliated to Bangalore University.
- Gender: It refers to Male and Female student-teachers studying at B.Ed. colleges and involved in the study.
- Subject: It refers to the Science and Arts opted by the student-teachers in their B.Ed. course.
- Locality: It refers the place (either from rural or urban areas) from where student-teachers come to B.Ed. College.

Hypotheses of the Study

1. There is no significant difference between pre-test scores of Experimental (E) and Control (C) Groups with reference to water conservation practices.

2. There is no significant difference in the effectiveness of IPCC and CMTEE with reference to water conservation practices among B.Ed. student-teachers.

3. There is interaction between treatment and gender–subject, locality–subject; and locality–gender with reference to water conservation practices among E group.

4. Immediate and delayed post-test scores of E group differ significantly with reference to water conservation practices.

Design of the Study

Pre-test Post-test equivalent group experimental design was followed in the present study.

Tools

1. Raven's Standard Progressive Matrices Test (RSPMT)

2. CCPS has 10 dimensions each with 10 statements with level of responses viz. Always (5), Frequently (4), Sometimes (3), Rarely (2) and Very Rarely (1). The omitted statement is given zero. The reliability coefficient is 0.87 (split half) and 0.88 (test-retest) and 0.93 (intrinsic validity). The second dimension covers water conservation practices.

Sampling Procedure

Multistage purposive sampling technique was employed to select student-teachers from two B.Ed. colleges in Bangalore city as Experimental (E) and Control (C) groups. RSPMT was used to obtain two matched groups (36+36) for the E and C groups.

Treatments for E and C Groups

1. IPCC: This validated package was meant for E group with duration of 40 hours.

1. Orientation Session (1 Hour)
2. Printed User Guide
3. Printed SIMs

　　　Module 1: The Background of the Climate Change (5 Hours)
　　　Module 2: Impacts of Climate Change (6 Hours)
　　　Module 3: Global Fight on Climate Change (5 Hours)
　　　Module 4: India's Fight on Climate Change (5 Hours)
　　　Module 5: Green Solutions for Climate Change (5 Hours)
　　　Module 6: Climate Change Education (4 Hours)

4. Documentaries and Discussion (3 Hours)

　　　Glimpses of Climate Change –NASA (5.48 Minutes)
　　　Impacts of Climate Change on World (2.22 Minutes)
　　　Climate Change–Causes, Impacts and Solutions (3.55 Minutes)
　　　An Inconvenient Truth (1 Hour and 47 Minutes)

5. Consolidating Sessions (6 Hours)

2. CMTEE: It was meant for C group with duration of 5 hours. It covers the topics like environment; environmental pollution; meaning, importance, objectives and strategies for teaching environmental education at secondary school.

Conducting of the Experiment

- The C and E Groups were pre-tested on water conservation practices.
- Both the E and C groups were given treatment respectively through IPCC and CMTEE.
- Immediately after the treatment, both E and C Groups were post-tested to know any change in water conservation practices.

- The E group was administered delayed post-test after a gap of five weeks to know the sustainability of change occurred on their water conservation practices.

Statistical Techniques and Interpretation of Data

The statistical techniques such as mean, standard deviation, 't' test and a Two-way ANOVA were used in analyzing the data.

Hypothesis 1: There is no significant difference between Pre-test scores of Experimental and Control Groups with reference to water conservation practices.

Table 1: Comparison of Pre-test Scores of E and C Groups with reference to Water Conservation Practices

Group	N	Mean	S.D.	't' Value	'P' Value at 0.05 LoS
C Group	36	29.56	1.664		0.891
E Group	36	29.58	1.500	–0.138	*NS

*NS – Not Significant

The obtained 't' value –0.138 is less than the tabled 't' value 2.0281 and 'P' value 0.891 is more than tabled 'P' value 0.05 level of significance with df 35. So the null hypothesis is accepted. This means that before treatment, C and E groups were homogenous in terms of having water conservation practices.

Hypothesis 2: There is no significant difference in the effectiveness of IPCC and CMTEE on water conservation practices among B.Ed. student-teachers.

Table 2: Comparison of Post-test Scores of C and E Groups with reference to Water Conservation Practices

Group	N	Mean	S.D.	't' Value	'P' Value at 0.05 LoS
C Group	36	29.50	1.612		0.000
E Group	36	40.78	3.181	–27.545	**S

**S – Significant

The obtained 't' value –27.545 is more than the tabled 't' value 2.0281 and 'P' value 0.000 is less than tabled 'P' value 0.05 level of significance with df 35. The mean value of post-test score of E group is higher than C group. So the null hypothesis is rejected. This proves that IPCC as a treatment is very effective than CMTEE in enhancing the water conservation practices among

the B.Ed. student-teachers belonging to experimental group.

Hypothesis 3 (a): There is interaction between treatment and gender–subject with reference to water conservation practices among E group.

Table 3a (i): A two-way ANOVA of Water Conservation Practices in regard to interaction of treatment and Gender–Subject

Source	df	Mean Square	'F' Value	'P' Value (0.05 los)
Corrected Model	3	56.737	9.867	0.000 **S
Intercept	1	51646.581	8981.445	0.000 **S
Gender	1	61.464	10.689	0.003 **S
Subject	1	90.427	15.725	0.000 **S
Gender * Subject	1	0.009	0.001	0.970 *NS

* NS – Not Significant   ** S – Significant

The obtained 'F' value 0.001 is less than tabled 'F' value 4.00 with df 1 and 32. The obtained 'P' value 0.970 is not significant as this value is more than tabled 'P' value 0.05 level of Significance. It implies that IPCC has equal effect in increasing water conservation practices among B.Ed. student-teachers irrespective of their gender-subject.

Table 3a (ii): Gender–Subject wise mean and significance values of Water Conservation Practices

E Group Gender	E Group Subject	Mean	df	'F' Value	'P' Value (0.05 level)
Female	Arts (11)	39.909	1		0.002
(24)	Science (13)	43.308	32	11.968	**S

E Group Gender	E Group Subject	Mean	df	'F' Value	'P' Value (0.05 level)
Male	Arts (06)	37.167	1		0.022
(12)	Science (06)	40.500	32	5.797	**S

* NS – Not Significant   ** S – Significant

The obtained 'F' value 11.968 is more than tabled 'F' value 4.00 and 'P' value 0.002 is less than tabled 'P' value 0.05 level of significance with df 1 and 32. It means IPCC has more interaction with female student-teachers belonging to Science than Arts with reference to water conservation practices. The obtained 'F' value 5.797 is more than tabled 'F' value 4.00 and 'P' value 0.022 is less than the tabled 'P' value 0.05 level of significance with df 1 and 32. It means IPCC has more interaction with male student-teachers belonging to Science than Arts with reference to water conservation practices.

Graph 1: A two-way ANOVA of Water Conservation Practices among E group by the gender–subject and treatment.
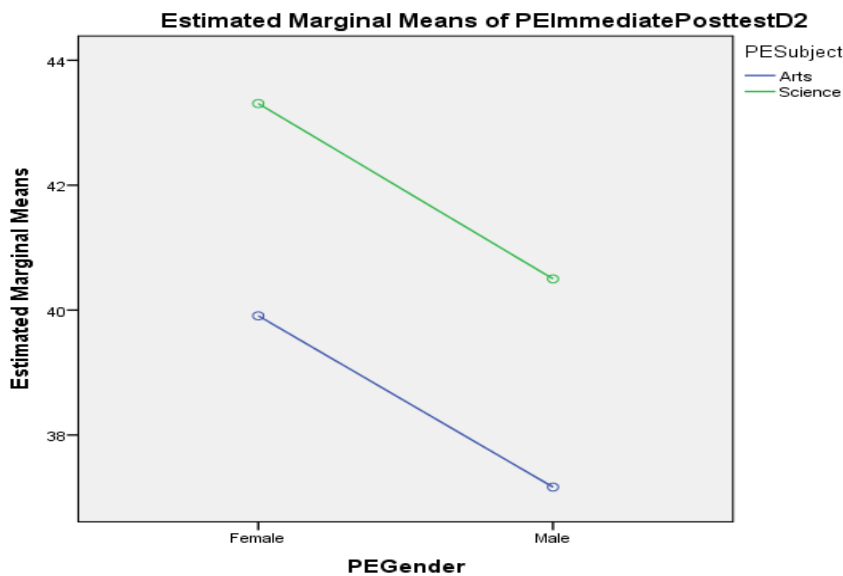
Hypothesis 3 (b): There is interaction between treatment and locality–subject with reference to shopping practices among E group.

Table 3b (i): Summary table of two-way ANOVA of Water Conservation Practices in regard to interaction of treatment and locality–Subject

Source	df	Mean Square	'F' Value	'P' Value (0.05 los)
Corrected Model	3	64.317	12.762	0.000 **S
Intercept	1	58091.502	11526.502	0.000 **S
Locality	1	50.887	10.097	0.003 **S
Subject	1	103.385	20.514	0.000 **S
Locality * Subject	1	27.748	5.506	0.025 **S

* NS – Not Significant   ** S – Significant

The table reveals that the obtained 'F' value 5.506 is more than tabled 'F' value 4.00 and 'P' value 0.025 is significant as this value is less than tabled 'P' value 0.05 level of significance with df 1 and 32. It implies that effect of IPCC on water conservation practices among E group is not homogenous as there is significant interaction of IPCC and locality–subject.

Table 3b (ii): Locality–Subject wise mean and significance values of Water Conservation Practices

E Group Locality	E Group Subject	Mean	df	'F' Value	'P' Value (0.05 level)
Rural (16)	Arts (07)	38.571	1	2.129	0.154 *NS
	Science (09)	40.222	32		
Urban (20)	Arts (10)	39.200	1	26.827	0.000 **S
	Science (10)	44.400	32		

*NS – Not Significant   ** S – Significant

The obtained 'F' value 2.129 is less than tabled 'F' value 4.00 and 'P' value 0.154 is more than tabled 'P' value 0.05 level of significance with df 1 and 32. It means IPCC is equally effective on rural student-teachers belonging to both Science and Arts with reference to water conservation practices. However, IPCC has more interaction with urban student-teachers belonging to science than Arts with reference to water conservation practices as the obtained 'F' value 26.827 is more than tabled 'F' value 4.00 and 'P' value 0.000 is less than tabled 'P' value 0.05 level of significance with df 1 and 32.

Graph 2: A two-way ANOVA of Water Conservation Practices among E group by the locality–subject and treatment
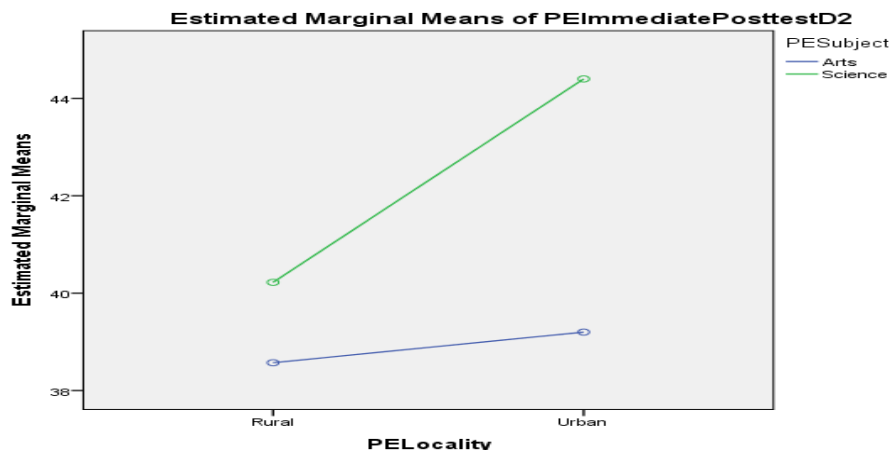
Hypothesis 3 (c): There is interaction between treatment and locality–gender with reference to water conservation practices among E group.

Table 3c (i): Summary table of a two-way ANOVA of Water Conservation Practices by Locality–Gender and Treatment

Source	df	Mean Square	'F' Value	'P' Value (0.05 level)
Corrected Model	3	42.242	5.942	0.002 **S
Intercept	1	51122.316	7190.982	0.000 **S
Locality	1	19.926	2.803	0.104 *NS
Gender	1	55.750	7.842	0.009 **S
Locality * Gender	1	19.926	2.802	0.104 *NS

* NS – Not Significant   ** S – Significant

The table reveals that the obtained 'F' value 2.802 is less than tabled 'F' value 4.00 and 'P' value 0.104 is not significant as this value is more than the tabled 'P' value 0.05 level of significance with df 1 and 32. It implies that IPCC is has equal effect in increasing water conservation practices among B.Ed. student-teachers irrespective of their locality-gender.

Table 3c (ii): Locality–Gender wise mean and significance values of Water Conservation Practices

E Group Locality	E Group Gender	Mean	df	'F' Value	'P' Value (0.05 level)
Rural (16)	Female (10)	39.900	1		0.444
	Male (06)	38.833	32	0.600	*NS
Urban (20)	Female (14)	43.071	1		0.003
	Male (06)	38.833	32	10.611	**S

*NS – Not Significant   ** S – Significant

The obtained 'F' value 0.600 is less than tabled 'F' value 4.00 and 'P' value 0.440 is more than tabled 'P' value 0.05 level of significance with df 1 and 32. It means IPCC is equally effective on female and male rural student-teachers with reference to water conservation practices. In addition, the obtained 'F' value 10.611 is more than tabled 'F' value 4.00 and 'P' value 0.003 is less than tabled 'P' value 0.05 level of significance with df 1 and 32. It means IPCC has more interaction with female student-teachers belonging to urban than male with reference to water conservation practices.

Graph 3: A two-way ANOVA of Water Conservation Practices among E group by the locality–gender and treatment
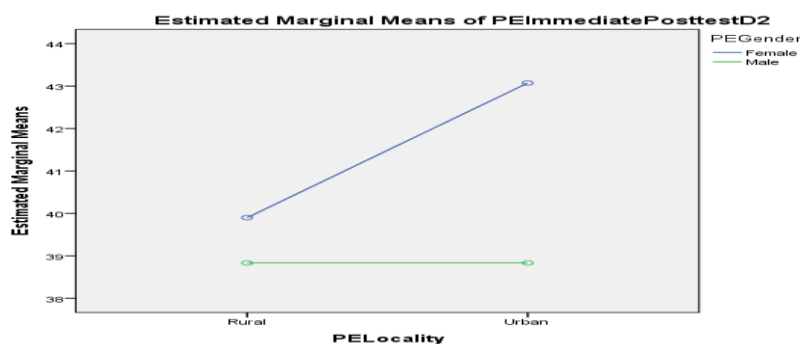
4. Immediate and Delayed Post-test scores of Experimental group differ significantly with reference to water conservation practices.

Table 4: Comparison of Immediate and Delayed Post-test of Scores of Experimental Group with reference to Water Conservation Practices

E Group	N	Mean	S.D.	't' Value	P Value at 0.05 at LoS
Immediate Post-test	36	40.78	3.181		0.324
Delayed Post-test	36	40.75	3.219	1.000	*NS

*NS – Not Significant

The obtained 't' value 1.000 is less than the tabled 't' value 2.0281 and 'P' value 0.324 is more than tabled 'P' value 0.05 level of significance with df 35. It proves that the water conservation practices fostered through IPCC are sustainable by the experimental group even after five weeks. Hence the package is found to be reliable.

Major Findings

1. Pre-test: There was no significant difference in the Pre-test scores of E and C Groups. This indicates that both the groups were alike in water conservation practices before subjected to treatment.
2. Post-test: There was a significant difference in the Post-test scores of E and C Groups. This proves that IPCC is more effective than CMTEE in enhancing water conservation practices among B.Ed. student-teachers.
3. ANOVA of Gender–Subject: IPCC has more interaction with female student-teachers belonging to Science than Arts and also male student-teachers belonging to Science than Arts with reference to water conservation practices.
4. ANOVA of Locality–Subject: IPCC is equally effective on rural student-teachers belonging to both Science and Arts with reference to water conservation practices. However, IPCC has more interaction with urban student-teachers belonging to science than Arts with reference to water conservation practices.
5. ANOVA of Locality–Gender: IPCC is equally effective on female and male rural student-teachers with reference to water conservation practices. However, IPCC has more interaction with female student-teachers belonging to urban than male with reference to water conservation practices.
6. Sustainability: A high degree of reliability is found between immediate and delayed post-test scores. It proves that the IPCC has sustainable effect on water conservation practices among experimental group. Hence the package is found to be reliable.

Educational Implications

1. B.Ed. student-teachers being the future secondary school teachers, have a great role in inculcating water conservation practices among the adolescents who are future citizens.
2. The findings of the study reveal that IPCC has superiority over the CMTEE in increasing and sustaining water conservation practices among B.Ed. student-teachers in Bangalore.
3. There shall be a provision for a specific module on water conservation practices as a part of teaching of Environmental Education at College of Education.
4. Colleges of Education can celebrate the World Water Day on 22nd March. They can screen documentary to reflect how consuming too much water, or polluting a shared body of

water, can make it hard for others to have enough for drinking, hygiene, agriculture and other needs, not to mention the health of the ecosystem.

5. Center for Environmental Education (CEE), Bangalore can organize workshops on rain water harvesting for B.Ed. student-teachers.

Limitations

1. The study was confined to B.Ed. Student-teachers studying in Bangalore city.
2. The study was limited to two parallel groups of student teachers drawn from two of B.Ed. Colleges affiliated to Bangalore University.
3. The study was confined to moderate variables like Gender, Subject and Locality.
4. Sample groups were selected from two separate B.Ed. Colleges due to the non-availability of good number of student-teachers from same institution.

Suggestions for Further Study

1. The study can be extended to study the effectiveness of IPCC on values, attitude etc. pertaining to climate change among B.Ed. student-teachers.
2. Similar study could be undertaken with other moderate variables qualification, marital status, socio-economic status etc.
3. Similar study could be undertaken with larger sample of B.Ed. student-teachers.
4. The study can be extended to B.Ed. Teacher Educators and Secondary School Students.

Conclusion

The study has proved that IPCC is more effective than CCTEE in increasing water conservation practices among B.Ed. student-teachers. This calls for the proper integration of IPCC in B.Ed. curriculum which also helps the student-teachers to influence secondary school students (who are future citizens) towards practicing water conservation now and in future.

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