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Developing a Scientific Learning Continuum of Natural Science Subjects at Grades 1 – 4

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ABSTRACT

This research aims at investigating teachers', principals', and school supervisors' views of scientific methods of natural science subjects at public elementary schools. Within a survey research method, the sample of the current study consisted of 135 teachers, 119 principals, and 116 supervisors drawn from public elementary schools in Yogyakarta, and seven regencies in the Central Java Province. The instruments developed by researchers were validated through expert's judgements. Findings showed that the teachers', principals', and school supervisors' views could be used for developing a learning continuum of "natural science" subjects in Grades 1 – 4. This continuum purposing to measure scientific methods of "natural science" subjects was constructed via a blue print of confirmatory tests using convergent and divergent patterns.

Keywords: learning continuum, natural science subjects, scientific methods

INTRODUCTION

The Indonesian Educational Authority has released the 2013 curriculum for Indonesian school system suggesting the use of scientific method in learning "natural sciences". Some workshops or training activities for elementary school teachers have been prepared to achive their professional development of newly released curriculum. Science processes and products should be integratedly taught. Biology curriculum in Turkey was mainly carried out in primary schools until 1950s and then revised/developed in the following years in the peiod of republic. A constructivist approach has been adopted into the curriculum through a spiral and integrated approach since 2000s (Kurt & Kurt, 2015.

As stated by Northwest Evaluation Association (2001), a learning continuum (i.e., which enhances a teacher's ability to provide the targeted instruction for individually or group learning) has a strategic role in the teaching activities, i.e. Such a learning continuum involves in material selections, sharing resources, planning curriculumschool improvement and individual education, monitoring student learning progress, and informing parents. Northwest

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Evaluation Association (2015) states that a learning continuum measures such academic progresses as skills, awards, mastery tools to easily accomplish four main tasks.

European Commission (2001) claims that a learning continuum can be used as a guideline for formal, informal, and non-formal learning activities. Indonesia is not well-performed for integrating a learning continuum into a curriculum. The 2013 Curriculum (Minister of Educational and Culture, 2016) including Natural Science subjects at Elementary School has not presented a learning material coherence for science processes and science products at the nature of learning continuum.

The 2013 Curriculum expects students to (a) ask the questions: what, why, and how?, (b) observe the Natural Science objects using their five senses, and (c) report their observations using a clear language. For the next level, it equips students with (a) observing the Natural Science objects using five senses and simple tools, (b) making notes and presenting observation data, (c) reporting their observation results in verbal and written forms, and (d) describing the "natural science" concept. Instead of performing these competencies, elementary school students, for the next levels, are also expected to (a) present their observation data via tables and graphs, (b) draw conclusions and report their observation results in the verbal and written forms, and (c) explain the concepts and principles of Natural Sciences (Minister of Education and Culture, 2016). The mastery of scientific methods will be dependt on pedagogical content knowledge consisting of (a) planning and management, (b) cognitive expertise, and (c) measuring and assessing learning process (Wan Husin, Fairuz, Syukri, & Halim, 2015).

As mentioned above, teachers do not have a clear understanding of the scientific methods and time allocation in teaching and assessing students' achievements. Also, teachers may not have any clear step in preparing instructional materials for assessing the scientific methods from the easiest to the most difficult ones. This paper presents some exporatory experiences to initiate the development of learning continuum within the scientific methods of natural science subjects. Such exploratory experiences will be useful for others in developing the related learning environment.This research aims at formulating the scientific methods taught and assessed in the Natural Science subjects at elementary schools. Hence, the current study will show a learning continuum, whichis easily understood and assessed by the elementary school teachers. Also, it will help themprepare instructional and assessment materials of their 'scientific method' competencies.

LITERATURE REVIEW

a) The Essence of Science Teaching

This section presents the main literatures used in preparing the learning continuum of scientific methods in natural science for the elementary schools in Indonesia. The Indonesian schools only have little experience in developing such documents.

Bloom's taxonomy contains three domains, namely (a) cognitive (b) affective, and (c) psychomotor. Meanwhile, revised version of Bloom's taxonomy comprises of four domains (Dettmer, 2006): (a) cognitive, (b) affective, (c) sensorimotor (a psychomotor substitute), and (d) social. Those four domains shoud be considered as a unity in learning in the classroom. The unity concept of learning ties one domain to another through theearning activities. The creative ability is a part of the cognitive domain.

Thinking process involves several mutually stages, i.e., (a) deductive and inductive processes, (b) product and association, and (c) convergent and divergent thinkings (Garry, 1970). Convergers are naturally demonstrated towards one end of the spectrum and divergers to the other end (Hudson, 1966 cited in Alamolhodaei, 2001). Also, he dissagreed with the belief of many psychologists "divergent thinkers are potentially creative while convergent ones are potentially uncreative." Moreover, the convergence/divergence dimension is a measure of bias, not the level of ability. Divergent and convergent thinking ideally complement to each other. Conversely, the convergent thinking occurs systematically at formulating basic ideas to organize ideas and information. Divergent and convergent thinking integrate into critical/analytical thinking (Conny Semiawan, 1997).

Ideational learning, recommended by Dettmer (2006), bases on the ideas of the learners, and initiates creativityt. Pollman (1973) showed that there was no strong correlation between the IQ scores of Lorge Thorndike and creativity test scores of Torrance models. Ferrando, Prieto, Ferrandiz, and Sanchesz (2005) indicated a low correlation between creativity and intelligence. Learners with high IQ are not always creative. In view of Cromie (2007), few studies revealed a cleardirect correlation between IQ and creativity. Some studies pointed that an increase in creativity is in line with that of an IQ up to 120. In point of Kim's (2005) view, a meta-analysis of 447 correlation coefficients showed that a lot of creativity test scores had nothing to do with IQ scores, but many did.

Creative processes consisted of four stages: (a) preparation, (b) incubation, (3) illumination, and (4) verification (Gary, 1970). Meanwhile, There are seven stages of creative processes, namely (a) orientation or problem formulation, (b) preparation and data collection, (c) analysis, (d) initiation or identification of alternatives, (e) incubation and eluminationi, (f) synthesis, and (g) evaluation. These information sources to develop "scientific method" skillsinspire to prepare the learning continuum to be used in the Indonesian elementary schools.

A creative problem solving process begins with an "anticipation" phase (Torrance, 1979). The next phase compares desirable expectations with undesirableones. This phase occurs in the mind to face difficulties, integrate , re-check, elaborate and sort varied existing knowledge. Thus, a process of convergent and divergent occurs. Then, the last phase involves the ability in going beyond the existing barriers.

Critical thinking skills consist of three aspects, namely: (a) identifying the important things under discussion, (b) reconstructing the arguments, and (c) evaluating the reconstructed arguments (Bowell & Kemp, 2002). Critical thinking skills incorporateto (a) classify, (b) make assumptions, (c) predict and hypothesize, (d) summarize, interpret data to draw conclusions, (e) measure, (f) design an investigation to solve a problem, (g) observe, (h) make a graph, (i) reduce the experimental errors, (j) evaluate, and (k) analyze (Carin & Sund, 1989). Thus, critical thinking involves various aspects of thinking. Critical thinking skills can be developed by divergent open-ended questions stimulating high order thinking. The mastery of divergent thinking skills will enhance the students' capacities to make a decision as a form of convergent thinking (Collette & Chiappetta, 1994).

According to Aldridge (1993), science is a scientific method process consisting of observing, classifying, measuring, interpreting data, inferring, communicating, hypothesizing, developing models and theories, and predicting. Meanwhile, Brum and McKane (LeBoffe & Wisehart, 1989) depicts that science is a scientific method process consisting of: (a) observation, (b) formulation of a hypothesis that can be tested inductively, (c) a deductive experiment design with the formulation of the control and the experimental groups, (d) testing hypothesis, (e) the analysis of the experimental data, (f) drawing the experimental conclusions, (g) accepting, rejecting or changing the hypothesis, which may yield to a theory and rule, and (h) sharing the research results. Natural sciences may be equated with the scientific methods. Therefore, learning science may not neglect the ability to make observations, formulate accountable hypotheses, perform induction and deduction, design and carry out experiments to prove the hypothesis. Observation skills possesses the lowest position in the scientific processes (Rezba, Sparague, Fiel, Funk, Okey, & Jaus, 1995). The higher-orderskills include "measuring and classifying" processes, while doing experiments is the highest skill. Bryce, McCall, MacGregor, Robertson, and Weston (1990) classifed science process skills into basic process and integrative skills. The implementation of scientific methods in elementary schools has been viewed as the investigative form since 1970s (Brewer, Garland, & Marshall (1972).

The teaching and learning processes of science should rely on the scientific processes involving such science process skills as (a) observing, (b) collecting the data, (c) measuring, and (d) organizing and classifying the data (Towle, 1989). Aktamiş and Ergin (2008) showed that the science process skills increased students' achievements and scientific creativity levels. However, no meaningful progress appeared at their attitudes towards science as compared to the teacher-centered methods.

Revising any curriculum, like Indonesia, generally occurs in all developing and developed countries. With regard to this, Dickson and Kadbey (2013) stated that significant educational reforms have taken place in Abu Dhabi of the United Arab Emirates since 2007. Teacher-centered instruction and heavily textbook-based instruction have been replaced with practical and student-centered approaches. These approaches have also been carried out in the teacher preparation institutions. However, the schools are not always responded positively to the efforts of local authorities. For example, some differences in science learning were observed between groups of schools in high and low performance based on some developed countries' TIMSS 2007 scores (Ceylan & Akerson, 2013). Indeed, the high performance schools have conducted many inquiry-oriented activities while the lower performance schools have performed teacher-oriented ones. Again, the literature review uses basic information to develop the learning continuum of scientific methods in natural sciences for the Indonesian elementary schools.

b) The Principles of Assessment and ıts Effects on Education

Assessment can be defined as the process of collecting and organizing data to meet the different educational needs (Hart, 1994; Miller, 2008). Data are formally obtained through exams, essays and homeworks. They are informally collected through observations or interactions, too (Muijs & Reonald, 2008). An educational assessment is defined as a formal attempt to determine student's status of educational variable(s) (Popham, 2005).

An assessment is supposed to align with the curriculum's goals and materials (Puckett and Black, 1994). This means that standards, content, assessment, and learning strategies are complementary suitable for each other. Therefore, assessment is a part of a learning activity (an assessment of learning) (Drake, 2007). Assessment also serves to advance learners in learning (assessment as learning). Therefore, fully test-oriented learning will not give a positive effect for the learner's advancement (Drake, 2007). Assessments of the student's mastery on the entire materials are called confirmatory assessmentsobtaining a standardized test (Frazier & Sterling, 2009). Science education covers pre-service teachers' assessments. Pre-service teachers are able to present their conceptions about the nature of science through many different representative ways, i.e., drawing, writing, or diagrams (Colagrande, Martorano & arroio, 2016). A learning continuum of scientific methods in natural sciences makes strategies and assessments usefull to guide learning and teaching. Therefore, preparing a learning continuum for elementary school curriculum is a basic strategy in improving the quality of education in Indonesia. Hopefully, some critics may solve long-term educational problems in Indonesia.

METHODOLOGY

The current research, which was conducted in the 2016-2017 schooling year, reviewed the literatures to grasp ideas of scientific methods at elementary science education. The researchers developed a draft of the Learning Continuum (LC) given Subali's (2009) suggestions on the first-hand experiences in science teaching-learning. The draft LC was then reviewed by 10 science teacher educators from the Yogyakarta State University and Sebelas Maret University. Interrater reliability (agreement percentage) was so high for these science student teachers. They were mostly between about 40% and 80%, while some indicators got as low as 20% agreement. This becomes the basis to put scientific methods into the LC. Given their critics and suggestions, the researchers made corrections to refine the draft of the scientific method in the LC.

The results of 10 science teacher educators wee also viewed as a judgment to align items with indicatorsi. This process ensured content validity (Lissitz & Samuelsen, 2007). The refined draft was used as the final instrument to collect data from teachers (who taught nature science subject to grades 1-4), principalss, and supervisors in 12 regencies and/or cities in Yogyakarta and Central Java.

Based on the refined LC, the researchers developed a Likert-scale to validate and collect the sample's views of relevant aspects. This is only limited to the scientific methods including basic and process skills. Each participant was asked to select an element of the scientific methods taught and assessed at grades 1-6.

The sample of the research was purposively drawn from two Regional Technical Implementation Units (RTIU). From each RTIU, one Elementary School teacher was selected as a sample from each grade, therefore; each school sample was one each first, second, third, and fourth grade teachers. Thus, the number elementary school teachers was four teachers (first, second, third, and fourth grade teacher, each) from 12 regencies and/or cities in two RTIUS. The school principals were from 12 regencies and/or cities in RTIUs, while two supervisors from each RTIU participated in the study.

The data collection lasted from May to June 2016 by help of a field coordinator to pass questionnaires out to the participantsand collect them back. The data were exposed to descriptive statistical analysis. The data were intended to indicate the sample's tendencies of the refined LC, and assessments in scientific methods for elementary students.

RESEARCH FINDINGS AND DISCUSSIONS

The results of the study presented thesample's views of the LC and assessments of scientific methods. Tables 1- 7 present the formulation of the learning continuum dealing with basic skills. Tables 8- 10 indicate the formulation of learning continuum in related process skills.

Each table describes a respondent mode of percentage stating an element of scientific method at a certain grade. The percentage of each group is presented in the appendix. The highest number of choice selected by the group is presented as a mode in each table. In the last column of each table, grades and scientific methods were arranged consecutively into a learning continuum.

Table 1 presents the teachers', principals', and supervisors' views of observation skills, that must be taught and assessed in the elementary schools. As seen in Table 1, all observation skills were recommended to be taught and assessed from the first grade, except for "identify the impact of technology on nature, a region, or images" at the third grade.

Table 1. The teachers', principals', and school supervisors' views of observation skills, which have to be taught and assessed

Observation skills	Modus of choices	Recomendation for the LC
1. Identify the names of the living things or non-living things based on sounds they hear	8 G1	G1
2. Select a comperative phenomenon when they are faced with two kinds of the living or non-living creatures to identify differences	8 G1	G1
3. Choose observable species, whose bodies are varied colors, shapes, and levels	8 G1	G1
4. Match a real living or non-living thing with the picture or vice versa to know the diversity of appearance	8 G1	G1
5. Identify circumstances equally having full potential risks when making observations in the school with everyday situations at home.	6 G1	G1
6. Identify the impact of technology on nature, a region, or images	4 G1 3 G3	G1
7. Select and match the object of the observation in the form of the living or non-living things with pictures	8 G1	G1

Table 2 presents the sample's views of the data/information collection skills, which have to be taught and assessed. They recommended to teach and assess them from the third or fourth grade.

Table 2. The teachers', principals', and school supervisors' views of the data/information collection, which have to be taught and assessed

The data/information collection skills	Modus of choices	Recomendation for the LC
1. Complete a chart, graph or histogram of the phenomenon on the living or non-living things	6 G1 2 G3	G1
2. Present data in a tabular form completed with labels	5 G3 2 G4	G3
3. Make a histogram of the phenomenon on the living or non-living things completed with labels	4 G3 3 G4	G3
4. Make a summary of some paragraphs/chapters to review the phenomenon on the living or non living things	5 G4 2 G5	G4
5. Write a paper containing information about the observations results of the phenomenon on the living or non living things completed with its title.	5 G4	G4
6. Determine the information about the characteristics of a living or non living thing presented in charts, graphs or histograms	6 G3	G3
7. Make charts, graphs or histograms of the phenomenon on the living or non living things	3 G4 3 G3	G4
8. Determine body or parts of the living or non- living bodies to be drawn accurately	5 G4 2 G3	G4

Table 3 presents the sample's views of the following instructional skills, which have to be taught and assessed. They suggested to teach and assess them from the third and/or fourth grade.

Table 3. The teachers', principals', and school supervisors' views of the following instructional skills, which have to be taught and assessed

Following instructional skills	Modus of choices	Recomendation for the LC
1. Prepare equipment or arrange the steps to observe the phenomenon on the living or non-living things after the teachers give written explanation	4 G3 3 G4	G3
2. Prepare equipment or arrange the steps to observe the phenomenon on the living or non-living things after the teachers perform demonstration	4 G4 2 G3	G4
3. Prepare equipment or arrange the steps to observe the phenomenon on the living or non-living things after the teachers give oral explanation	3 G4 3 G3	G4
4. Prepare equipment or arrange the steps observe the phenomenon onthe living or non-living things after reading written procedures in the student worksheets.	4 G4 4 G3	G4

Table 4 presents the sample's views of classification skills. They recommended to teach some of them from from the first grade or some from the third and/or fourth grades. .

Table 4. The teachers', principals', and school supervisors' of the classification skills, which have to be taught and assessed

Classification skills	Modus of choices	Recomendation for the LC
1. Determine the base to separate the living or non-living things or parts of his body based on his body characteristics in reference to the data presented in books or given by the teachers	5 G1 2 G3	G1
2. Determine the base to put them together the living or non-living things or parts of his body based on his body characteristics in reference to the data presented in books or given by the teachers	5 G3 2 G1	G3
3. Determine the base to separate the living or non-living things or parts of his body based on his body characteristics in reference to the data of observations results	6 G3	G3
4. Determine the base to put them together the living things or non-living things or parts of his body based on his body characteristics in reference to the data of observations results	4 G3 2 G4	G3

Table 5 presents the sample's of measurement skills, which have to be taught and assessed. They suggested to teach and assess them from the fourth grade, but instruct some of them from the third or fifth grade. Escpecially, the skill "Estimate the size similarity of the two bodies or body parts of the living or non-living things roughly" was recommended from the first, third, or fifth grades.

Table 5. The teachers', principals', and school supervisors' views of measurement skills, which have to be taught and assessed

Measurement skills	Modus of choices	Recomendation for the LC
1. Find the causes of inaccuracies in measuring the characteristics of the living or non-living things bodies using tools	3 G4 3 G3	G4
2. Find a mistake in using grid to estimate the area of a surface of the body/parts of the living or non-living things	4 G1 2 G3 2 G4	G1
3. Find the causes of inaccuracies in reading the scale of thermometer to measure temperature of the living or non-living things	5 G4 3 G3	G4
4. Determine the measurement instruments in accordance with the characteristics of the living or non-living things to be measured	6 G4	G4
5. Find the causes of inaccuracies in measuring the temperature of the living or non-living things using a digital thermometer	6 G4	G4
6. Find the causes of inaccuracies in measuring characteristics of the living body using up and down scales	6 G4 2 G5	G4
7. Find the causes of inaccuracies in reading the meter scale or measuring tape when measuring the characteristics of the living or non-living things	7 G4	G4
8. Estimate the size similarity of the two bodies or body parts of the living or non-living things roughly	4 G4 2 G3 2G5	G4

Table 6 diplays the teachers', principals', and school supervisors' views of manipulation movement skills, which have to taught and assessed. They suggested to teach and assess them from the fourth or fifth grade. There were two skills suggested for the third or fourth grade: "Find the ways to move solid or liquid in an experiment related to the phenomenon on the living or non-living things " and "Find out how to use the hand skills to create works that are associated with the phenomenon on the living or non-living things".

Table 6. The teachers', principals', and school supervisors' views of the manipulation movement skills, which have to taught and assessed

Manipulation movement skills	Modus of choices	Recomendation for the LC
1. Find the ways to move solid or liquid in an experiment related to the phenomenon on the living or non-living things	3 G3 3 G4 2G1	G3
2. Find the things that cause errors in using lope to observe the phenomenon on the living or non-living things	4 G4 3 G3	G4
3. Find the things that cause errors in using a thermometer to measure and observe the phenomenon on the living or non-living things	8 G4	G4

4. Find the things that cause errors in squashing material derived from the living or non-living things	5 G4 2 G5	G4
5. Find out for how to use the body/organs of the living body as measurement tools	4 G4 4 G5	G4
6. Find out how to use the hand skills to create works that are associated with the phenomenon on the living or non-living things	5 G4 2 G5	G4
7. Find the things that cause errors in using a microscope to observe the phenomenon on the living or non-living things	5 G4 2 G5	G4

Table 7 presents the sample'sprocedure/technique/tool skills of the implementation, which have to be taught and assessed. They suggested to teach and asses them from the fourth or fifth grade. There were only two skills recommended for the fifth grade.

Table 7. The teachers', principals', and school supervisors' views of procedure/technique/tool skills of the implementation, which have to be taught and assessed

Procedure/technique/tool skills of the implementation,	Modus of choices	Recomendation for the LC
1. Find out the causes of errors in using a stop clock or stopwatch	4 G4 2 G3	G4
2. Find the things that cause the malfunction of a pipette to move the solution in the experiments associated with the phenomenon on the living or non-living things	4 G5 3 G4	G5
3. Choose the ways to reduce errors in the experiments associated with the phenomenon on the living or non-living things.	5 G4 3 G5	G4
4. Find the things that cause the malfunction of a liquid chemical test paper on the testing of materials derived from the living or non-living things	6 G5	G5
5. Find the causes of error in mixing the solution of the materials used in the experiment associated with the phenomenon on the living or non-living things	5 G5 2 G4	G5
6. Find the ways to avoid the mistake of using a measuring spoon to move the substance	3 G4 3 G5 2 NO	G4
7. Find things that cause errors in filtering to obtain the extract from a living or non-living thing	5 G5 2 NO	G5
8. Find out the things that cause an error in using magnifying lenses to observe the phenomenon on the living or non-living things	7 G5	G5
9. Find the secure working steps in using flammable laboratory equipments	4 G5 3 G4	G5
10. Find the things that cause the error in determining the type of equipment that will be used to observe the phenomenon on the living or non-living things	5 G4 2 G5	G4
11. Find the type of equipment to be used in accordance with the tasks assigned by the teachers	4 G4 3 G5	G4

Tabel 8 presents the sample's inference skills, which have to be taught and assessed . They offered to teach and assess them from the fourth grade. There was only one skill from the first-grade; "Find the differences between the body shape of the living or non-living thing presented in the picture".

Table 8. The teachers', principals', and school supervisors' views of inference skills, which have to be taught and assessed

Inference skills	Modus of choices	Recomendation for the LC
1. Formulate conclusions in accordance with the information presented in textbooks	7 G4	G4
2. Formulate conclusions that suit with the observed data	6 G1	G1
3. Formulate conclusions based on observational data on living or non-living things	7 G4	G4
4. Find the differences between the body shape of the living or non- living thing presented in the picture	6 G4	G4
5. Formulate conclusions based on data from observations of a living or non-living thing	6 G4	G4
6. Formulate hypothesis in a new investigation of symptoms in a living or non-living thing	7 G4	G4

Table 9 shows the sample's views of prediction skills, which have to be taught and assessed. They suggested to teach and assess them from the fourth grade. There was only one skill suggested from the fourth or fifth grade: "Predict the process changes that occur in the body of living or non- living thing if being given certain conditions".

Table 9. The teachers', principals', and school supervisors' views of prediction skills, which have to be taught and assessed

Prediction skills	Modus of choices	Recomendation for the LC
1. Predict the possibility that occurs when the existing living or non- living things in conditions that do not support the faced facts	7 G4	G4
2. Predict the changes on the size of body parts of living or non- living thing given a certain condition	7 G4	G4
3. Predict the changes on the size of the body or body parts of living or non- living thing given a certain condition	6 G4	G4
4. Predict the process changes that occur in the body of living or non- living thing given a certain conditions	4 G4 3 G5	G4

Table 10 reveals the teachers', principals', and school supervisors' views of the selecting procedures/techniques/tools skills, which have to be taught and assessed. They recommended these skills from the fourth grade.

Table 10. The teachers', principals', and school supervisors' views of the selecting procedure/technique/tool skills, which have to be taught and assessed

Selecting procedure/technique/tool skills	Modus of choices	Recomendation for the LC
1. Determine the working steps in an observation/measurement or select the equipment that are appropriate with the problems.	5 G4 3 G5	G4
2. Find a way to anticipate the risks and take preventive actions and suitable ways of working in experiments/investigations	6 G4 2 G5	G4
3. Choose an appropriate type of equipment to measure something to get the accurate results	5 G4 3 G5	G4
4. Choose the things that can affect the outcome of an investigation, determine the data obtained according to the results of the investigation, and decide how to present the results of the experiments	5 G4 3 G5	G4

DISCUSSION

This part compares the results of the current research with those by Subali, Paidi, and Mariyam (2016), who measured the fourth graders' achievements of science process skills on living things. The results of this study showed that almost all observation skills were recommended to teach and assess from the first-grade, with an only skill "identify the impact of technology on nature, a region, or images", which might be taught and assessed in the third grade.

Although the skill "select and match the object of observation in the form of living or non-living things with pictures" was recommended to teach and assess in the first grade, the first grade students seem to have possessed difficulties in the subjects. Subali et al (2016)found that only 19% of the fourth grader students could have answered correctly on the 'living things' subjects.

As seen in Table 2, especially the skill " accurately determine body or parts of livings or non-living things" should be taught and assessed from the first grade. But, Subali et al (2016) reported that it seemed to be very difficult for the fourth grader students because only 17% of them answered it correctly. Similar conflicted results were also available for the skill "prepare equipment or arrange the steps to observe the phenomenon on the living or non living things after reading written procedures in the student worksheet". The present study suggested to teach and asses the skill from the first grade; but Subali et al. (2016) students found it difficult for the fourth grader students. That is, when they faced with corresponding items, only about 19% of them gave correct responses.

As observed in Table 5, some of the sample under investigation referred to the third or fourth or fifth grade to teach and assess relevant skill. The skill "estimate similarity size between two bodies or body parts of the living or non-living things roughly" was recommended to be taught and assessed in the first grade.

Conflicting results between the suggested and identified skills appeared for the current study and that by Subali et al., (2016). This may stem from previous curricula emphasizing more cognitive aspects. .

The conflicting results presented here may actually be useful for preparing future science teachers especially for elementary education, i.e., making science teachers aware of difficulties and new requirements suggested by the 2013 curriculum. Hence, teacher preparation may focus on new materials in teaching scientific methods. This new requirements definitely will make science teachers perceive problems, which need to be solved in elementary schools. It may also warn science educators and teacher preparation institutions to get more new science teaching materials for for elementary teachers. Many years ago, the USA also encountered with similar conditions (Marzano & Haystead, 2008).

Given the sample's recommendations, there was no a rational order for them. As can be seen in all tables, the teachers', principals', and school supervisors' suggested to teach and assess them by starting from the first, third, and fourth grades. Only three skills "procedures/techniques/tools skills of the implementation," "find things that cause errors in filtering to obtain the extract from a living or non-living thing" and "find out the things that cause an error in using magnifying lenses to observe the phenomenon on the living or non-living things," which have to be taught and assessed, were recommended from the fifth grade.

Finding some skills difficult for lower grades is a contradictory issue with the nature of the learning continuum developed. Conceptually, the development of learning continuum is supposed to be compiled from the lowest to the highest degree. Moreover knowledge should be developed from the simplest to the most difficult. This principle can beapplied to all learning continuum components. Renaisance Academy (2017) defines learning continuum as a sequence of skills, that are built from one level to the next. The initial skill is a pre-request for advancing/learning other skills at the next level. In this case, learning skills are cumulative meaning that current instructional skills are added into early acquired skills.

Learning continuum by Australian Curriculum, Assessment and Reporting Authority (ACARA) (Randall, 2015) was also compiled from the simple elements into complex ones at the Australian Curricula. NWEA (2001) did the same thing on Rusch Item Test (RIT) from lowest to highest. Learning continuum was sequenced from simple to complex or from easier to most difficult (Renaissance Academy, 2016). In addition, Kessler and Galvan (2007) suggested inquiry-based chemical materials for for Grade 4, and science process skills for Grades 5-8.

Three things need to be known about the learning continuum. Firstly, learning statements give an instructional starting point to explain the skills and concepts that are mostly ready to be introduced, developed, or reinforced along a learning continuum. Secondly, test and class views supply global and student-specific information for tailoring instruction. Thirdly, MAP RIT scores are connected to skills and concepts that students are ready to learn, identify learning goals and targets. Hence, teachers can share them with students and parents to create more personalized lesson plans (NWEA, 2014).

Learning continuum, which is uninterrupted for the child from the youngest age through adolescence, is an emblematic of Montessori educational settings. In programs adhering to the standards by Association Montessori Internationale (AMI), the learning continuum develops a standardized practice, that establishes a seamless consistency approach across individual classrooms and up through grades. This consistency is supported by a rigorously monitored and integrated teacher training, that focuses on the developmental path of the child. Language development, progression of mathematics, and various other disciplines are empowered in the early years, that are directly utilized as a platform for the elementary experience and beyond.

The results of the study supported to teachers, principals, and supervisors, who gave less attention to the difficulty level. Their views of the scientific methods in the classrooms indicated that all skills had not been taught and less that half of them had instructed the scientific methods. The teachers depicted that many grade 1 students were unable to read and some 3rd grade students still had difficulties in reading. On the contrary, Elliott (2010) stated that spoken and written language are central to explore scientific phenomena, share and test ideas, and demonstrate understanding. Moreover, language usage in science learning helps students' literacy development and associated cognitive skills. Therefore, how can we insert the mastery of literacy skills in science and promote synergy between science teaching and literacy? Science can be learned most naturally and effectively in collaborative, social contexts. This can be enhanced through the use of literacy strategies that aid students to draw on real-world evidence to generate explanations, arguments and questions. From the earliest grades, students should be supported to grow positive habits, attitudes towards science learning (including collaborative approaches), and 'scientific language' competency. In addition, he mentioned that teachers could use several strategies to intimately connect the development of literacy to science. Literacy skills are required to learn and practise science effectively. Students at Grades 1-6 encounter more than 170 scientific words at the Ontario curriculum and have opportunities to incorporate them into their vocabularies. However, literacy in science is about more than just the development of familiarity with scientific vocabulary and writing genres: it is also about the use of language in inquiry and the construction of meaning.

A lack of 'fluent reading' skill causes difficulty for teachers to teach science when they need to deal with understanding, and the essence of the scientific method. In point of Barlia's (2016) view, a conceptual change determines students' success levels. Conceptual changes can be taught via addition, rearrangement, replacement, and extinction (Barlia, 2016). To master them, teachers' selected strategies are needed. Therefore, how to teach and assess the scientific method cannot be separated from teaching the objectives. The current study recommends that teachers should be aware of the importance of their students' basic knowledge and effective teaching strategies that promote conceptual change processes in learning science.

Some teachers may not probably teach due to the time factor or unavailability of laboratory tools. Moreover, , there is no special laboratory for elementary schools in Indonesia. The research by Bozdoğan and Uzoğlu (2015) reported similar results to the current study. They implied that teachers found such problems as the allocation of time, textbooks and workbooks, inability to connect to everyday life, and unit features while teaching "force and motion unit in 8th grade". In general, teachers suggest improvements to enrich and supply some facilities (i.e., an increase in class-hours, laboratory equipments) for implementing science process skills. As well as context-based science learning, technology should be utilized (video, flash, presentations, hand, etc.) in their classes to solve science-related problems in the workbooks. Also, the number of science activities in the workbooks should be improved and/or enhanced and/or enriched. The study by Yalçin (2015) showed that science teachers were aware of the importance of gaining scientific research skills, and development of positive attitudes towards scientific method. Aktamiş etal. (2016) suggest to employ inquiry-based learning strategies in primary schools (especially, science courses) in order to increase student achievement, science process skills and attitudes towards science.

The findings of this research indicated that all elements of the scientific methodsfrom grade 1 to grade 4 may serve as starting point for further studies in achieving the learning continuum of scientific method for these grades.

CONCLUSION AND RECOMENDATION

In light of the results, it can be concluded that the teachers', principals', and school supervisors' views could be used for developing a learning continuum of "natural science" subjects in Grades 1 – 4. This continuum purposing to measure scientific methods of "natural science" subjects was constructed via a blue print of confirmatory tests using convergent and divergent patterns.

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