
A Four-Tier Diagnostic Test to Assess Pre-service Elementary Teachers' on Electricity Magnetism

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ABSTRACT

This article reports on the calculation procedure which is to recover and to device a four-tier test diagnostic instrument, which has not been defined in the literature. It is an enhanced arrangement of the two-tier test substances. As in two-tier tests, its answer and reason tiers extent pre-service elementary teachers' contented knowledge and clarifying knowledge, separately. The two added tiers quantity the level of confidence of pre-service elementary teacher in the accurateness of their selected choices for the answer and reason tiers separately. The four-tier diagnostic test was focussed on electricity magnetism concept. It was measured to 40 pre-service elementary teachers later. They were correctly trained on the preceding topics. The substantial corporate of the respondents was established to have an unfortunate kind and misconceptions of the subjects tested. We have already described that the test able to investigate and categorize students into student conception of electricity magnetism concepts. Research result with four tier tests showed scientific conception 5%, which was likely to have misconceptions 44.89%, and the students were lack of knowledge the concept of 46.52%, and had an error amounted to 3.59%. The pre-service elementary teachers inclined to be unwell aware among what they diagnosed and what they do not diagnosed. Kindsof question tested was connected by enhanced percentage of pre-service teacher substantial accurate responses, established buoyancy and enhanced perception calculation. 23 truthful misconceptions were predictable. It might be determined that a Four-Tier Diagnostic Test which has previously been established be able to assess pre-service elementary teachers' conception on electricity magnetism.

Keywords: *Diagnostic tests, Four-tier test, Misconceptions, Electricity Magnetism*

Introduction

Presently misconceptions consume remained lone of significant area exploration in knowledge teaching, added obvious at behavior substance. Misconceptions between beginners on composite and nonfigurative behavior thought can be seen general. Beginners which considerate misconception difficult to alteration since incorrect to right

considerate. Beginners' misconception sacks solitary be changed obsessed by the exact idea resultant to logical conception. If beginners consume internal motivation to transformation which is identified as abstract transformation. As of misconceptions, abstract transformation has similarly adapted one of the furthest important study parts in the learning of Science Education. The foremost abstract

variation copy, advanced by Posner, *et al.* (1982) has advanced the furthest real belief meanwhile the start up to at this time. This abstract typical consumes remained advanced to designate the alteration of education as the assembly amongst present knowledge with innovative knowledge that hints to the four situations, namely: dissatisfaction, clarity (intelligibility), the sensible thing (plausibility) and success (fruitfulness). Some teachings as an indecorous perfect on abstract modification method linking reasoning fight in it can be made (Costu, *et al.*: 2012; Calik, *et al.*: 2011; Costu: 2008; Costu, *et al.*: 2010; Costu, *et al.*: 2007).

Cognitive conflict strategy is further import on beginners' self-confidence inconsistency (depression the learner's optimism) on full ideas finished exercise reverses as discrepant trendy. Overall models of conceptual change approach consumed remained familiar rewarded positively and optimally when teachers absorbed an investigation previous to the suspect that would be the subject of later analysis. To overawe this problematic, we take previously advanced a Four Tier Diagnostic Test Items (Four Tier) from a two tier test items. We take remained advanced four level trials after two row exam meanwhile numerous details such as: 1) two tier test does not has poised grade to improve influential scrutiny; and 2) two tier test is not fitting to investigate learners' beginnings. The analytic exam entry which is advanced now is connected by the charm origins. Here, we have one fixated on the progress of pre-service elementary teachers in shifting their beginnings linked to the education in the elementary school level on science. The indicative exam matters consume remained settled built on the advance of three tier test items Samsudinet *al.* (2016), while the progress of this utensil linked with Samsudinet *al.* (2016); Kaltakci (2017); and Samsudinet *al.* (2017). The device takes stood now ordered in the four tier (four levels), namely: the first tier labels about abstract inquiries in method of several picks, the next level for sureness score gauge ("Sure" and "Not Sure"), the third tier a reason connected

with the select in the first tier and four tier surrounds the second confidence rating, namely: "Sure" and "Not Sure".

Methodology

An appraisal technique was conducted by getting the profile of 40 pre-service elementary teachers and was used as the 4D model (Define, Design, Development and Disseminate). For the phases of define and design, conduct a learn of the meaning and the universal form (design) of a two-tier test and four-tier test. In the developing phase was the growth of diagnostic examination substance through a four-tier test. At the phase of disseminate, was analyzed by initial completion to classify the students in the classifications of Scientific Conceptions (SC), Misconceptions (M), Lack of Knowledge (LK) and Error (E) (Caleon (2010); Kaltakci (2017)) since the respondent did not responses in complete answers. The sample was course by exam the diagnostic test items in the form of four-tier test about sixty minutes' time period of knowledge. The assessment consumes remained lead proceeding to the pre-service elementary teachers who erudite about appeal notions on the sequence of The Basic Concept of Science.

Result and Discussion

The four row analytic substance have been format in the four-tier test in conditions of diagnose the pre-service elementary teachers' conceptions of the electricity magnetism concept. The rising investigated in this background connected by Four-D model (Define, Design, Develop and disseminate). For complete treatment, we are leaving to explain follow.

1). Define

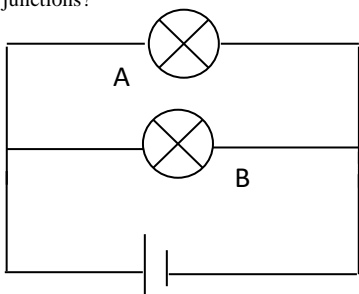
The Four Tier Diagnostic Test substance in electricity magnetism concept has been preliminary to be developed in describe phase. Electricity magnetism concept was a major

idea for diagnosing height of students' conception. Thus, the four-tier examination arrangement was utilize to expand this tool. Why have the researchers utilized the four-tier test substance in construct this tool? The researchers have constructed the tool by four row examination because in the preceding shape of three tier diagnostic test, we could not distinguish the merely one self-assurance score to the two (the first connected to the manifold choices and the second row connected by the reason from the choose of the first tier). As mention in the Samsudin *et al.* (2016); Samsudin (2017); and Kaltakci (2017) that three tier has more than a few weaknesses in arrange to make a diagnosis students conceptions particularly in the confidence rating section.

2). Design

In the second stage of four-D model, we have by now constructed the four-tier diagnostic test substance on electricity magnetism concepts. The plan of these instruments that was constructed in the manifold choice and the reasons as exposed in shape 2.a format designed to be a four-tier test. The example of the diagnostic test is shown in the Figure 2.b.

Question: The picture below shows two identical lights A and B connected in parallel, if later on the circuit one more lamps will be added C lamp which is also identical with A and B in connected parallel with A and B. How two lamps flame compared with the previous when the circuit consists only of two junctions?



Answer Choice:

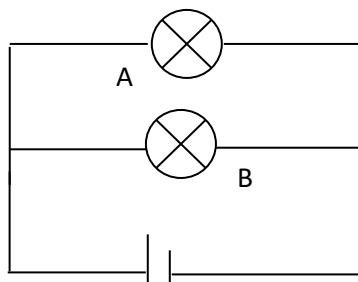
- A. same bright
- B. brighter
- C. dimmer

Confidence Rating Scale

- A. Sure
- B. Not Sure

(a)

Question: The picture below shows two identical lights A and B connected in parallel, if later on the circuit one more lamps will be added C lamp which is also identical with A and B in connected parallel with A and B. How two lamps flame compared with the previous when the circuit consists only of two junctions?



Answer Choice (Tier I):

- A. same bright
- B. brighter
- C. dimmer

The first Confidence Rating Scale (Tier II)

- A. Sure
- B. Not Sure

Reasons (Tier III): Which one below is the reason for your answer to the previous question?

- A. The parallel circuit is an electric current divider circuit, so that when in the circuit is added one more junction, current flows in three junctions will be smaller because the total current is divided by more junction.
- B. The addition of identical junction in parallel will not reduce the amount of current flowing in each of its junction.
- C. If lamps are added in parallel connected, the total resistance will be smaller so that the current flowing in each branch will be greater than before
- D. If lamps are added in parallel connected, the total resistance will be greater so that the electric current flowing in each junction will be smaller than before
- E.

The Second Rating Scale (Tier IV)

- A. Sure
- B. Not Sure

(b)

Figure 1. (a) Design *two-tier test* and (b) Design *Four-tier test*

The four tier diagnostic test items were consisted four levels, namely: the first was multiple choices, the second was confidence rating correlated to the first tier, third was reason for complete the answer in the first tier and the end (the forth) was confidence rating correlated to the third tier. For analysis, this instrument we have developed the category to diagnose the pre-service elementary teachers' conceptions.

Table 1. The Category of Pre-Service Elementary Teachers' Conceptions through Four Tier Diagnostic Test

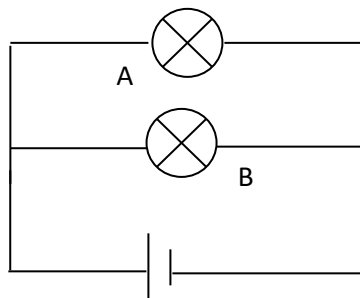
No	Category	Combination of answers			
		Option (Tier I)	The first Confidence Rating Scale (Tier II)	Reasons (Tier III)	The Second Rating Scale (Tier IV)
1	Scientific Knowledge (SK)	Correct	Sure	Correct	Sure
2	Lack of Knowledge (LK)	Correct	Sure	Correct	Not Sure
3		Correct	Sure	Incorrect	Not Sure
4		Correct	Not Sure	Correct	Sure
5		Correct	Not Sure	Correct	Not Sure
6		Correct	Not Sure	Incorrect	Not Sure
7		Incorrect	Sure	Correct	Not Sure
8		Incorrect	Sure	Incorrect	Not Sure
9		Incorrect	Not Sure	Correct	Not Sure
10		Incorrect	Not Sure	Incorrect	Not Sure
11		Misconception (M)	Correct	Sure	Incorrect
12	Correct		Not Sure	Incorrect	Sure
13	Incorrect		Sure	Incorrect	Sure
14	Incorrect		Not Sure	Incorrect	Sure
15	Error (E)	Incorrect	Sure	Correct	Sure
16		Incorrect	Not Sure	Correct	Sure

(Samsudin *et al.*: 2017)

3). Develop

Instrument test used in this study by to 23 questions. The form of question 10 in a four-tier format was as follows.

The picture below shows two identical lights A and B connected in parallel, if later on the circuit one more lamps will be added C lamp which is also identical with A and B in connected parallel with A and B. How two lamps flame compared with the previous when the circuit consists only of two junctions?



- A. same bright
- B. brighter
- C. dimmer

Confidence rating:

Are you sure about the answers of the previous two questions?

- A. I am sure
- B. I am not sure

Which one below is the reason for your answer to the previous question?

- A. The parallel circuit is an electric current divider circuit, so that when in the circuit is added one more junction, current flows in three junctions will be smaller because the total current is divided by more junction.
- B. The addition of identical junction in parallel will not reduce the amount of current flowing in each of its junction.
- C. If lamps are added in parallel connected, the total resistance will be smaller so that the current flowing in each branch will be greater than before

- D. If lamps are added in parallel connected, the total resistance will be greater so that the electric current flowing in each junction will be smaller than before

E.

Confidence rating:

Are you sure about the answers of the previous two questions?

- A. I am sure
- B. I am not sure

Predicament number 10 discusses misconceptions that knowledge in students about the rule of power attraction concept. Based on that, 16 from 40 students got incorrect in answering Question 10 and the consequences show that 40% of students experience misconceptions.

4). Disseminate

Accompanied appraisal explore information was the analytic consequence of a profile of pre-service basic school teachers' conceptions that astringent fundamental idea knowledge route in the university year 2016/2017. Quantitative data were expressed in percentage while qualitative data was obtaining pertinent information about the reasons for the answers on the first level. Here was a profile information of pre-service basic school teachers' conceptions to the awareness of the electricity magnetism that were diagnose using Four-tier test such as Table 1.

Table 1. showed that the beginning pre-service basic school teacher profiles were in difficulty. This was owed to very low proportion about 5% of students who Scientific knowledge (SC). In addition, students who had misconception much senior than the students who scientific

knowledge of electricity magnetism, that was 46.52% relative to 5%. The data information that alertness of students when they study electricity magnetism idea in the basic school stage in the fundamental Concept Science course to modify from the misconception to the scientific conceptions has before now discussed in Kaniawati *et al.* (2016).

Table.1. Students' Conceptions Profile on Electricity Magnetism

No	M	LK	SC	E
1	52.5	22.5	17.5	7.5
2	45	25	25	5
3	47.5	50	2.5	0
4	30	62.5	0	7.5
5	62.5	25	12.5	0
6	42.5	50	7.5	0
7	35	57.5	5	2.5
8	32.5	60	5	2.5
9	70	30	0	0
10	40	55	0	5
11	45	52.5	0	2.5
12	37.5	62.5	0	0
13	60	35	0	5
14	57.5	37.5	0	5
15	42.5	52.5	0	5
16	67.5	22.5	2.5	7.5
17	45	50	2.5	2.5
18	50	50	0	0
19	30	50	12.5	7.5
20	20	75	5	0
21	20	62.5	5	12.5
22	50	45	2.5	2.5
23	50	37.5	10	2.5
Σ	1032.5	1070	115	82.5
Average	44.89	46.52	5	3.59

Conclusion

In universal, we have completed that the growth of four tier diagnost test items be able to measure the pre-service elementary teachers' conceptions through four D model. In the four D model, the instrument has been developed in the fourth steps, 1) define, 2) design, 3) develop and 4) disseminate.

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