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Alternative Assessment Practices of a Classroom Teacher: Alignment with Reform-Based Science Curriculum

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The purpose of this study was to explore alignment between reform-based Turkish primary science curriculum and alternative assessment practices of a classroom teacher. Observational case study approach was utilized. A classroom teacher with 32 years of experience and his 31 students participated in the study. The data were collected during one academic year via classroom observations, teacher interviews, instructional materials and a science teaching belief instrument. Analysis of the data indicated that the teacher's use of traditional assessment activities was more dominant than alternative assessment activities although the latter was strongly emphasized by the curriculum. Moreover, implementation of alternative assessment activities was not in line with what the curriculum stated. Decisions of policy makers, lack of instructional time, exclusion of the curriculum by the teacher, inadequate pedagogical content knowledge and insufficient teacher training on assessment were found to be the elements that might have negatively affected the alignment negatively. Possible actions that may support a higher level of alignment were discussed.

Keywords: Science education, curriculum implementation, alternative assessment practices, primary school, classroom teacher.

INTRODUCTION

Most science education initiatives primarily focus on the development of science curricula, but details of the curriculum implementation at school level are not considered in general (Rogan & Grayson, 2003). Implementation of a science curriculum has long been a troublesome for the science education community as well as for policy makers because of a incoherence between standards, curriculum, assessment, and professional development (Penuel, Fishman, Gallagher, Korbak, & Lopez-Prado, 2009).

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For example, Eminah (2007) observed 20 science teachers and their students during instructions in order to determine the coherence between in-class behaviors of teachers, students and science curriculum and found coherence to be about 25 percent.

Research indicates that it is not easy to transfer the principals of curriculum reform that emphasize student-centered classrooms into classroom practices (Chrispeels, 1997). Possible reasons for this lack of transfer have been well discussed in related literature. Lewthwaite (2005) states that effective implementation of science curriculum is mainly affected by extrinsic factors like the principal role but such intrinsic factors as teachers' complex knowledge background, beliefs, and attitudes also affect effective science curriculum delivery. According to Roehrig and Kruse (2005), the change in high school chemistry teachers' classroom practices in a reform-based curriculum is associated with teachers' beliefs about teaching and learning, their deep knowledge of chemistry, and their teaching experience.

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State of the literature

- One of the reasons for the slow rate of change in reform-based classroom practices is the mismatch between the assessment system and the curriculum framework. Moreover, changing traditional assessment practices used in the classroom is not an easy job for teachers.
- The successful alignment of classroom assessment with learning standards depends on teachers' beliefs about the usability of standards and their positive effects on both instruction and students.
- There might be a discrepancy between teachers' statements in a survey about what they do and what they actually do. Therefore, research suggests that a general picture of classroom assessment practices drawn from surveys needs to be cleared through in-depth qualitative studies at classroom-level, especially from the perspective of practices.

Contribution of this paper to the literature

- The current study contributes to this area by conducting long-term classroom observations to explore what is going on in the primary classroom with regard to alternative classroom assessment practices.
- Specifically, how an experienced and in-service trained classroom teacher implemented alternative assessment practices was explored since experienced teachers tend to interpret curriculum innovations through their past experiences or beliefs that in general limit implementation of the intended curriculum. Therefore, in-service training on the curriculum reform was taken into account in order to diminish this negative effect.
- The results of the study show that implementation of alternative assessment activities were not in line with what the curriculum stated. Factors that negatively affected the alignment were reported.

Moreover, teachers believe that lack of opportunities for staff development, inefficient resources, and ineffective administrative support are some of the barriers that can obstruct the implementation of science education reform (Haney, Czerniak, & Lumpe, 1996).

Science education reforms are not generally consistent with teachers' basic teaching beliefs. Although teaching methods based on research and inquiry are strongly emphasized in these reforms, there is no robust evidence that these approaches are implemented (Carroll, 1999). Indeed, after the introduction of National Primary Science Education in 1989 in England and Wales, teachers were required to put new adjustments and demands into practice, but these attempts were never entirely fulfilled (Sharp & Grace, 2004).

One of the reasons for the slow rate of change in classroom practices is the mismatch between the assessment system and curriculum framework (Chrispeels, 1997). In the context of reform-based science curriculum implementation, Erstad (2008) underlines the same issue and argues that although the ways of learning implemented in school have been changed, the approach used in the assessment has not changed concurrently. This may in part because changing traditional assessment practices used in the classroom is not an easy job for teachers (Sato & Atkin, 2006). Nevertheless, because of the mission known as no child left behind, which necessitates the adoption of content and achievement standards in order to monitor student progress with respect to those standards (Hamilton et al., 2007), it seems necessary to change the purpose and forms of assessment in schools (Stiggins, 2005). This change requires alignment between assessment practices and curriculum principles. The successful alignment of classroom assessment with learning standards depends on teachers' beliefs about the usability of standards and their positive effects on instruction and students (Wolfe, Viger, Jarvinen, & Linksman, 2007). Why is such an alignment important? The alignment of teachers' assessment practices with learning goals and principles as stated by the curriculum can solve the problem of individual teacher preferences in grading students (McMillan, Myran, & Workman, 2002).

If one of the most important aspects of current educational philosophy is the attainment of learning standards, which constitutes the aim of educational practice (Lalley & Gentile, 2009), then the question of "How do we monitor students' gain of learning goals by ensuring alignment between assessment and curriculum?" emerges immediately from this perspective. Some suggestions have been made with regard to this issue. One approach is to conduct curriculum-based assessment which gives an opportunity to the educational community to control student learning based on the curriculum as well as for the teachers to identify the level of their students' learning by taking into account instruction given in the class (Fuchs & Deno, 1994). Another approach is to use criterion-referenced assessment so that student performance aganist established instructional goals can be interpreted (Gentile, 2004; Lalley & Gentile, 2009). Additionally, results of formative assessment can explore the mastery level of students with regard to academic achievement standards (Stiggins & Chappuis, 2008). Besides, Stiggins (2005) argues that in order to be successful in achieving specified learning goals, formative assessment must be changed to assessment for learning. Lastly, learning occurring in the classroom

can be compared with the curriculum expectations with the help of embedded assessment activities (Kennedy, Brown, Draney, & Wilson, 2005).

As indicated above, there are a variety of assessment approaches in theory to determine students' level of attainment for learning goals. But what about in practice? Do classroom teachers incorporate one of the assessment approaches into their science courses in a reform-based science curriculum, or do they continue to use traditional assessment approaches? In order to be able to answer this question, obviously classroom observations are required as stressed in the related literature. For instance, Black and Wiliam (1998) suggest that there is a need to conduct qualitative studies on the issues of classroom assessment regarding the processes and interactions occurring in the classroom. Moreover, types of classroom assessment practices used by teachers in order to assess and monitor students' achievement and progress are considered as an interesting area for research. Therefore, it is suggested that in-depth research at the classroom-level to complement the results of surveys conducted on classroom assessment practices could be carried out (Lyon, 2011; Martínez, Stecher, & Borko, 2009). Lyon (2011) argues that an assessment process implemented by teachers in the classroom can be understood better through the observation of assessment practices, and mentions the need to identify the factors that may affect the alignment between science teachers' use of assessment approaches and the principles of science education reform. James and Pedder (2006) state that there might be a discrepancy between teachers' statements in a survey about what they do and what they actually do. Therefore, they argue that a general picture of classroom assessment practices drawn from surveys needs to be cleared through qualitative studies, especially from the perspective of practice that might be conducted differently by teachers for the same learning objective.

The current study was grounded on the suggestions made in the literature mentioned above and aimed at contributing to this area by conducting long-term classroom observations to explore what is going on in a primary classroom with regard to classroom assessment practices. Specifically, this paper focuses on the implementation of alternative assessment practices. Among classroom teachers, it is especially those teachers who are the most experienced who are worth investigating in relation to their classroom practices. This is because; experienced teachers tend to interpret curriculum innovations through their past experiences that in general limit implementation of the intended curriculum (Rogan & Aldous, 2005). Moreover, experienced classroom teachers favor professional support in science teaching more than novices may do (Sharp, Hopkin, & Lewthwaite, 2011). The reason for this might be that since novice teachers were trained in their teacher education programs according to current science curriculum reforms, and they probably do not feel a need themselves to take any form of professional support. Orpwood (2001) argues that in order to carry out challenges of a new science curriculum reform, teachers need to participate in professional development activities, especially in assessment activities coherent with the new curriculum. These findings directed the current case study to focus on assessment practices of a classroom teacher who is both experienced and has participated in the required in-service training regarding the newly reformed curriculum. Since experienced classroom teachers (years of experience > 25) make up a relatively high percentage (e.g. 18% as reported by Sharp, Hopkin, & Lewthwaite, 2011) of teachers in education systems, investigation of the alignment between assessment practices of these teachers and the principals of reformed-based science curriculum seems crucial. Hence, the research problem of this study was stated as follows: Do alternative assessment practices used by an experienced and in-service trained classroom teacher align with the aims, principles and learning goals of the reform-based primary science and technology curriculum? The sub-problems were defined as follows:

1. How is the distribution and source of alternative and traditional assessment practices used in the class?
2. How are alternative assessment activities implemented in the class?
3. To what extent do alternative assessment practices match with expected student outcomes (content knowledge, scientific process skills, science-technology-society-environment, attitude and values) stated in the curriculum?

Reform-Based Primary Science and Technology Curriculum in Turkey

Primary Science and Technology Curriculum (PSTC) in Turkey was developed under the supervision of the Teaching and Education Board of the Ministry of National Education, by the PSTC development committee (2005) involving academicians from the field of science education, research assistants, curriculum development experts, measurement and evaluation experts, and teachers. All curricula in Turkey are mandatory. In other words, all primary schools in Turkey have to implement the same science and technology curriculum declared by the Ministry of National Education.

The vision of the PSTC was stated as to make all students scientifically literate citizens whatever their individual differences are. Consistent with this mission, the curriculum mainly adopted the constructivist approach as a framework. The constructivist learning

approach was operationally defined in the curriculum by explaining the behavior of an individual during a learning process as the following: An individual

- does not start learning process with an empty mind,
- awakens existing constructs of the mind associated with newly learned concepts,
- is aware of what he or she knows and what pieces of newly learned knowledge can be constructed on the existing knowledge, individually and socially,
- actively participates in the teaching-learning process.

The PSTC covers seven learning strands. The first four indicate the content knowledge framework of the curriculum. These are known as living things and life, matter and change, physical phenomena, and lastly, the world and the universe. The remaining three learning strands are Science-Technology-Society-Environment (STSE), Scientific Process Skills (SPSs), and Attitudes and Values (AVs). The chapters in the curriculum were constructed on the first four strands. The remaining three strands were not treated as separate chapters since they require long-term, even life-long experiences. Accordingly, they were incorporated into expected student outcomes of the first four strands organized for science content knowledge. Each chapter in the curriculum includes the following sections: overview, purpose of the chapter, focus of the chapter, suggested subject titles, concept map of the unit, student outcomes and activities, suggested instructional and assessment activities.

Student outcomes of the STSE were based on three basic dimensions, which are the nature of science and technology, the relationship between science and technology, and the social and environmental context of science and technology. There are 36 STSE outcomes within the curriculum. The SPSs highlighted in the curriculum are observation, comparison-classification, inference, prediction, estimation, identifying variables, designing experiment, recognizing and using experimental materials and tools, information and data collection, measurement, recording data, data processing and modeling, interpretation and inference, and presentation. The curriculum introduces 24 outcomes regarding the SPSs for students to gain. In the organization of scientific AVs, the curriculum presents a classification with five categories. These categories are students' voluntary perception of what is going on around, students' positive reactions coherent with a situation, developing positive values to movements, phenomena and objects, organizing these values in their self-esteem, and finally, developing a life style including positive attitudes and values. There are 26 outcomes related with AVs in the curriculum.

In order to understand how the learning strands were integrated into students' outcomes, a student outcome from the 5th grade science curriculum is indicated here: "Students design an experiment to show that burning materials produce heat (SPS-14,15,19; STSE-14)". According to the directions of the curriculum, during the instruction of this outcome, teachers must take into account both the SPS and STSE outcomes given in parentheses. These outcomes were defined in the curriculum as follows:

- SPS 14: Students propose a simple experiment intended to see how the accuracy of a prediction can be tested.
- SPS 15: Students choose the required materials and tools to conduct a simple research under the supervision of the teacher and use them efficiently, cautiously, and effectively.
- SPS 19: Students gather information and data by using different sources (e.g. observation in the environment, observation and experiment in the class, photographs, books, maps, and information and communication technologies).
- STSE 14: Students give examples of how scientific developments propogate new inventions and applications in technology.

Consequently, in the teaching-learning process for the above outcomes, teachers must first take students' predictions about whether or not the burning materials give off heat. Then, the teacher should allow students to propose an experiment in order to validate their predictions. Next, the teacher should create a classroom environment in which students can do the required things discussed in SPS 15. Then, students collect data by undertaking the experiment and examining the available sources of information. Finally, students try to give examples of heating technology based on the fact that burning materials generate heat.

Seven basic principals were taken into account in the organization of expected student outcomes. The first principle is that little knowledge is the essence of knowledge that points to learning the core ideas instead of the bulk body of knowledge. The next principle is scientific and technological literacy, which aims to prepare students to be scientifically and technologically literate individuals. The third principle is related with learning process approach that is mainly based on constructivism. The fourth principle is about assessment that stresses alternative assessment methods in addition to traditional ones so that the learning process can also be evaluated as well as evaluating student outcomes. The fifth principle mentions students' developmental level and their individual differences. During the construction of student outcomes, both cognitive and physical development levels of students were paid attention to. In addition, the curriculum encourages the choosing of different activities by taking into account

students' individual differences and to deal with each student confidentially as far as possible. The following principle discusses the order of concept introduction that is organized by taking into account the principles of spiral curriculum approach. Thus, the main subjects were given in each grade level, with a deeper content as the grade level increases. The last principle of the curriculum states its coherence with other courses. In this context, related student outcomes from the other courses were cited in the curriculum.

Since the present study deals with classroom assessment practices, the assessment approach emphasized by the curriculum is elaborated in the following paragraphs. The curriculum states different ways through which assessment can be used in science and technology education as follows:

- To determine the students' gain level regarding outcomes specified in the curriculum by means of diagnosing students' level of learning,
- To provide feedback in order to ensure meaningful and deep learning,
- To determine the students' future needs
- To inform parents about their children's learning,
- To monitor if instructional strategies and the content of the curriculum are effective and well-balanced, respectively.

Because of the tendency to move from teacher-centered approach to student-centered approach in instructional strategies in accordance with constructivism, the assessment approach of the curriculum was constructed in line with this change. The curriculum's point of view for assessment is indicated in Table 1.

Turkish PSTC highlights alternative assessment more than traditional assessment because the constructivist learning approach adopted by the curriculum requires presenting multiple evaluation opportunities for students to exhibit their knowledge, skills, and attitudes. Traditional assessment was defined in the curriculum as the activities that focus only on the product and have only one correct answer. The curriculum defined alternative assessment as the activities that evaluate not only the product, but also the learning process and encourage students to take responsibility in their learning. Table 2 demonstrates traditional and alternative assessment techniques given in the curriculum.

The curriculum states that in order to succeed in the curriculum implementation, a rubric for each alternative assessment activities, if it is suitable, must be developed and shared with students/parents in a timely manner. Moreover, the curriculum directs implementers to primary mathematics curriculum with the title of

Table 1. Emphases on assessment issues in Turkish PSTC (PSTC Development Committee 2005, p. 23)

Less emphasis	More emphasis
• Traditional assessment methods.	• Alternative assessment methods.
• Assessment free from teaching and learning.	• Assessment as part of teaching and learning.
• Assessment of easily acquired knowledge via memorization.	• Assessment of knowledge acquired meaningfully and profoundly.
• Assessment of pieces of knowledge independent of each other.	• Assessment of well-constructed pieces of knowledge dependent on each other.
• Assessment of scientific knowledge.	• Assessment of scientific understanding and scientific logic.
• Assessment to learn what students do not know.	• Assessment to learn what students understand.
• End-of-term assessment activities.	• Ongoing assessment activities during the academic term.
• Evaluation made only by the teacher.	• Group evaluation and self-evaluation as well as teacher evaluation.

Table 2. Traditional and Alternative Assessment Techniques Mentioned in Turkish PSTC (PSTC Development Committee 2005, pp. 23-24)

Traditional assessment techniques	Alternative assessment techniques
Multiple choice questions, true-false questions, matching exercises, completion, short-answer essay questions, extended-answer essay questions, question & answer (oral essay)	Performance evaluation, portfolio, concept map, structured grid, diagnostic tree, Vee-map, word association, project, drama, interview, written report, demonstration, poster, group/peer evaluation, self-evaluation

"Common explanations related with assessment works in primary school curricula", in which characteristics and examples of some assessment methods and tools were elucidated.

The last section of each chapter of the curriculum presents examples of instructional and assessment activities, which can be used to decide on the degree to which students gained the expected outcomes and to direct instruction. The curriculum notes that in choosing and developing the assessment activities, the philosophy of the curriculum and the principles of the assessment emphasized in the curriculum must be protected. The curriculum also presents some forms of assessment that can be used in some instructional or assessment activities, i.e. student observation form, peer evaluation form, evaluation form for project works, and checklist for evaluation of experiment.

Summative Evaluation of Students on the Primary Science and Technology Course

Summative evaluation refers to "assigning a grade for learners' achievement at the end of the term, semester, course or instructional program" (Patel, 2010, p. 205). Evaluation of students' achievement in the primary Science and Technology Course (SATC) was based on *primary school regulations* prepared by the Ministry of National Education (2003). This regulation states that achievement of students is determined through the use of tests, projects and performance works. Performance works include participation in in-class activities and performance tasks. The minimum number of examinations is two for the SATC. Students have to take at least one project that can be done individually or via group work for any course during a school year. However, they also have to take at least one performance task for each course in each academic term. Project and performance tasks are evaluated using rubrics prepared in advance. Students' SATC grade for each academic term is determined by calculating the arithmetic mean of scores taken from the performance task, participation in in-class activities, the project (if students take a project from the SATC) and tests.

METHOD

The present study was designed as a qualitative research in which a classroom teacher's implementation of the PSTC in terms of classroom assessment practices was investigated as a case study. Qualitative research aims at describing and explaining complex phenomena (Miles & Huberman, 1994). Case studies are used to define an environment or a phenomenon as it is and try to describe individuals and organizations by taking the existing conditions into consideration without any attempt to introduce any modification or impact (Yin, 1984).

School Setting

The study was conducted in a fourth grade class of a public primary school, founded in a city center in 1940. In this school, there were two information and communication technology classrooms including internet access, a projector, smart-board and 32 desktop computers. In addition, there was a science laboratory with internet access and a library. Moreover, a multi-purpose hall with a capacity of 120 people was available for social and cultural activities. The hall included scene and stage lighting, a sound system, computer, internet access, a projector, plasma TV, and air conditioning.

Students at the school were taught in six class hours a day from 12:40 p.m. to 17:35 p.m. Each class hour was 40-minute long, and there were 10-minute breaks between course hours. The Ministry of National Education allocated three class hours per week to the SATC. In the observed observed, one science class was held on Tuesdays as the third class hour of the day, and two science classes were on Thursdays as the first two class hours of the day. The socioeconomic status of the students' parents was relatively high when compared with that of the students' parents in other schools.

Participants

The participant teacher was selected by taking into account the nature of case defined for this research. Since the aim of the research was to explore assessment practices of an experienced and in-service trained classroom teacher, the participant teacher was required to have these two features as well as being voluntary. The teacher was male and had 32 years of teaching experience. He also had attended in-service training related with the new reform-based primary science curriculum. The other participants of the study were the 31 fourth grade primary students that were in this teacher's class. Of 31 the students, 10 of them were female, and 21 of them male.

Research Design

Classroom observations were needed in order to determine the degree to which the primary science curriculum implementation was consistent with the intended curriculum with regard to assessment practices. This situation required using an observational case study approach (Bogdan & Biklen, 1998, p.55). The observer took the role of an unobtrusive observer (Marshall & Rossman, 1999, p. 107) since the current study deals only with the implementation of the PSTC in the class from the assessment framework. For this aim, different

data collection procedures such as observation, voice recordings, interviews, documents, and a questionnaire were used. The purpose of classroom observations was to explore the classroom assessment environment. Observations also allowed the observer to take notes related with assessment activities written on the white-board or shown on a projection screen. The aim of voice recordings was to capture discourse related with assessment activities. Interviews were conducted with the teacher in order to find out his opinion and beliefs about the PSTC, its implementation, and assessment practices. The belief questionnaire was used to describe the teacher's opinion and belief regarding science teaching, so that it would support findings from interviews. Documents including assessment activities used in the class, were collected in order to see what types of assessment activities were used in the class.

Data Collection

A prospective classroom teacher, who was trained by the researcher, collected the data. The main data collection method was classroom observation. Three successive class hours were observed each month during the academic year. Consequently, a total of 24 science class hours were observed for this study. During the observations, the observer took field notes when any assessment activity was conducted in the class. In such cases, the observer wrote down the assessment activity in a notebook and then focused on how the activity was processed, i.e., role and behavior of the teacher and students.

All conversations that took place in the class were audio-recorded by the observer. Therefore, a total of 24 science lessons were audio-recorded so that classroom assessment practices could be analyzed in detail with the help of transcribed dialogues of both the teacher and the students during any assessment activity.

As stated by Bogdan and Biklen (1998, p.55), in observational case studies, observations must be supported with interviews and document reviews. Thus, in the current study, the data were also gathered via teacher interviews and a review of documents used in the science instruction. Three interviews were conducted at different stages with the teacher. The first was towards the end of the academic year, and it was audio-recorded. The aim of the other two interviews ones was to complement inexplicit issues raised in the first. This was ensured through asking specific targeted questions, audio-recordings were not required, therefore, for the last two interviews, only note-taking was used. The interviews were focused on understanding what the teacher thinks about and the implementation of PSTC, the assessment approach proposed by the PSTC and its implementation, as well as teachers' belief about science teaching.

The observer also collected the documents including assessment activities used in the class. The documents were were from the science course book, the student workbook, ancillary textbooks, and from the exam papers. The documents were assessed specifically to see the types of assessment activities in student homework, in addition to the assessment activities discussed in the class.

Finally, in order to have an idea about what the teacher thinks about the contribution of some factors to becoming an effective teacher in science teaching, the instrument of Context Beliefs about Teaching Science (CBATS), developed by Lumpe, Haney, and Czerniak (2000), was administered.

Data Analysis

First of all, audio-recordings of classroom dialogues and teacher interviews were transcribed. Then, all the qualitative data were analyzed by following the six steps explained by Creswell (2003, pp. 191-195). This data analysis process includes the organization and preparation of the data, attaining a general sense of the information, conducting a coding process, generation of themes, representation of the themes in the qualitative narrative, and finally, interpretation. The coding process was conducted by two coders independently. Then, coded data was compared. In cases of contradiction, the coders discussed the issue in order to reach a comporomised agreement for a single code. The assessment techniques presented in Table 2 were treated as the codes for the first research question and the data coded according to this list. *Traditional assessment* and *alternative assessment* were pre-defined categories.

The second coding process was used to explore how alternative assessment practices were implemented in the class. Assessment approaches described in the curriculum were used as codes (see Table 1).

The third coding process was utilized in order to explore the degree to which alternative assessment practices match with the expected student outcomes stated in the curriculum. Four codes were used for this process: content knowledge, scientific process skills, science-technology-society-environment, and attitudes and values. Implementation of alternative assessment activities used in the class were coded by using these codes and then matched with the expected students' outcomes.

Finally, the data obtained from the CBATS instrument was used to support the qualitative data. The teachers' responses to the items associated with assessment were analyzed descriptively and compared with the findings obtained from the qualitative data.

FINDINGS

In this section, findings are reported based on the research questions. First of all, distribution of traditional and alternative assessment techniques used in the class with their sources is presented. Secondly, implementation of alternative assessment activities in the class is explained. Finally, the coherence between alternative assessment practices and expected student outcomes stated in the curriculum were discussed within each presented assessment activity.

Distribution and Sources of Traditional and Alternative Assessment Techniques

The teacher highlights two major sources regarding the classroom assessment. The first one is to use some printed ancillary books as well as the course book. The second one is to use web-based learning environment. Indeed, classroom observations indicated the use of both sources in the assessment process. The teacher in interview-1 (I-1) explained sources used in conducting classroom assessment procedure as follows:

> *Apart from the in-class examinations, we make use of paper tests. We solve questions from ancillary books. In these books, in addition to multiple choice questions there are true-false questions, completion questions, concept maps, and puzzles. We do them. These are printed resources. We also solve questions from visual sources, i.e. web-based learning environments. Students answer these questions verbally or in writing. (I-1)*

Classroom assessment practices appeared in the SATC observed in the current study are represented in Table 3. Frequency values in Table 3 indicate the number of questions/activities that were practiced in the class or assigned as homework. According to Table 3, traditional assessment practices are much more dominant than alternative assessment practices in terms of both in-class practice (ICP) and homework (HW). Moreover, printed sources were used much more than

Table 3. Observed Frequencies of Assessment Techniques Mentioned in the PSTC

		F				
		Printed Sources		Web-based Sources		
		ICP*	HW*	ICP	HW	Total
Alternative assessment techniques	Performance evaluation	3	-	-	-	3
	Portfolio	-	-	-	-	-
	Concept map	-	-	-	-	-
	Structured grid	-	-	-	-	-
	Diagnostic tree	-	-	-	-	-
	Vee-map	-	-	-	-	-
	Word association	-	-	-	-	-
	Project	1	1	-	-	2
	Drama	-	-	-	-	-
	Interview	-	1	-	-	1
	Written report	1	-	-	-	1
	Demonstration	-	-	-	-	-
	Poster	-	-	-	-	-
	Group/peer evaluation	-	-	-	-	-
	Self-evaluation	-	3	-	-	3
	Total	*5*	*5*	*0*	*0*	*10*
Traditional assessment techniques	Multiple choice question	30	10	17	-	57
	True-false question	-	12	5	-	17
	Matching question	33	-	16	-	49
	Completion question	2	8	10	-	20
	Short-answer essay question	4	3	-	-	7
	Extended-answer essay question	-	1	-	-	1
	Question & answer (oral essay)	153	2	8	-	163
	Total	*222*	*36*	*56*	*0*	*314*
	Grand totals	*227*	*41*	*56*	*0*	*324*

* ICP: In-class practice; HW: Homework

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web-based sources. The reason for distinguishing between paper and web-based sources was the importance stated by the curriculum in the use of information and communication technologies. About one fifth of traditional assessment techniques come from web-based sources, whereas for alternative assessment techniques web-based sources were not used. In addition, with respect to the ICP, web-based sources were not used for alternative assessment techniques while both web-based and printed sources were used for traditional assessment techniques. Furthermore, all HW assignments were given from printed sources.

Both printed and web-based instructional materials used by the teacher covered almost all alternative assessment techniques mentioned in the curriculum. Therefore, it can be said that the teacher had rich sources in terms of alternative assessment practices. However, during the instruction the teacher skipped most of them. For example, in lesoon-12 the teacher began the instruction by students reading from the course book. At the beginning of the text there were three open-ended questions aimed to determine students' pre-knowledge regarding the topic. But the teacher skipped this part and requested a student to read the text to the class. Moreover, at the end of the text, there was a review part including two questions, one of which asked students to prepare a poster explaining environments including organisms too small to be seen by the naked eye. Similarly, the teacher did not dwell on this poster task.

Implementation of Alternative Assessment Activities

Among the alternative assessment techniques shown in Table 3, only three of them, namely, performance evaluation, project, and written report were used in the class. In the following sections each of them are explained as they were used in the class.

Performance Evaluation

Performance evaluation is one of the requisites, which is described in the primary school regulations in Turkey, in determining students' success in the SATC. According to the regulation, classroom teachers have to give at least one performance task (PT) in each term and evaluate it according to a rubric. Classroom observations conducted in the current study indicated that the teacher mentioned an additional two performance tasks (APT) apart from the requisite one during the school year.

The first APT was related with scientists, inventions, and inventors. Regarding this APT, the teacher said in lesson-6 that "I will give a performance task related with scientists or inventions and inventors. From now on you can start to prepare slowly. I do not want to assign sections so go ahead and select yourself, and I will give information in detail later on". Then some students said "Oley" indicating their happiness and some students were observed to be as in determining their topic among themselves. The teacher continued the lesson by asking a student to read the next paragraph from the course book. However, the data indicated that there was no discussion regarding this APT throughout the school year.

The name of the second APT was "environment inspectors" actually given in the course book as an activity. Table 4 indicates elements of this APT.

The APT given in Table 4 seems like an unplanned APT. How did this APT emerge in the class? During

Table 4. Details of an APT Called "Environment Inspectors"

Tools and materials	Method (with group working)	Data Collection and Analysis	Conclusion and Interpretation
• Plan of school garden or nearby environment (for each student group), observation form, pen, paint, eraser and magnifier.	• Start your investigation by drawing the appearance of the habitat on your plan. • Investigate and discuss whether there is evidence related to any living beings. • Use your magnifier by considering the possibility of existence of small creatures. • Predict living beings that could be found. • Works carefully when, lifting, mixing and listening in the observed habitat.	• What evidence was used in identification of the habitat? • Write your predictions about which living beings can exist in this habitat. • Write about the investigations done during observation. • Write about characteristics of observed living beings by drawing their picture.	• Write about living beings observed in the habitat. • If you did not see animals or plants, was there any evidence of living beings in the habitat? • Was there a living being that you would like to see? If no, what changes you should do in order to ensure this? • Prepare a presentation related with your group work.

lesson-13, the teacher asked a student to read this activity from the course book. Later, the following conversations occurred. The conversations originally were in Turkish, and translated into English by the researcher.

Teacher: Do you understand what you will do? It's easy. You can do this study under a tree; this study can be done anywhere. Is ther anyone who did not understand this study?
A student: I did not understand.
Teacher: Okay. Now, it is your performance task.
Students: Hurrah!
Teacher: Create your groups by yourselves however, you want and then start your work. Is that clear enough?
A Student: Can we work individually?
Teacher: Of course.
A student: Can we prepare a Power-point presentation?
Teacher: Do you want to work individually? Children who are not able to can. The important thing here is what we research? Habitat. Which habitat will you investigate? Which living beings will you find? How are they? What are the characteristics of young animals? Describe them briefly. There is no need to make long explanations, but your presentations will need to be from your investigation, and not a ready-made presentation. In other words, I do not want a presentation based on a search for information from resources. You will do it by observing.
A student: I have lots of materials.
Teacher: I do not want you to search for information. I want you to conduct a real research.

The second APT was also emphasized by the teacher in the interview. By referring to this APT the teacher stated that:

Students did their research. One raised a stone and took photographs whatever existsed underneath it. One saw an insect or a worm. We investigated their habitat. Since our school has no garden, we did our study (as an out of school activity). Students were so happy. They took photographs, prepared PowerPoint slides, and made presentations. Some wonderful products were created; however, the time was not enough. If we had more time, the one-week course could have continued for up to one month. Each student prepared a different presentation. One took a photograph and edited it, searched for this photograph again from the internet and other resources, and collected information related with them. As a result, that was beautiful. (I-1)

The first emerging finding from the above dialogs and interview is that students were willing to engage in the performance task. Classroom observations indicated that when the teacher said I will give you a performance task, students' responded as "Hurrah!". This finding was supported by the teacher interview in which he stated that students were so happy during the APT process.

Secondly, the dialogue does not seem like one we would expect in a constructivist learning environment, but rather an instructivist one. The teacher had set a task and told the students how he wants it to be done. There was no co-construction of meaning seen here. Even when a student asked if students could make a PowerPoint presentation, the teacher did not use this to stimulate their thinking.

Although the teacher introduced the students to the two APTs explained above, at the beginning of the process he did not distribute a rubric indicating how the students will be evaluated while doing these APTs. As stated by the teacher in the interview-2 (I-2), the processes of APTs ended with the students' presentations. The teacher did not evaluate the students' works during or at the end of the process by using a rubric. Therefore, performance evaluation of students by using these APTs was not ensured and terminated properly by the teacher.

The PT evaluated by the teacher by using a rubric is shown in Appendix 1. The PT was related with properties of matter. Directions for students to follow in their investigations were explained clearly. Furthermore, a rubric showing how students' work will be evaluated was presented. The teacher allowed students to present their PTs in the class. However, the teacher stated that because of time constraints not all students could not present their PTs, instead the best were selected and presented (I-2).

The teacher believes that process evaluation is necessary and points out its advantage as follows: "Giving more than one performance task allows us to better monitor the students' progress. In other words, in such a case we can conclude that the student was not good at the first performance task, but that he was good at the second" (I-1). However, in practice, the teacher did not act as he said. Throughout the three performance tasks, the teacher did not monitor the students' progress.

When the content of the PT is compared with the expected student outcomes stated in the curriculum, it was observed that the following two knowledge outcomes (PSTC Development Committee, 2005, p.75) match with the PT:

- Students distinguish objects that can be attracted or not by a magnet.
- Students classify objects with respect to swimming, sinking, getting wet, being dry, and water absorption.

In the curriculum, the above knowledge outcomes are associated with some SPS outcomes related with observation, comparison, classification, and selecting and using experimental tools. When the PT was investigated from this perspective, it was observed that all the skills were included in the PT. Moreover, the third, fifth and last criteria in the PT match with the following SPSs pointed out in the curriculum: planning experiment, data collection, recording data, processing data, creating model, and presentation. Therefore, the

PT seems to be in line with the related student outcomes stated in the curriculum. What about assessment of the PT? The teacher assessed student PTs only by taking into account only their submitted reports. Since process of the PT was took place outside of the school by the students, the teacher did not monitor the students' performance on the task. Therefore, assessment of the PT seemed to be weak in terms of process evaluation.

Project Task

According to the primary school regulations, each student must take at least one project task (PRT) from any course during an academic year. When the teacher was asked about how many students selected the science and technology course for their PRT, the teacher stated that almost half of the students selected the science and technology course for their PRT (I-2). The teacher explained the reason for such a high preference for the science and technology course for the PRT as follows: "The subject of the project task was electricity and a trip to the Gökçekaya Dam would be made. The trip to the dam and the close relationship between the subject of the project and the dam would cause students to select the science and technology course for their project task (I-2)". The PRT assigned to students is shown in Appendix 2. The teacher mentioned about the usefulness of the trip and students' PRT as following:

> *The project task was assigned at the beginning of the second term so that students could create a background for the electricity unit. Students had about three months to complete the task. We went on the trip to the dam with all fourth grade classes. It was very nice. We [teachers] also learned things we did not know (I-3)… Students prepared wonderful presentations which I liked very much. They took photographs at the dam and used them in their presentations. Students presented their project tasks in the class. Unfortunately, I could not let all 31 students present their tasks, so just the best works were presented. Students' presentations made in the science and technology course were also useful for speaking skill, expression skill, etc. which are taught in the Turkish language course. Thus, at the same time, the Turkish language course is processed (I-2)…Unless there is a very negative situation [project task], I do not mark [project tasks] below 85 points. (I-3)*

While investigating the teacher's statement, four issues attractrd attention. The first is that although the rubric consists of a criterion that measure whether or not a presentation was made, the teacher did not allow all students to present their works. In such a case, how did the teacher evaluate the students, who did not make presentation, on that criterion? The second issue is the large class size of 31 students, which restricted the teacher in allowing all of the students to make their presentations. The third one is the subjective evaluation of the teacher who was prone to mark at least 85 points for all students' PRTs. The last one is the importance given to the Turkish language course by the teacher.

The directions of the PRT indicate that the expected product was to write a document based on a search for information. The expected product of this PRT conflicts with that of the real project tasks in which students in general try to construct an apparatus to solve the problem at hand. Although the content of the project does not require a long period of time to complete the task, the teacher gave three months. During this period of time the teacher did not do anything to maintain the students' interest in and focus on the task, apart from reminding them about the project task. Although the nature of the project tasks entails process evaluation, the teacher did not conduct this type of evaluation and focused only on the end product.

When the PRT was compared with the expected student knowledge outcomes for the electricity subject as stated in the curriculum, only the first and second directions of the PRT matched with the following two expected knowledge outcomes stated in the curriculum (PSTC Development Committee, 2005, p.142):

- Give examples of electrically powered vehicles,
- Search for and present about the importance of electricity in daily life.

The other directions were not in the scope of expected knowledge outcomes of the curriculum. The two knowledge outcomes are also associated with two SPSs stated in the curriculum: observation and presentation. Moreover, the criteria list in Appendix 2 indicates that contribution of the PRT to development of students' SPSs should be measured in three aspects, which are the collection of information, the recording information, and the presentation. Nonetheless, in practice, none of the SPSs could be assessed through process evaluation, apart from the presentation skill. The curriculum does not include any STSE and AV skills regarding content of the PRT, so comparison of the PRT with the curriculum could not be made in terms of these skills.

Written Report

Written reports are used to allow students to construct their own responses as well as to demonstrate their creativity and in-depth knowledge in a given subject (Priestley, 1982, pp.214-215). In science education, written reports are widely used in assessing students' laboratory work; in this case it is called laboratory report. Experiments and investigations can be documented through laboratory reports. Students undertaking an investigation can indicate their thinking

and understanding of the content and process by writing a laboratory report (Hammerman, 2009, p. 50).

The written report used in the classroom was included in the student workbook. It was similar to a laboratory report as shown in Appendix 3. The teacher began lesson-5 with doing an activity from the course book. The activity was related with objects that look like a light source. The aim of the activity was to help students understand the common features of objects that look like a light source and the reason why such objects look like a light source. In order to conduct this activity, the teacher brought the class a traffic reflector, mirror, spoon, some aluminum foil, ink, a plastic water bottle, and a flashlight. First of all, the teacher asked students if the reflector emits light when the flashlight was turned off. Then, the flashlight was turned on and directed onto the reflector by the teacher, who then asked the students whether the reflector was shining like a light source or not. The teacher followed the same procedure for the remaining objects. After the activity, the teacher asked the students the following questions to check their understanding from the activity.

Teacher: Well. What did we understand with this experiment? What was our purpose in doing this activity? We wanted to learn what?

Student: We saw the reflection of light.

Then the teacher asked a student to read the first paragraph of the lab report. The teacher answered the question asked there as the following, although it was a good chance for the teacher to engage their students with inquiry process after conducting the activity.

Teacher: Is each luminary a light source? What have we seen just now? When we directed the turned on flashlight to the mirror, we saw light from the mirror like coming from a light source. Then what? Each body of light is not a light source, but reflects light taken from others.

In the second part of the report, students wrote the names of the five objects used in the activity. The teacher asked students the second question in the lab report and students answered the question by saying "no" and they wrote down their observation results in line with this answer. For example, student F wrote in the lab report "it is not emitting light". The third part of the lab report was completed in association with the following dialogue:

Teacher: Now. Objects that look like a light source and do not look like a light source. What have we observed as a light source?

Student Y: Mirror, reflector, spoon, aluminum foil.

Teacher: We saw them like a light source but the others were not seen like a light source. Write that down on the lab report.

Student R: I also wrote down plastic water bottle.

Teacher: Okay.Also write down the bottle.

Student N: Apart from the ink?

Teacher: We looked at the tablecloth and the plastic water bottle. We can look at so many things. We can look at a chair. The bright objects reflect like a light source. The ones that are not bright do not reflect. Fill in the blanks on the lab report now as quickly as you can. Well. Do the "conclusion and interpretation" part. Write with proper sentences. You will read them out.

The last expressions of the teacher contain two important points. The first one is misuse of sentences from a scientific point of view. The teacher used the term "reflect" incorrectly herein and elsewhere during the activity, although the curriculum warns teachers not to mention about reflection, as that will be taught during sixth grade. This teacher behavior might trigger formation of misconceptions regarding the reflection process in students' minds. The second one is to create a link to Turkish language course again by emphasizing the proper writing of sentences.

The written report matches with the following two knowledge outcomes stated in the curriculum (PSTC Development Committee, 2005, p. 105):

- Observe that some objects emit light,
- Realize that some objects look like emitting light in the presence of another light source in the environment.

The curriculum links these knowledge outcomes with observation skill through the SPSs. The written report activity carries out this feature so it can be said that it is in line with the curriculum in this respect. In practice, the teacher allowed students to observe the objects through conducting the activity in the class. However, the teacher did not conduct process or formative evaluation while the students stated their ideas in the "result and interpretation" part. For example, one student explained the first question by change in shape. The reaction of the teacher was "… what does that have to do with this topic?" and he did not elaborate as to why the student mentioned it. The teacher seemed to focus only on correct statements, i.e. knowledge outcomes, of the students. Such practices of the teacher indicate more emphasis on outcome but not process, and that is inconsistent with the philosophy of the curriculum.

Assessment of the SPS, STSE and AV

A new side of the curriculum was to include SPSs, STSEs, and AVs components that were not covered in the previous curricula. Classroom observations indicated that, in general, assessment of expected student outcomes related with the SPS, STSE, and AV were missing. For example, the Earth's layers were taught in lesson-11. According to the curriculum, this subject includes five SPSs and one STSE expected outcomes. In this lesson, students in groups of 6-7 pupils did a model showing layers of the Earth by using play dough.

Although this was a group task, only two students were active; the others were just watching them. At the same time the teacher was looking at the slides and told students to help each other. Then, the teacher took one of models made by the students and explained the layers of the Earth by cutting and showing it. At the end of the lesson, the teacher introduced multiple-choice questions measuring content knowledge from a web-based learning environment. In contrast, the teacher did not use any assessment technique to measure the SPS and STSE expected outcomes during the students' the Earth's layer model task.

Diagnosing Misconceptions

In the 4th grade science curriculum, seven misconceptions were emphasized for teachers to take them into account in their instruction. However, classroom observations showed that there was no discussion on any of misconceptions in the class. In addition, the interview revealed that the teacher did not master the concept of misconception. When the interviewer asked the teacher about the misconception regarding heat and temperature, the teacher could not respond with any scientific knowledge, but stated that such subjects should not be given at this grade level. The teacher's response to the interviewer's statement "such concepts might be given through evoking" was that "There is no need. They should not be given. Students are confused much more when you try to explain in detail" (I-2). The teacher's responses imply that he is not good at pedagogical content knowledge in dealing with science misconceptions.

Homework Assignments

All homework assignments were from printed sources although web-based sources used in the class allow student members to log into the system and study the assessment activities. The majority of the homework were set from traditional assessment techniques. Homework assignments based on alternative assessment techniques were project, interview, and self-evaluation (see Table 3), all of which were from the student workbook. In the project homework, students were assigned the task to develop a project in order to prevent light pollution. The job of the students in the interview homework was to learn about illumination technologies used by family elders from their childhood up to the present day. Self-evaluation practices for students were at the end of some assessment activities in student the workbook. Neither classroom observations nor teacher interviews indicated any discussion on these homework assignments. For example, in lesson-9 the teacher asked students to read what they wrote about three open-ended questions related to illumination given in the homework called "creative writing work". At the end of this activity, there was a self-evaluation part but the teacher did not check this part.

Classroom observations indicated that the teacher only checked homework assignments twice. Although this checking process provided the teacher with an opportunity to diagnose levels of student understanding, the teacher did not behave like this as indicated in the following dialog in lesson-9:

Teacher: Well. Let me see your notebooks… Is there anyone who could not do the homework…
Student: I could not do some parts.
Teacher: If you do not understand some parts, it is okay. If you have any other reason of failure to do it [homework], then what shall we do? We complete [it].

During the above dialog, the teacher checked students' notebooks and then signed them. However, some parts of the homework not carried out by the students were not discussed in the class and the teacher continued the lesson with the next topic, without giving any feedback regarding the homework content at which students experienced difficulty in understanding.

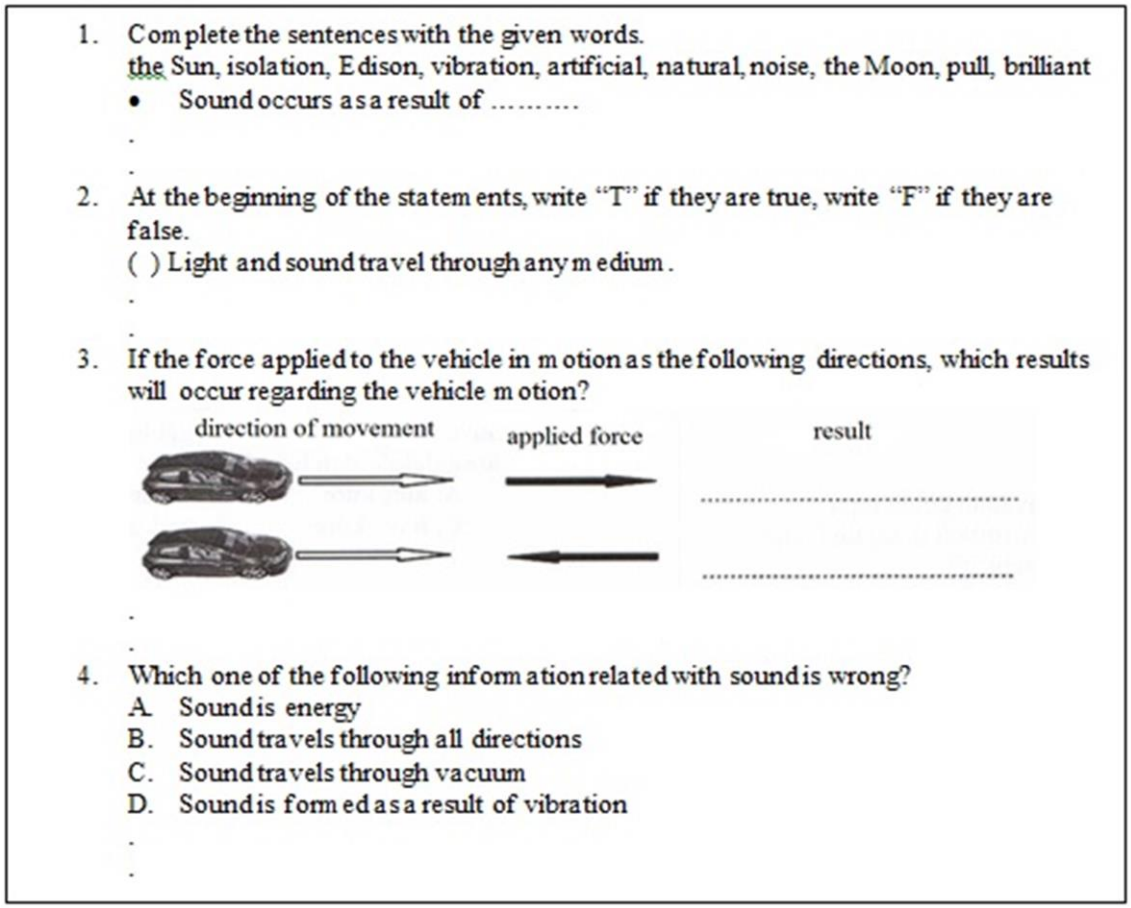
Another interesting issue was to assign homework to students with the aim of preparing them for an in-class science examination. The teacher's statement in lesson-9 indicates this issue: "We will do an exercise before the exam on this subject. Or, I can give it to you as homework before the exam in order to revise [the content]".

In-Class Science Tests

The teacher administered three science tests in the first term and two in the second term. Content of the tests were similar to each other. Each test included matching, completion, short-answer, multiple choice, and true-false type questions. An excerpt from one of the tests to indicate the types of questions is shown in Figure 1. The tests measure only students' content knowledge, not higher order thinking skills or the SPSs and STSE although they were highlighted in the curriculum.

DISCUSSION

The CBATS instrument indicated that the teacher finds classroom assessment strategies as an influential factor in being an effective teacher. The teacher, as stated in the interviews, believed that process evaluation is more perfect in terms of retention and reinforcement of subject matter. However, classroom observations showed that the teacher did not sufficiently use alternative assessment strategies stressed in the curriculum. In practice, the teacher, in general, deselected alternative assessment tasks in the books and


1. Complete the sentences with the given words.
the Sun, isolation, Edison, vibration, artificial, natural, noise, the Moon, pull, brilliant
   - Sound occurs as a result of .....

2. At the beginning of the statements, write "T" if they are true, write "F" if they are false.
( ) Light and sound travel through any medium.

3. If the force applied to the vehicle in motion as the following directions, which results will occur regarding the vehicle motion?

4. Which one of the following information related with sound is wrong?
   A. Sound is energy
   B. Sound travels through all directions
   C. Sound travels through vacuum
   D. Sound is formed as a result of vibration

Figure 1. An excerpt from a science examination administered by the teacher in the class

did not make use of information received in the performance assessment tasks. Therefore, it might be said that the teacher's alternative assessment practices did not match with what the teacher believed. Similar findings were also reported by other studies (e.g. Lyon, 2011). The reason for limited use of alternative assessment strategies might be explained by different aspects. The first is the decrease in weekly course hours without any content decrease in the curriculum. This resulted in a lack of instructional time for each topic. Lack of instructional time restricts the use of multiple assessment formats (Gott & Duggan, 2002). Since it requires extra time to check, homework probably could not be used by the teacher for the aim of formative evaluation that is specifically emphasized by the curriculum. Therefore, the teacher indicated in the CBATS instrument that a decrease in the number of subjects to be taught may contribute in being an effective teacher. This allows teachers to concentrate more on fewer subjects and to free up more time for the preparation of teaching and for alternative assessment activities (Cheng, 2006). The second one is that the teacher did not adopt the curriculum as indicated by both the CBATS instrument and the interview. For example, in the interview the teacher stated "The curriculum is given to us to implement. When other things are not forthcoming… I go outside of the curriculum". Teachers' adoption of curriculum that necessitates alignment between teacher beliefs and curriculum is a crucial factor to conduct teaching-learning process as intended by the curriculum (Levitt, 2001; Lewthwaite, 2005; Van Driel, Bulte, & Verloop, 2008). The current study revealed that the same is also true for assessment. In other words, teachers implement assessment approaches consistent with the philosophy of the curriculum, unless that is, they adopt the curriculum.

Alternative assessment tasks assigned to the students were in line with expected student outcomes stated in the curriculum. This is consistent with the curriculum implementation research that suggests alignment between learning goals and assessment (Krajcik, McNeill, & Reiser, 2008). However, in practice the teacher could not manage the alternative assessment process successfully. The teacher assessed students' alternative assessment practices through only marking their reports on the tasks. The extent to which students follow scientific process while working on the tasks was not monitored by the teacher. Abraham and Millar (2008) also reported similar findings, in such that

teachers do not primarily concentrate on scientific inquiry procedures in practical works. Moreover, the teacher did not give any feedback during the process since the activities were conducted outside of the classroom. Students only presented their studies to the class after they had completed their performance tasks at home. The teacher's behavior contrasts with recommendations for a successful implementation and evaluation of alternative assessment practices (Siegel, Hynds, Siciliano, & Nagle, 2006). Even though there were such drawbacks in the performance assessment process, presentation of studies conducted by the students during their performance tasks allowed the students to share their knowledge and discuss with the rest of the class the concepts to be learned. Therefore, the students' level of participation in the instruction was higher for the use of alternative assessment activities when compared with traditional assessment activities. Increased knowledge share and active participation during the alternative assessment activities observed in the current study indicate social and personal outcomes of alternative assessment activities as affirmed by Stears and Gopal (2010).

The need for high-quality teacher training in alternative assessment practices specifically appeared in the teacher interview in which he stated that although he had attended an in-service training regarding the new curriculum, it was not fruitful. He understood what the new curriculum aims were when he started to implement it, however, the teacher underlines the issue that the system still does not work well enough although the curriculum has been implemented for five years. The new reform-based science curriculum invalidated most of his long time used instructional materials and forced him to prepare new instructional materials consistent with the new curriculum. Of course, it is challenging to prepare, select, and conduct assessment practices coherent with the philosophy of a new curriculum without teacher training. Therefore, this finding of the study agrees with the finding of Koloi-Keaikitse (2012), who indicated that primary teachers need more skills training in assessment practices. One of the training needs identified in the current study was how to handle misconceptions, which is strongly related to pedagogical content knowledge. Jones and Moreland (2005) found that pedagogical content knowledge of teachers has an effect on the assessment of learning practices. Given that classroom teachers have insufficient science content knowledge (Anderson & Clark, 2012), the significance of pedagogical content knowledge in effective use of alternative assessment practices comes into prominence within primary science education. Another troublesome issue for the teacher was to evaluate the alternative assessment practices. The teacher marked students' performance or project tasks only by assessing the final products, which were a written report and a table. However, the teacher did not conduct a process evaluation, which is a major requirement for the review of performance or project tasks. This picture shows that the teacher evaluates alternative assessment activities using a traditional assessment approach. The teacher was prone to giving out high marks, stating that he'd not give less than 85 points by ignoring some criteria in the rubric. Such marking practices give rise to the issue of validity and reliability of the assessments. This case supports the idea that alternative assessment techniques suffer from reliability and validity (Klassen, 2006). Although teachers are aware of the need for more frequent use of alternative assessment practices to assess students' skills (Ogunkola & Archer-Bradshaw, 2013), they need professional training on how to implement alternative assessment practices (Cheng, 2006; Koloi-Keaikitse, 2012; Penuel et al., 2009; Priestley, 1982; Towndrow, Tan, Yung, & Cohen, 2010).

Although the teacher has teaching experience of 32 years, innovative assessment practices conducted by the teacher were less than traditional assessment practices. This finding is opposed to Orphanos' (2008) finding that asserts that more experienced teachers use innovative assessment practices more. Nevertheless, Rosas (2014) reported that there is no relationship between years of experience and assessment practices. Assessment rules declared in the primary school regulations might be one of the reasons for the limited use of alternative assessment practices, since the regulations state that only one performance task is compulsory and one project task that is elective during each term. Actually, the teacher mentioned about two additional performance tasks in addition to the requisite one, but he did not integrate them into the instruction. Moreover, the lack of the teacher's in-service training in alternative assessment practices might be another reason for the rarity of his applying alternative assessment practices in the classroom setting.

Is it better to use a higher level/frequency of alternative assessment practices? Teachers' frequent use and marking of alternative assessment decreases students' orientation and interest toward performance tasks (Alkharusi, 2008; Stefanou & Parkes, 2003). In the current study, only a few alternative assessment tasks observed in the class. Furthermore, although performance tasks were marked and therefore affected the students' course grades, the students' interest toward it did not decrease, adversely, they were actually quite happy to be assigned performance tasks. The reason for this might be the teacher's arbitrary high marking of performance tasks. At the same time it should be noted that students favor alternative assessment over multiple-choice questions (Waters, Smeaton, & Burns, 2004). Therefore, it can be said that in light of the aforementioned research, that students' willingness to

take part in alternative assessment practices in the current study might be down to its rare application, and the apparent high marking of such activities by the teacher.

CONCLUSION

The current research indicated that there wasn't a huge problem regarding the coherence between alternative assessment tasks used by the teacher and related expected student outcomes. However, the implementation process of the tasks in terms of assessment wasn't in line with the requirements of performance assessment as intended by the curriculum, although the teacher had a positive belief regarding alternative assessment activities. Understanding challenges that affect alignment between assessment practices and reform efforts is an ongoing issue for the science education community (Lyon, 2011). The current in-depth research aimed at shedding light on the understanding of the challenges that can affect the alignment between alternative assessment practices of a classroom teacher, and the philosophy and goals of the reform-based primary science curriculum. The decision of policy makers to decrease the number of science lessons per week, a lack of instructional time, the exclusion of curriculum by the teacher, inadequate pedagogical content knowledge, and insufficient teacher training for reform efforts on assessment, were found to be the elements that most probably affected the negative alignment. Although the teacher believed that performance tasks are valuable in monitoring student progress, such shortcomings did not allow the teacher to implement them professionally. On the other hand, the enthusiasm of the students and the teacher, even while engaging somewhat in performance tasks, encourages us to keep up with alternative assessment activities.

What to do in such a case? A two-stage roadmap might be suggested. The first stage would be to provide alternative assessment activities as part of the teaching-learning process. To achieve this, primary school assessment regulations may be organized in such a way that alternative assessment practices have sufficient weight in determining students' final grades. This might force teachers to integrate alternative assessment practices into their instruction, as observed in the current study. Since the quality of practices under mandated reform-based science curriculum is low, the second stage may focus on finding ways to increase the quality of alternative assessment practices of teachers. As a result, effort could be made to create a classroom assessment environment that is unaffected by the drawbacks that came to light in the current study. Classroom teachers may then feel freer from pressures of such drawbacks and be better equipped to proficiently implement alternative assessment practices. This effort may promote higher alignment between reform-based primary science curriculum and alternative assessment practices of a classroom teacher. Although in this study the teacher was very experienced and had attended in-service training for the reform-based science curriculum, he did not sufficiently implement the alternative assessment activities. Therefore, this case study presents evidence for the claim that reforming educational practices is more complicated than just rewriting the curricula, even for experienced and in service-trained teachers.

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REFERENCES

Abraham, I., & Millar, R. (2008). Does practical work really work? A study of the effectiveness of practical work as a teaching and learning method in school science. *International Journal of Science Education, 30*(14), 1945-1969.

Alkharusi, H. (2008). Effects of classroom assessment practices on students' achievement goals. *Educational Assessment, 13*(4), 243-266.

Anderson, D., & Clark, M. (2012). Development of syntactic subject matter knowledge and pedagogical content knowledge for science by a generalist elementary teacher. *Teachers and Teaching: theory and practice, 18*(3), 315-330.

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice, 5*(1), 7-74.

Bogdan, R.C., & Biklen, S.K. (1998). *Qualitative research for education: An introduction to theory and methods* (3rded.). Needham Heights, MA: Allyn & Bacon.

Carroll, T.M. (1999). *Developing partnerships: Teacher beliefs and practices and the STS classroom.* (ERIC Document Reproduction Service No. ED443669).

Cheng, M.H. (2006). Junior secondary science teachers' understanding and practice of alternative assessment in Hong Kong: Implications for teacher professional development. *Canadian Journal of Science, Mathematics and Technology Education, 6*(3), 227-243.

Chrispeels,J.H. (1997). Educational policy implementation in a shifting political climate: The California experience. *American Educational Research Journal, 34*(3), 453-481.

Creswell, J.W. (2003). *Research design: qualitative, quantitative, and mixed method approaches* (2nded.). Thousand Oaks: Sage Publications.

Eminah, J.K. (2007). The alignment of junior secondary school science curriculum intentions and classroom practice in Ghana. *Journal of Development Alternatives and Area Studies, 26*(3), 73-101.

Erstad, O. (2008). Changing assessment practices and the role of IT. In J. M. Voogt & G. A. Knezek (Eds.), *International handbook of information technology in*

primary and secondary education (pp. 181–194). New York: Springer.

Fuchs, L.S., & Deno, S.L.(1994). Must instructionally useful performance assessment be based in the curriculum? *Exceptional Children, 61*(1), 15-24.

Gentile, J.R. (2004). Assessing fundamentals in every course through mastery learning. *New Directions for Teaching and Learning, 2004*(100), 15-20.

Gott, R., & Duggan, S. (2002). Problems with the assessment of performance in practical science: which way now? *Cambridge Journal of Education, 32*(2), 183-201.

Hamilton, L.S., Stecher, B.M., Marsh, J.A., McCombs, J.S., Robyn, A., Russell, J.L., et al. (2007). *Standards-based accountability under no child left behind: experiences of teachers and administrators in three states*. Santa Monica, CA: Rand Corporation.

Hammerman, E.L. (2009). *Formative Assessment Strategies for Enhanced Learning in Science, K-8*. Thousand Oaks, California: Corwin Press.

Haney, J.J., Czerniak, C.M., & Lumpe, A.T. (1996). Teacher beliefs and intentions regarding the implementation of science education reform strands. *Journal of Research in Science Teaching, 33*(9), 971-993.

James, M., & Pedder, D. (2006). Beyond method: assessment and learning practices and values. *Curriculum Journal, 17*(2), 109-138.

Jones, A., & Moreland, J. (2005). The importance of pedagogical content knowledge in assessment for learning practices: a case-study of a whole-school approach. *Curriculum Journal, 16*(2), 193-206.

Kennedy, C.A., Brown, N.J.S., Draney, K., & Wilson, M. (2005, April). *Using progress variables and embedded assessment to improve teaching and learning*. Paper presented at the Annual Meeting of the American Education Research Association, Montreal, Canada.

Klassen, S. (2006). Contextual assessment in science education: Background, issues, and policy. *Science Education, 90*(5), 820-851.

Koloi-Keaikitse, S. (2012). *Classroom assessment practices: A survey of botswana primary and secondary school teachers. (Ball State University). ProQuest Dissertations and Theses*, 172. Retrieved from http://search.proquest.com/docview/1017539559?accountid=7181. (1017539559).

Krajcik, J., McNeill, K.L., & Reiser, B.J. (2008). Learning-goals-driven design model: Developing curriculum materials that align with national standards and incorporate project-based pedagogy. *Science Education, 92*(1), 1-32.

Lalley, J.P., & Gentile, J.R. (2009). Classroom assessment and grading to assure mastery. *Theory into Practice, 48*(1), 28-35.

Levitt, K.E. (2001). An analysis of elementary teachers' beliefs regarding the teaching and learning of science. *Science Education, 86* (1), 1-22.

Lewthwaite, B. (2005). 'It's more than knowing the science': A case study in elementary science curriculum review. *Canadian Journal of Science, Mathematics and Technology Education, 5*(2), 171-184.

Lumpe, A.T., Haney, J.J., & Czerniak, C.M. (2000). Assessing teachers' beliefs about their science teaching context. *Journal of Research in Science Teaching, 37*(3), 275-292.

Lyon, E.G. (2011). Beliefs, practices, and reflection: Exploring a science teacher's classroom assessment through the assessment triangle model. *Journal of Science Teacher Education, 22*(5), 417-435.

Marshall, C., & Rossman, G.B. (1999). *Designing qualitative research* (3rded.). Thousand Oaks: Sage Publications.

Martínez, J.F., Stecher, B., & Borko, H. (2009). Classroom assessment practices, teacher judgments, and student achievement in mathematics: Evidence from the ECLS. *Educational Assessment, 14*(2), 78-102.

McMillan, J.H., Myran, S., & Workman, D. (2002). Elementary teachers' classroom assessment and grading practices. *The Journal of Educational Research, 95*(4), 203-213.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.

Ministry of National Education. (2003). *Primary school regulation*. Retrieved July 20, 2012, from Ministry of National Education Web site: http://mevzuat.meb.gov.tr/html/225_0.html

Ogunkola, B.J., & Archer-Bradshaw, R.E. (2013). Teacher quality indicators as predictors of instructional assessment practices in science classrooms in secondary schools in Barbados. *Research in Science Education, 43*(1), 3-31.

Orphanos, S. A. (2008). *Do good grades make a good teacher? An investigation of the relationship between teachers' academic performance and perceived teacher effectiveness in Cyprus*. (Doctoral Dissertation). Retrieved from ProQuest Database.

Orpwood, G. (2001). The role of assessment in science curriculum reform. *Assessment in Education, 8*(2), 135-151.

Patel, R. N. (2010). *Educational Evaluation: Theory & Practice*. Mumbai: Himalaya Publishing House.

Penuel, W., Fishman, B.J., Gallagher, L.P., Korbak, C., & Lopez-Prado, B. (2009). Is alignment enough? Investigating the effects of state policies and professional development on science curriculum implementation. *Science Education, 93*(4), 656-677.

Priestley, M. (1982). *Performance assessment in education and training: alternative techniques*. Englewood Cliffs, New Jersey: Educational Technology Publications, Inc.

PSTC Development Committee. (2005). *Turkish primary science and technology curriculum*. Retrieved July 18, 2012, from Ministry of National Education, Teaching and Education Board Web site: http://ttkb.meb.gov.tr/www/ogretim-programlari/icerik/72.

Roehrig, G.H., & Kruse, R.A. (2005). The role of teachers' beliefs and knowledge in the adoption of a reform-based curriculum. *School Science and Mathematics, 105*(8), 412-422.

Rogan, J.M., & Grayson, D.J. (2003). Towards a theory of curriculum implementation with particular reference to science education in developing countries. *International Journal of Science Education, 25*(10), 1171-1204.

Rogan, J., & Aldous, C. (2005). Relationships between the constructs of a theory of curriculum implementation. *Journal of Research in Science Teaching, 42*(3), 313-336.

Rosas, R. (2014). Elementary school teachers' and principals' formative assessment beliefs, practices, and assessment literacy. (California State University, Fresno). *ProQuest Dissertations and Theses*, 109. Retrieved from http://search.proquest.com/docview/1559970533/abstract?accountid=7181. (1559970533).

Sato, M., & Atkin, J.M. (2006). Supporting change in classroom assessment. *Educational Leadership, 64*(4), 76-79.

Sharp, J.G., & Grace, M. (2004). Anecdote, opinion and whim: lessons in curriculum development from primary science education in England and Wales. *Research Papers in Education, 19*(3), 293-321.

Sharp, J.G., Hopkin, R., & Lewthwaite, B. (2011). Teacher perceptions of science in the national curriculum: findings from an application of the science curriculum implementation questionnaire in English primary schools. *International Journal of Science Education, 33*(17), 2407-2436.

Siegel, M.A., Hynds, P., Siciliano, M., & Nagle, B. (2006). Using rubrics to foster meaningful learning. In M. McMahon, P. Simmons, R. Sommers, D. DeBaets, & F. Crowley (Eds.), Assessment in science: Practical experiences and education research (pp. 89-106). Arlington, VA: National Science Teachers Association Press.

Stears, M., & Gopal, N. (2010). Exploring alternative assessment strategies in science classrooms. *South African Journal of Education, 30*(4), 591-604.

Stefanou, C., & Parkes, J. (2003). Effects of classroom assessment on student motivation in fifth-grade science. *The Journal of Educational Research, 96*(3), 152-162.

Stiggins, R. (2005). From formative assessment to assessment for learning: A path to success in standards-based schools. *Phi Delta Kappan, 87*(4), 324-328.

Stiggins, R., & Chappuis, J. (2008). Enhancing student learning. *District Administration, 44*(1), 42-44.

Towndrow, P.A., Tan, A-L., Yung, B.H.W., & Cohen, L. (2010). Science teachers' professional development and changes in science practical assessment practices: What are the issues? *Research in Science Education, 40*(2), 117-132.

Van Driel, J.H., Bulte, A.M.W., & Verloop, N. (2008). Using the curriculum emphasis concept to investigate teachers' curricular beliefs in the context of educational reform. *Journal of Curriculum Studies, 40* (1), 107-122.

Waters, F.H., Smeaton, P.S., & Burns, T.G. (2004). Action research in the secondary science classroom: Student response to differentiated, alternative assessment. *American Secondary Education, 32*(3), 89-104.

Wolfe, E.W., Viger, S.G., Jarvinen, D.W., & Linksman, J. (2007). Validation of scores from a measure of teachers' efficacy toward standards-aligned classroom assessment. *Educational and Psychological Assessment, 67*(3), 460-474.

Yin, R. K. (1984). *Case Study Research: Design and Methods*. Newbury Park, CA: Sage.

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Appendix 1: The PT and its Rubric Used by the Teacher

Subject: Properties of matter

Directions:

1. Decide which properties of matter will be investigated (at least 5 properties).
2. Decide which experiments will be done.
3. Provide required materials.
4. Draw a table to write results.
5. Make experiments.
6. Write down what you see on the table.
7. Work clean and tidy.
8. Compare the results with your friends.

Sample Table:

	Eraser	Coin	Paper	Sponge	Gold	Glass	Wood	……
Magnet attracts								
Magnet does not attract								
Swims in water								
Sinks in water								
Attracts water								
Does not attract water								
……								

Note: You can use a new table for each investigation.

RUBRIC

CRITERIA	**PERFORMANCE LEVEL**			
	Very good (4)	Good (3)	Moderate (2)	Need to develop (1)
Investigation of sufficient number of property				
Investigation of sufficient number of matter				
Investigation of matters with experiment				
Drawing tables properly				
Writing results on the table				
Achieving the right results				
Preparing a cover page				
Clean and tidy work				
Completing the work on time				
Readiness of work for presentation				
TOTAL:				

Student name:

Appendix 2: The PRT and its Rubric Used by the Teacher

SCIENCE AND TECHNOLOGY COURSE PROJECT TASK

Subject: Use of electricity and its production
Deadline: May 18, 2011

Directions:

1. Places in which electricity used.
2. How does electricity facilitate our life?
3. How is electricity generated? (river, coal, nuclear, etc.).
4. New alternatives in generation of electricity (inexhaustible sources).
5. How do you wish electricity be generated?
6. Investigate issues mentioned above (take notes).
7. Prepare your plan and enrich it with visuals.
8. Write your works nicely.
9. You can work on the computer.
10. Prepare a cover sheet.
11. Write down references you used.
12. Be careful to keep your homework clean and tidy.
13. Prepare your homework for presentation.
14. Submit your homework on time.

RUBRIC

CRITERIA		POINT
The chosen subject is searched and explained	40 points	
Original thoughts are specified	10 points	
Visuals are used	10 points	
Homework is clean and tidy	10 points	
Homework is written nicely and carefully	10 points	
Cover sheet is prepared	5 points	
Homework is finished on time	5 points	
Presentation is done	10 points	
	TOTAL:	

Student name:

Appendix 3: The Written Report (lab report) used in the Classroom

Is each luminary a light source? In order to learn this, do the activity given in page 112 in your course book.

Are the objects emitting light in the classroom environment? Write your observation results.

Name of the object	**Result of observation**
1.	.....
2.	.....
3.	.....
4.	.....
5.	.....

What did you observe when you illuminated objects through flashlight? Please write down.

Objects look like a light source	**Objects do not look like a light source**
.....	.....
.....	.....
.....	.....

Result and Interpretation

1. What is the reason of the difference between before and after illuminating objects?
   .....
   .....
   .....

2. What are common properties among objects that look like a light source?
   .....
   .....
   .....

3. What are other objects that can be seen as a light source in an illuminated environment? Give example.
   .....
   .....
   .....