

Personal Science Teaching Efficacy of Primary Pre-service Teachers in Fiji: Impact of Constructivist Approach¹

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Abstract

The Personal Science Teaching Efficacy (PSTE) of primary pre-service teachers of Fiji was investigated to identify the confidence level of prospective primary teachers in teaching primary science. The Science Teaching Efficacy Beliefs Instrument-B modified by Bleicher was used to measure the PSTE of the pre-service primary teachers. Results reveal that the present science education in the newly implemented 3-year primary teacher education program with effect from the 2011 session is effective in enhancing the PSTE of primary pre-service teachers.

Introduction

The teaching and learning of science at the primary level in Fiji and other countries of the South Pacific Region is a major challenge. Primary school teachers generally dislike science teaching due to various reasons (Tilger, 1990). The lack of knowledge in science has a direct relationship with the confidence levels of teachers in teaching science at the primary level (Ginns and Foster 1983; Lu-

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cas and Dooley 1982; Tilgner 1990; Taylor and Coll 1999). Steps have been taken from time to time by the Government of Fiji to improve the standards of science teaching and learning (Fiji Education Commission 1969; Muralidhar 1989, 1993, 1999; Singh 1997; Taylor and Lucas 1997, 2001; Taylor and Coll 1999; Fiji Islands Education Commission, 2000; Ministry of Education, Fiji, 2007). Muralidhar (1989) emphasised an activity-based science education. Taylor & Coll (1999) investigated PSTE of 131 pre-service primary teachers of Lautoka Teachers College.² They reported that the mean values of PSTE related to the sample was 50.58. A new primary pre-service B.Ed. program has been implemented by Fiji National University from 2011. The science education unit /course developed on constructivist approach has been implemented with effect from 2011 in the first year. This paper aims to investigate the effect of existing constructivist science education course on the personal science teaching efficacy of primary pre-service teachers of the existing three year B.Ed. program. PSTE is one of the parameters of confidence level of science teaching in teachers.

Conceptual Framework

Humans are affected by self-efficacy beliefs. Self efficacy is people's 'judgments of their capabilities to organize and execute courses of action required to attain designated types of performances' (Bandura, 1986: 391). People's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances are critical in affecting motivations and efforts people spend on the action, which in turn has a critical impact on the outcome of the action (Bandura, 1995). According to Bandura's social learning theory, individuals with strong sense of self-efficacy consider problems as tasks to be mastered (Bandura 1977, 1986, 1995, 2000, 2002). Such persons have strong sense of commitment and develop deep interest in activities in which they participate. Individuals are viewed as self-organizing, self-reflecting and self-regulating rather than as reactive organisms shaped by environmental forces or driven by internal hidden impulses (Bandura 1977, 1986, 1995, 2000, 2002). According to Bandura, there is an interaction of (a) personal factors (in the form of cognition, affect,

² The College is now part of the College of Humanities and Education, of the Fiji National University.

and biological events), (b) behaviour, and (c) environmental influences. Cognition plays a critical role to construct reality, self-regulation, encoding of information, and performing of behaviours.

A number of studies on impacts of various factors on the development and enhancement of teaching self-efficacy of teachers at various levels have been published (Benczo 2010; Pajares, 2002; Seung, Park & Narayan 2011). According to Morris & Usher (2011), mastery experiences and social persuasions are the important self-efficacy factors in teaching in case of certain award-winning professors. Bandura's social learning theory has also been investigated in the area of science teaching self-efficacy of school teachers (Seung, Park & Narayan, 2011). Research regarding self-efficacy in primary science teaching have been reported on primary science education by a number of workers in advanced countries (Cantell, Young & Moore, 2003; Hechter, 2011; Jones & Carter, 2007; Joseph, 2010; Moulholland, Doran & Odgers, 2004; Tosum, 2000). Variations have been reported in results depending on various conditions.

This study investigates the PSTE of primary pre-service teachers in Fiji. It examines the effect of constructivist science education unit, a core unit in the 3-year Bachelor of Education program in Fiji, on the PSTE of primary pre-service teachers in Fiji. The key indicator sought was the mean value of Personal Science Teaching Efficacy of primary pre-service teachers in Fiji.

Method

The 'before-and-after' study method was followed (Burns, 1997) to establish the effect of some event which had occurred between the phases of the survey on the experimental group. The pre-service teachers of first year of B.Ed. program were selected for the before-and-after survey study. This lot was selected because the first part of the science education course developed on constructivist approach was to be transacted in trimester 2 of that year. The investigators were interested in the investigation of the effect of constructivist science education course on the PSTE of primary pre-service teachers. Data regarding PSTE of the pre-service teachers was measured with the help of a questionnaire known as Science Teaching Efficacy Beliefs Instrument-B (STEBI-B) initially developed by Enochs and Riggs (1990) and modified further by Bleicher (2004). All the 300 pre-service teachers admitted in the first year of the pro-

gramme were taken up in the present study.

The filled up STEBI-B questionnaires related to two phases of the present study were examined and it was found that 118 out of 300 pre-service teachers filled up the questionnaire at both the phases of the survey, that is, at the beginning (initial stage) and at the close (final stage) of the study term. Software Package in Social Science (SPSS), IBM (Version-20) was used to analyze data.

Results and Discussion

Mean Value of PSTE

Table-1 and Figure-1 show 49.26 as the initial (PSTE1) mean value of PSTE of entire sample of primary pre-service teachers. The enhancement in the mean value by 3.39 to 52.65 in the PSTE2 shown in Table-2 and Figure-2 is significant at .01 level of confidence.

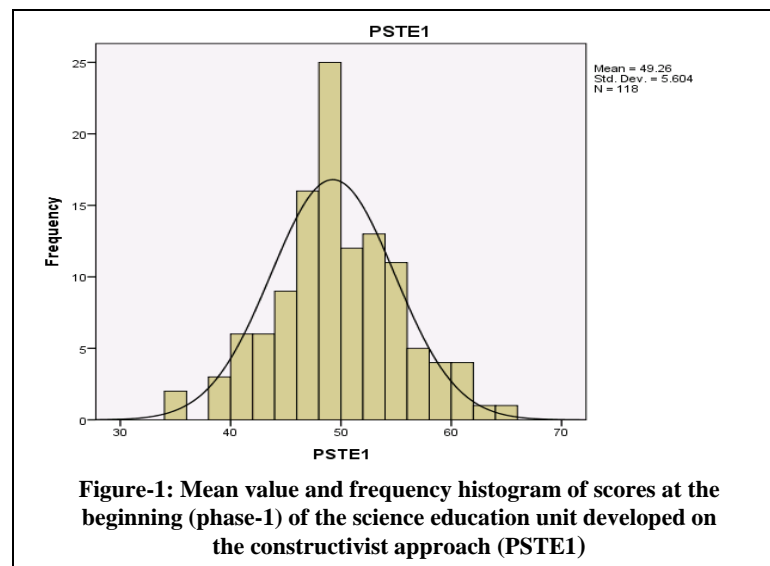


Figure-1: Mean value and frequency histogram of scores at the beginning (phase-1) of the science education unit developed on the constructivist approach (PSTE1)

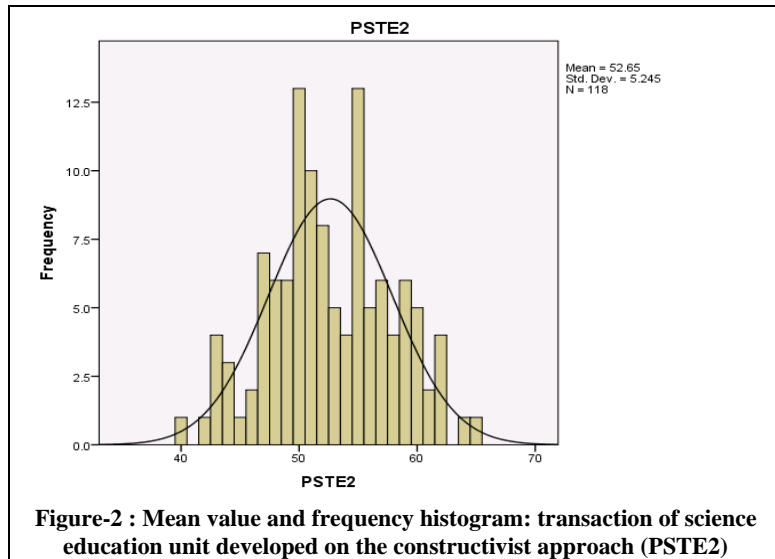


Figure-2 : Mean value and frequency histogram: transaction of science education unit developed on the constructivist approach (PSTE2)

Table-1: Descriptive statistics of Personal Science Teaching Efficacy Phase-1 (PSTE1) & Phase-2 (PSTE2)

	N	Range	Minimum	Maximum	Mean		Standard Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
PSTE1 (Initial)	118	29	35	64	49.26	.516	5.604	31.409
PSTE2 (Final)	118	25	40	65	52.65	.483	5.245	27.511

Table-2: Paired Samples test of Personal Science Teaching Efficacy at the initial stage (PSTE1) and final stage (PSTE2)

	Paired Differences				t	df	Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error Mean	99% Confidence Interval of the Difference				
				Lower				Upper
PSTE2 (Final stage) & PSTE1 (Initial stage)				2.086	4.693	6.809	117	.000

Taylor and Coll (1999) conducted studies on PSTE in Fiji taking 131 pre-service primary teachers and reported the mean value of PSTE of the entire sample as 50.58. The entire sample mean value of PSTE in the USA has been reported as 47.00 (Enochs & Riggs, 1990), and 44.86 in Australia (Watters & Ginns, 1994). What is apparent is that the mean value in the present study is less than that of PSTE reported by Taylor & Coll and more than the present mean value reported for Australia and that reported for USA. The variations may be due to various reasons, for example, pedagogical differences, level of science content teaching and different institutional conditions in different countries. There is a need to explore the reasons for these variations in personal science teaching efficacy in primary pre-service teachers at the international level.

Constructivist Approach and PSTE

Data in Table 1 shows that final mean value of PSTE (PSTE2, 52.65) is higher than the initial mean value (PSTE1, 49.29). The comparison of the mean values with the help of SPSS reveals that the difference of 3.390 in the mean values is statistically significant at .01 level (Table 2). The results show that the transaction of science education unit on constructivist approach significantly enhanced the confidence level of pre-service primary teachers in Fiji. The values of minimum and maximum scores are higher as compared to the initial minimum and maximum values (Table 1) The range is also reduced from 29 to 25 (Table 1). There is also the reduction in the variance and standard deviation (Table 1).

Frequency Changes

56.8% of the subjects got scores up to 49 and 43.2% got scores between 50 and 64 (see Table 3); 26.3% of the subjects got scores up to 49 and 73.7% got scores between 50 and 65 (see Table 4). Data in Table 5 on changes in cumulative frequencies as a result of the transaction of science education unit on constructivist approach show that the scores of primary pre-service teachers in PSTE improved. Score 49 at serial number 13 is the interesting score from where the decreasing tendency in the difference of cumulative percentage starts on either side of the score. This leads to the inference that 31% of the subjects improved their scores in science teaching. The percentage of subjects who improved their scores to more than

49 at the final stage in PSTE decreased gradually with the higher scores, that is, from 50 to 65 in final stage.

Table-3: PSTE scores at the initial stage (PSTE1)

Score	Frequency	Percent	Valid Percent	Cumulative Percent
35	2	1.7	1.7	1.7
38	1	.8	.8	2.5
39	2	1.7	1.7	4.2
40	1	.8	.8	5.1
41	5	4.2	4.2	9.3
42	2	1.7	1.7	11.0
43	4	3.3	3.4	14.4
44	5	4.2	4.2	18.6
45	4	3.3	3.4	22.0
46	6	5.0	5.1	27.1
47	10	8.3	8.5	35.6
48	12	10.0	10.2	45.8
49	13	10.8	11.0	56.8
50	6	5.0	5.1	61.9
51	6	5.0	5.1	66.9
52	9	7.5	7.6	74.6
53	4	3.3	3.4	78.0
54	7	5.8	5.9	83.9
55	4	3.3	3.4	87.3
56	3	2.5	2.5	89.8
57	2	1.7	1.7	91.5
58	2	1.7	1.7	93.2
59	2	1.7	1.7	94.9
60	3	2.5	2.5	97.5
61	1	.8	.8	98.3
62	1	.8	.8	99.2
64	1	.8	.8	100.0
Total	118	98.3	100.0	

Table-4: PSTE scores at the final stage (PSTE2)

Score	Frequency	Percent	Valid Percent	Cumulative Percent
40	1	.8	.8	.8
42	1	.8	.8	1.7
43	4	3.3	3.4	5.1
44	3	2.5	2.5	7.6
45	1	.8	.8	8.5
46	2	1.7	1.7	10.2
47	7	5.8	5.9	16.1
48	6	5.0	5.1	21.2
49	6	5.0	5.1	26.3
50	13	10.8	11.0	37.3
51	10	8.3	8.5	45.8
52	8	6.7	6.8	52.5
53	5	4.2	4.2	56.8
54	4	3.3	3.4	60.2
55	13	10.8	11.0	71.2
56	5	4.2	4.2	75.4
57	6	5.0	5.1	80.5
58	4	3.3	3.4	83.9
59	6	5.0	5.1	89.0
60	5	4.2	4.2	93.2
61	2	1.7	1.7	94.9
62	4	3.3	3.4	98.3
64	1	.8	.8	99.2
65	1	.8	.8	100.0
Total	118			

Table-5: Changes in cumulative percentages of frequencies of Personal Science Teaching Efficacy

Serial Number	Score	Cumulative % PSTE-1 (Initial)	Cumulative % PSTE-2 (Final)	Difference in Cumulative % (Final -Initial)
1	35	1.7	Nil	-1.7
2	38	2.5	nil	-2.5
3	39	4.2	nil	-4.2
4	40	5.1	.8	-4.3
5	41	8.3	Nil	-8/3
6	42	11.0	1.7	-9.3
7	43	14.4	5.1	-9.3
8	44	10.6	7.6	3-0
9	45	22.0	8.5	13.5
10	46	27.1	10.2	-16.9
11	47	35.6	16.1	-19.5
12	48	45.8	21.2	-24.6
13	49	56.8	26.3	-30.5
14	50	61.9	37.3	-24.6
15	51	66.9	45.8	-21.1
16	52	74.6	52.5	-22.1
17	53	78.0	56.8	-21-2
18	54	83.9	60.2	-23.7
19	55	87.3	71-2	-16-1
20	56	89.8	75.4	-14.4
21	57	91.5	80.5	-11.0
22	58	93.2	83.9	-9.3
23	59	94.9	89.0	-5.9
24	60	97.5	93.2	-4.3
25	61	98.3	94.9	-3.4
26	62	99.2	98.3	-0.9
27	63	Nil	Nil	Nil
28	64	100.0	99.2	-0.8
29	65	Nil	100.0	100

Conclusion

The results of the present investigation support the view that the present science education unit on constructivist approach in the existing 3-year Bachelor of Education (Primary), a newly implemented primary teacher education program in Fiji, is effective in improving the confidence level of primary pre-service teachers in

teaching primary science. The mean value of PSTE is 49.26 which is close to earlier reported PSTE mean value of 50.58 for Fiji. The effect of the constructivist approach in science education is positive.

Table-6: Changes in frequencies & scores at the initial and final stages

Serial Number	Max. Frequency Descending order	Score at the Initial stage	Score at the Final stage	Comments
1	13	49	50, 55	26 subjects in Phase-2; 13 subjects in phase -1
2	12	48	Nil	12 subjects in phase-1
3	11	Nil	Nil	Nil in both phases
4	10	47	51	10 each in both phases
5	9	52	Nil	9 in phase-1
6	8	Nil	52	8 in phase-2
7	7	54	47	7 in both phases
8	6	46, 50, 51	48, 49, 57, 59	18 in phase -1 and 24 in phase-2
9	5	41, 44	53, 56, 60	10 in phase-1 and 15 in phase-2
10	4	43, 45, 55	43, 54, 58, 62	12 in phase-1 and 16 in phase-2
11	3	56, 60	44	6 in phase-1 and 3 in phase-2
12	2	35, 39, 42, 57, 58	46, 61	10 in phase -1 and 2 in phase-2
13	1	38, 40, 61, 62, 64	40, 42, 45, 64, 65	5 in both the phases

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