Effective teaching approach employed by primary school science teachers

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Abstract: Teachers are often urged to use a variety of modes of instruction to ensure that diverse student interests and abilities can be accomodated. Yet teachers can be limited in the instructional modes they can use because of insufficient background or knowledge about a specific instructional mode (Dawson, 2004). Teaching approaches are various in purposes such as to trigger students' interest in science, to discover through inquiry approach, to build students understanding through constructivism approach or to introduce a concept through demontration approach. Every approach has the strength and weakness in its use. Although inquiry may not be the only way to teach science, many science educators believe that it may be the best way for students to learn science (Audet & Jordan, 2005). According to Woolfolk (2001), constructivism is a mode of instruction that emphasizes the active role of the learner in building, understanding and making sense of information. Demonstrations by teacher can be used with students of all ages and across all subjects. The teacher is not only knowledgeable about the topic but also uses a variety of aids to ensure that students understand what is being demonstrated (Marsh, 2004). By studying their teaching approaches and methods, the actual practices could be analysed and the effectiveness status of their effectiveness could be determined. Specifically, this study aimed to answer these questions in terms of three approaches namely inquiry, constructivism and demonstrations; how far is this approach effective in terms of teaching and learning, and what is the correlation between these three approaches. Data were collected from primary school science teachers (N=239) and the results shown that the teachers were agreeable with the three approaches, inquiry approach (mean=3.74, SD=0.27), demonstration approach (mean=3.61, SD=0.27) and constructivism approach (mean=3.86, SD=0.30). The results also showed that there are significant correlations among inquiry, demonstration and constructivism approach. This finding showed that primary school science teachers not depend only on one type of approach and apply variously in teaching science. There are also positive and significant correlation between that approaches used by primary school science teachers.

Key words: effective; teaching; science

1. Introduction

1.1 Background of the study

Researches into effective sciences teaching at primary school provide us with two important information: the ideas that science teaching and learning of children should start at school and understanding of a concept is the fundamental of the learning (Skamp, 2004). Recently, the quality of teaching and learning science becomes the

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question in hand. A lot of researchers agree that objectives of learning science at primary school may not be only to prepare students for the secondary stage's education. It is also important for the preparation of life long learning and understanding of the phenomenon around them. Teachers should provide the opportunities and experiences that are acceptable by students as something interrelated to their environment.

Education process is illustrated as a professional activity that needs consistent decision-making by teachers. Teaching science incorporates creativity, imagination and decision-making skill. Among the decision-making involved are content of lessons, teaching strategies, laboratory preparation and class management preparation. Teachers' duty is not only to explain, provide notes and use the teaching board or other teaching aids. Thus, one of the primary objectives of teaching is to ensure that students are fascinated by the lesson plans. Then the process of learning is contented compared to students who learn solely through taking notes. It means students are required to understand the information and put effort to seek for and accumulate information which is stated by Venville and Dawson (2004) in the meaning that science is not solely knowledge; it requires active involvement of students in the activities. Two main concerns in carrying out an activity are investigation skill and communication skill. The great challenge here is to manufacture genuine experiences from these two skills.

There are various applicable approaches for teachers in teaching science. In general, the selection of the approaches depends on the objectives of teaching. Influencing factors caused by students are the preparation of students, students' capability, class capacity and students' background like their behavior and expectation to the lesson as well as the teachers' factors besides the limitation of time table and facilities available for the process of teaching and learning (Dawson, 2000).

Research of Educational Planning Research Division, Ministry of Education, Malaysia (2000) showed that teachers who involve in the teaching process of students' low achievement yet manage to master certain aspects of pedagogy skills. In addition, they seldom construct the activities that put emphasis on scientific skill development and thinking skill. The research found that teacher's attitude was the main difficulties facing by the teachers in implementing science-teaching process on students under achievements. Followed by teachers' practice that has been carried out in the teaching process. The effect of teachers' attitudes were two times more than the teacher's practice. As for the teacher's practices, the practice that emphasized on scientific skill is the dominant factors and significant compared to other practices.

Therefore, science teaching approach needs to be targeted to what is applicable in the classroom setting. There are variety of teaching approaches like methods in cultivating students' interest towards science, applying manipulative method in hand-on approach, encouraging exploration through inquiry or the constructivism or traditional methods approach which focuses on students' understand. Every approach has the strength and weakness in its use.

1.2 Inquiry approach

The understanding of science knowledge and scientific inquiry skill is the fundamental of effective science teaching which is stated by Australian Science Teachers' Association (ASTA, 2002). Typical characteristic of science knowledge refers to the value and perception of science which is parallel with scientific knowledge and the development of the knowledge. Scientific inquiry approach may not only involve the utilizing of science process skill, but also includes scientific knowledge, scientific reasoning and critical thinking to develop the scientific knowledge (Venville & Dawson, 2004).

Inquiry approach also refers to the students' understanding of investigation and the ability to analyse critically according to the obtained data. Thus, the constructive beliefs of this approach are:

(1) Learning outcomes depend not only on the learning environment but also on the knowledge of the learner.

(2) Learning involves the construction of meaning.

(3) The construction of meaning is a continuous and active process.

(4) Learners have the final responsibility for their own learning. Teaching is promotion of opportunities and support for learning.

Although inquiry may not be the only way to teach science, many science educators believe that it may be the best way for students to learn science (Audet & Jordan, 2005). On top of this, Kluger-Bell (1999) elaborates three kinds of conventional activities in this approach: guidance for teachers, challenging activities with minimum assistance and brain storming by teachers. Barman (2002) defines inquiry approach as a situation where teacher chooses the question and students plan the procedure of the experiment.

At the initial stage, the teaching needs to be assisted by posting some questions. The aim of posting the questions is to initiate following activities by providing the students new knowledge. The activities of searching the answers are deemed as investigation or exploration. Inquiry refers to information searching through questioning (Bentley, et al., 2000). Inquiry approach in science teaching indicates modification of questioning approach to investigation approach in order to let students explore the procedure of obtaining the answers. Inquiry approach differs from conventional teaching approach. In conventional teaching approach, teachers tell students what they need to learn, list the information on board and provide entire information to the students.

1.3 Demonstration approach

Demonstration approach is an approach that enable teachers to manipulate teaching material, while students are the observers. Generally, there are three situations based on demonstration approach that will benefit the teachers. First, when an activity involves particular prevention steps or when dangerous materials are used in the teaching. Second, when the materials and expensive equipments need to be used in teaching and teachers need to demonstrate the correct way of operating the equipments. Third, sometimes students pay little attention towards certain important procedure and teachers can halt the procedure to ask the questions accordingly. This situation is emphasized by Bentley, et al (2000). He states that certain activities are more appropriate to carry out through demonstration approach. For example, when teachers aware of the possibility of some situations that involve dangerous chemical material or expensive laboratory instruments.

Demonstration approach is suitable to apply in all school levels, in primary, secondary or higher level's education. Teachers are not only knowledgeable about the topic, but also use variety of aids to ensure that students understand what is being demonstrated (Marsh, 2004). The common method for effective science teaching and learning is to carry out discussion activities in the classroom. Anyway, the ability to switch to various appropriate approaches in teaching is important. Effective teaching involves introducing activities and discussions that challenge the perspective of searching the information and evident that drives to improve various methods in acquiring knowledge. Cavalcante, et. al (1997) states that structure concept is suitable to apply in introducing topics, that will provide a basis of the observed experiment for them to construct the hypotheses.

1.4 Constructivism approach

Constructivism approach in sciences emphasizes on the important of supervising the students' concepts, guides them through open discussion and evaluates them according to the clear evidence. The details of this teaching strategy is based on how we think about students' intuitive concept (Venville & Dawson, 2004). According to Woolfolk (2001), constructivism is a mode of instruction that emphasizes the active role of the learner in building understanding and making sense of information. Thus, Skamp (2004) suggested that the

hand-on method and mind-on method are applied to support constructivism teaching approach.

As for this effective science teaching approach, Goodrum (2004) has suggested certain characteristics for students who are science smart. Therefore, it is important for teachers to cultivate this culture in their teaching process. The process of teaching and learning is an important activity. Teachers need to associate the knowledge with the real world to make the learning meaningful. The teaching of scientific knowledge smart should emphasize on the following matters:

(1) Science becomes something interesting for all students;

(2) The contents are meaningful for students experience and interest;

(3) Assist students actively and encourage inquiry;

(4) Provide opportunity for scientific discussion among students;

(5) Work in group and be cooperation in investigating the tasks;

(6) Open activity to investigate science problem;

(7) Learning of concept wisely to utilise in a new situation;

(8) Learning science actively through resources searching;

(9) Outcomes of the learning are assessable;

(10) Elaborate understanding and the usage in a new situation and skills to investigate, analyse data and methods of communication.

2. Methodology

2.1 Research design and respondents of the study

This study used survey method and quantitative data were generated by despondence's answer obtained from administered questionnaires. Data were collected from 239 teachers at primary schools from 4 states (Selangor, Negeri Sembilan, Melaka and Putrajaya) in this study. The respondents consist of teachers who teach science subject in level 1 or level 2 or both. The schools which involve are National Primary School (SK), National Chines Primary School SJK (C) and National Tamil Primary School SJK (T). Respondents were chosen according to teachers who teach science subjects at primary school. Table 1 shows the distribution of respondents according to the school types.

Table 1 Distribution of respondence according to school types

Type of schools	N
National school	163
National types Chinese school	75
National types Tamil school	1
Total	239

Referring to the Table 1, Sekolah kebangsaan (National school) comprises the highest numbers of respondence (N=163) and Sekolah Jenis Kebangsan (China) (National type Chinese school) are second highest (N = 75). Table 2 indicates overall profile of the respondents of this study.

Majority of the respondents are aged from 31 to 40 (41.4%). Only 3.8% are under 25 years old. Female respondents were 79.8%, more than male respondents. In term of academic qualification, the respondents with diploma, STPM and SPM qualifications are almost equal compared with the respondents with bachelor degree are

only 16.7%. As for professional qualification, most of the respondents possess teaching certificate or diploma in teaching. Only 1.3% possesses Bachelor in Education.

Table 2 Complete profile of study on respondence

Variable	N	%
Age:		
< 25	9	3.8
26-30	70	29.5
31-35	54	22.8
36-40	44	18.6
41-45	35	14.8
46-50	15	6.3
51-55	10	4.2
Total	237	100.0
Gender:		
Male	48	20.2
Female	190	79.8
Total	238	100.0
Levels of teaching:		
Level 1	104	44.1
Level 2	124	52.5
Level 1and 2	8	3.4
Total	236	100.0
Academic qualification:		
Bachelor	40	16.7
Diploma	72	30.2
HSC/STPM	65	27.2
SPM	62	25.9
Total	239	100.0
Professional qualification:		
KPLI	22	9.2
Bachelor of education	3	1.3
Diploma in teaching	95	39.9
Teaching certificate	115	48.3
Others	3	1.3
Total	238	100.0

Table 3 indicates the courses attended by respondents after Ministry of Malaysia implementing teaching science and math in English.

Table 3 Courses attended by the respondents

Variables	N	%
EteMS course:		
Attended	158	66.1
Never attend	81	33.9
Total	239	100.0
Science and mathematic oriented course:		
Attended	75	32.2
Never attend	158	67.8
Total	233	100.0

Table 3 above shows the majority of the respondents (66.1%) have attended English in Teaching Mathematic and Science (EteMS) course. On the other hand, there are only 32.2% of the respondents has attended science and mathematic orientation course.

2.2 Instrument

Data was obtained by using the questionnaire that was developed by researcher for this study. The instrument

consists of items revealing the facts that assessing the facts by using five Likert scale ranging from SNA = Strongly Not Agree, NA = Not Agree, LA = Less Agree, A = Agree, SA = Strongly Agree. These items comprising variables of teaching approaches assessed in this study, which are: inquiry approach, demonstration approach and constructivism approach. Besides, the questionnaire also includes the demography of teachers namely age, gender, school type, teaching experience, academic qualification and professional qualification. The reliability of the instruments is 0.93. The data were analyzed by using descriptive analysis, t-test and correlation analysis.

3. Finding

3.1 Inquiry teaching approach

According to the analysis, inquiry teaching approach in this study was found in high level (mean=3.74, SD=0.27). Determination of this level were based on the Nugent, Sieppert and Hudsan (2001) thumb of rule stating these scores can be employed to show magnitude in a continuum. High scores indicate big magnitude while low scores indicate small magnitude. In this study, score 4 to 5 indicate high level of agreement while score 1 to 3 indicate low level of agreement.

Table 4 Frequency and percentage of inquiry approach

	Items	Strongly not agree (SNA)	Not agree (NA)	Less agree (LA)	Agree (A)	Strongly agree (SA)	Mean	SD
1	Activities carried out considered students environment.	-	1 (0.4%)	14 (5.9%)	172 (72.0%)	52 (21.8%)	4.15	0.52
2	Teachers will punish the students if they make mistakes.	15 (6.3%)	38 (16.0%)	111 (46.6%)	60 (25.1%)	14 (5.9%)	3.08	0.95
3	Times are given to students to understand certain phenomenon.	2 (0.8%)	6 (2.5%)	11 (4.6%)	154 (64.7%)	65 (27.3%)	4.15	0.69
4	Students are given chances to ask the main content in the teaching and learning process.	1 (0.4%)	3 (1.3%)	14 (5.9%)	134 (56.3%)	86 (36.1%)	4.26	0.66
5	Students are encouraged to exploit the nature according to teacher's instructions only.	11 (4.6%)	45 (18.8%)	86 (36.0%)	69 (28.9%)	28 (11.7%)	3.24	1.04
6	Interesting and happy learning environment encourage the teaching and learning activities.	-	1 (0.4%)	10 (4.2%)	90 (37.7%)	138 (57.7%)	4.53	0.60
7	Students are encouraged to involve actively in the process of discussion.	1 (0.4%)	2 (0.8%)	12 (5.0%)	106 (44.4%)	118 (49.4%)	4.41	0.67
8	Discussions are encouraged in small groups (5-6 students).	1 (0.4%)	1 (0.4%)	27 (11.3%)	122 (51.0%)	88 (36.8%)	4.23	0.69
9	Teachers design activities which are easy to adapt to the teaching.	-	3 (1.3%)	8 (3.3%)	153 (64.0%)	75 (31.4%)	4.26	0.58
10	Students make the conclusion at the end of teaching and learning process.	-	2 (0.8%)	16 (6.7%)	155 (64.9%)	66 (27.6%)	4.19	0.58

Notes: Mean = 3.74; SD = 0.27.

Referring to Table 4, mean for item "Interesting and happy learning environment encourage the teaching and learning activities" (mean=4.53, SD=0.6), "Students are encourage to involve actively in the process of discussion" (mean=4.41, SD=0.67), "Students are given chances to ask the main content in the process of teaching and learning process" (mean=4.26, SD=0.66) and "Teachers design activities which are easy to adapt to the teaching" (mean=4.26, SD=0.58) obtained the highest score. The results indicate that in teaching and learning

plan, teachers agree that interesting activities plans encourage active involvement of students; students have opportunities to ask questions and the activities are easy to be accepted by students.

On the other hand, 2 items in constructing this teaching approach indicate low value of mean. Item “Teachers will punish the students if they make mistakes” obtained the lowest score (mean=3.08, SD=0.95.), “Students are encouraged to exploit the nature according to teachers’ instructions only” (mean=3.24, SD=1.04). These items reveal the fact that teachers moderately agree to punish the students when they make mistakes. They also moderately agree that students should listen to the instructions of teachers only to explore in their learning process.

3.2 Demonstration teaching approach

According to Table 5, level of teachers’ agreement towards demonstration teaching approach is in high level (mean=3.61, SD=0.27). The highest mean is “demonstration activities need to be carried out in a space which can be observed by all students” (mean=4.41, SD=0.6). This item indicates that teachers agree that demonstration shall be carried out in space observable by all students during the demonstration. As well as “demonstrations arouse students interest in their early learning stage” (mean= 4.24, SD=0.53). This item shows that majority of teachers agree that demonstration teaching approach generates students’ interest particularly during the early learning stage of science concept. Whereas, item of “I seldom allow students to use science equipment because it is dangerous” (mean=2.63, SD=0.94) and “Demonstration can be done by using the pictures of equipments only” (mean=2.52, SD=1.00) obtained lowest score. This shows that teachers do not agree that they are not allowed to use the science equipment because of the dangerous factor. They also do not agree to teach in demonstrate approach by using pictures only.

Table 5 Frequency and percentage for demonstration approach

	Items	Strongly not agree (SNA)	Not agree (NA)	Less agree (LA)	Agree (A)	Strongly agree (SA)	Mean	SD
1	To introduce demonstration concept thorough activities is difficult.	7 (2.9%)	31 (13.0%)	132 (55.2%)	60 (25.1%)	9 (3.8%)	3.14	0.80
2	Normally I try the demonstration activities before carrying out in front of students.	-	2 (0.8%)	26 (10.9%)	174 (72.8%)	37 (15.5%)	4.03	0.55
3	Demonstration activities need to be carried out in a space which can be observed by all students.	-	2 (0.8%)	8 (3.3%)	118 (49.4%)	111 (46.4%)	4.41	0.60
4	Demonstration activities only give little impact to students.	15 (6.3%)	53 (22.2%)	125 (52.3%)	41 (17.2%)	5 (2.1%)	2.87	0.84
5	Demonstration is a method to show students correct way of using the instruments.	-	2 (0.8%)	11 (4.6%)	157 (66.0%)	68 (28.6%)	4.22	0.56
6	Demonstrations arouse students interest in their early learning stage.	-	2 (0.8%)	6 (2.5%)	164 (68.6%)	67 (28.0%)	4.24	0.53
7	I seldom allow students to use science equipment because it is dangerous.	35 (14.7%)	57 (23.9%)	108 (45.4%)	36 (15.1%)	2 (0.8%)	2.63	0.94
8	Demonstration can be done by using the pictures of equipments only.	43 (18.0%)	69 (28.9%)	94 (39.3%)	26 (10.9%)	7 (2.9%)	2.52	1.00
9	Demonstration only involved a small number of students only.	20 (8.4%)	45 (18.8%)	109 (45.6%)	52 (21.8%)	13 (5.4%)	2.97	0.98
10	Demonstrations provide a clear idea of a new concept.	-	4 (1.7%)	19 (7.9%)	162 (67.8%)	54 (22.6%)	4.11	0.60

Notes: Mean = 3.61; SD= 0.27.

3.3 Constructivism teaching approach

Table 6 reveals the finding of this study on constructivism teaching approach. The finding shows that majority of the respondents agree to constructivism teaching approach (mean=3.86, SD=0.30). Item that obtain the highest mean is "Associate the lessons to students' real life" (mean=4.35, SD=0.53). This item shows that respondents agree that in the process of teaching, teachers should provide students examples which are interrelated to the real situation of their daily life. The following item that obtain the second highest mean is "Every students' opinion and idea are appreciated" (mean=4.31, SD=0.57). This item shows that teachers should take into consideration students' answers which reflect their understanding of certain concept. As for "Provide opportunities to students to generate new knowledge from their experiences" obtained (mean=4.30, SD=0.52). Another item that is also obtained high mean is "Teachers function as a facilitator that helps students to generate new knowledge" (mean=4.29, SD=0.53). Therefore, in constructivism approach, teachers play the role as guidance in students learning process. This role is different from the traditional teaching methods in which teachers take more responsibility in conveying the information.

Table 6 Frequency and percentage of constructivism approach

	Items	Strongly not agree (SNA)	Not agree (NA)	Less agree (LA)	Agree (A)	Strongly agree (SA)	Mean	SD
1	Focus to learning compare to teaching.	3 (1.3%)	23 (9.7%)	43 (18.1%)	142 (59.7%)	27 (11.3%)	3.70	0.84
2	Consider how students learn before the planning of teaching and learning.	1 (0.4%)	1 (0.4%)	20 (8.4%)	164 (68.6%)	53 (22.2%)	4.12	0.59
3	Relate the lessons' content to students' daily life.	-	1 (0.4%)	4 (1.7%)	144 (60.3%)	90 (37.7%)	4.35	0.53
4	Give opportunities to students in generating new knowledge from their old experience.	-	-	8 (3.3%)	153 (64.0%)	78 (32.6%)	4.30	0.52
5	Structure of the ideas in teaching are difficult to understand by my students.	8 (3.4%)	25 (10.5%)	116 (48.9%)	72 (30.4%)	16 (6.8%)	3.27	0.86
6	Supply the answers for all questions in the teaching and learning sessions.	5 (2.1%)	20 (8.4%)	66 (27.6%)	115 (48.1%)	33 (13.8%)	3.63	0.90
7	Students are guided in finding and generating the new knowledge.	-	1 (0.4%)	4 (1.7%)	167 (69.9%)	67 (28.0%)	4.25	0.50
8	Teachers play the role as a facilitator who assists students to generate new knowledge.	-	-	9 (3.8%)	150 (63.0%)	79 (33.2%)	4.29	0.53
9	Students are encouraged to elaborate their new idea.	-	-	9 (3.8%)	172 (72.3%)	57 (23.9%)	4.20	0.49
10	Every opinion and idea of students are appreciated.	1 (0.4%)	-	7 (3.0%)	145 (61.7%)	82 (34.9%)	4.31	0.57

Notes: Mean = 3.86, SD=0.30.

3.4 Correlation

The finding shows that there are significant relationship between mean of inquiry teaching, demonstration and constructivism approach form the respondents' perspective. All the values of mean were compared by using T-test to investigate the relationship between these three teaching approaches. The result indicates that there are significant relationship between all approaches at $p<0.01$ (see Table 7).

Table 7 Correlation t-test among the teaching approaches

	Mean inquiry	Mean demonstration	Mean constructivism
Mean inquiry	-	0.311**	0.351**
Mean demonstration	0.311**	-	0.319**
Mean constructivism	0.351**	0.319**	-
Total respondents	239	239	239

Note: **: Correlation is significant at the 0.01 level (2-tailed).

4. Conclusion

This study showed that teachers should use various teaching approaches for effective teaching in science. Three methods employed in this study indicated that various approaches can promote the effectiveness of teachers' teaching. This finding also indicated that there are significant correlations among three methods employed in this study. A good science teaching should consist of interactive, hand-on activities and active discussion to challenge old knowledge in order to construct a good new understanding of the knowledge. These approaches require teachers to exploit students' old knowledge and their understanding to integrate in the activities. Anyway, these approaches are found difficult to carry out in science classes due to the limitation of time allocation and other requirement of curriculum.

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