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SNAPSHOT OF SCIENCE CLASSROOM TEACHING FROM THE POINT OF VIEW OF IDEAS OF CONSTRUCTIVISM: A CASE STUDY – SECONDARY SCHOOLS IN SOFIA, BULGARIA

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Abstract. This paper provides the argument for in-service teacher training for secondary science educators in Bulgaria. Teachers need content knowledge as well as updated teaching methodologies. Observations of Bulgarian science classrooms confirmed the results of previous studies: Bulgarian teachers blend teacher-centered and student-centered style of teaching methodology. Bulgarian classrooms will be more effective if teachers are reintroduced to the constructivist, inquiry, problem-solving teaching methodology. Teachers need in-service constructivist-based education sponsored by the education departments of chemistry, biology, physics and mathematics faculties.

Keywords: constructivist environment, ESTEEM, science classroom teaching

Introduction

This is the final investigation instrument concerning the degree of constructivist, student centered inquiry education in secondary science education classrooms in the Republic of Bulgaria. Initially ten schools were recruited by the Faculty of Chemistry and Pharmacy of the Sofia University in Sofia for adequate sampling, demographic similarity and efficiency in transportation and communication. The actual population of the schools selected was determined by the number of schools and science educators that have elected to participate. The same schools have been researched in regards to Teachers Pedagogical Philosophy (TPPI), and Constructivist Learning Environments Surveys (CLES) from the teacher's perceptions and expectations and the students' perceptions and expectations (Hollenbeck, 1999). Five of the teachers invited us to return to their classrooms to conduct the final investigative instrument, the Expert Science Teaching Educational Evaluation Model Science Classroom Observation Rubric (ESTEEM SCOR). This is an observation of the teacher and their classroom that trained observers are able to analyze the degree of constructivist teaching methodology in the actual classroom.

This paper provides the argument for in-service teacher training for secondary science educators in Bulgaria, and for the need for the teacher trainers and universities to take an active role in providing updated content knowledge and teaching methodology to improve science education for all students.

Methodology

The Expert Science Teaching Educational Evaluation Model Science Classroom Observation Rubric (ESTEEM SCOR) (Burry-Stock & Oxford, 1994) addresses the question: What are the linkages between perceptions of new teacher performance and their actual classroom teachings? The ESTEEM is based on the Constructivist Learning Model developed by Yager (1991). Burry-Stock & Oxford (1994) describe this instrument as a tool to determine the awareness level of science teachers relative to the constructivist science teaching perspective. This instrument provides information concerning five aspects of teaching (teacher and student behaviors): (1) a classroom observation of teaching and student behaviors; (2) recall and conceptual student outcomes for one lesson; (3) a recall and conceptual student outcome rubric to be used as the end of the lesson; (4) a teacher's self-report of teaching practices, and (5) a teacher's self-report of his/hers grading practices.

The classroom observation rubric strongly reflects expert science teaching.

This instrument enables the researcher to measure outcomes pertaining to both the teachers and their students. The Science Classroom Rubric assesses science teaching from a constructivist perceptive.

The ESTEEM SCOR assesses a direct observation of the teacher's instruction. This instrument allows the researcher to assess science teaching using an analytical scoring guide. The ESTEEM rubric is designed to rank teachers on a 5-point scale. A rating of "5" would indicate an expert teacher level. A "3" ranking would indicate a capable, experienced teacher and a "1" would denote an inexperience teacher. A "0" score indicates that information was neither credible nor provided. This scale used to rank the teachers is defined by research by Leinhart & Greeno (1986). Scores of "2" and "4" are seldom awarded on this rubric. The behaviors observed are categorized into four subcomponents that include structure of content, teacher's actions, and resources and classroom environment. The four components of the ESTEEM SCOR instrument include: (i) facilitating the learning process from a constructivist perspective; (ii) Content-Specific Pedagogy (Related to student understanding); (iii) Content-Specific Pedagogy (Adjustments in Strategies based on interactions with students); (iv) Content knowledge of subject matter summary.

The validity of the ESTEEM SCOR is assured by the standardized procedures used in collecting data and having two evaluators grading the tapes. The interrater reliability check on 20 percent of the data chosen randomly was used to indicate agreement. Two faculty researchers and a graduate student were trained in the utilization of the ESTEEM

SCOR instruments for classroom observation. Training was conducted for more than eight hours until 90 percent rater reliability was achieved. The level of agreement among the two inter-raters using Fleenor et al. (1996)'s approach indicated a significant chi-square, which means that the observed agreement was greater than the agreement that would be derived by chance. The level of agreement among the raters was 0.88 for this study.

To obtain, analyze, and provide information for making decisions on the teacher and the classroom, a five-step model was designed (Burry et al., 1989; Burry-Stock & Oxford, 1993). These five steps must be applied to any kind of data collection efforts for performance assessment using the ESTEEM.

The five steps listed by Burry-Stock & Ohford (1994) are: (1) observe the data source; (2) record objective and accurate data; (3) retrieve the observation using some form of a record; (4) analyze the observation by comparing the record from the data source to a specific criterion, and (5) judge the observed performance using the information from the analysis step.

Each of these steps was observed by the researchers in sequence to protect the validity of the instrument. All data was collected live from the teacher's classroom, because of policies set forth by governmental agencies that severely restricted the use of videotaping classrooms.

Discussion of data

Table 1. ESTEEM SCOR results

Teachers	Average score by categories							Total score
	A	B	C	D	E	F	G	
Teacher T1	3,0	3,0	3,0	1,0	2,0	4,0	5,0	**21, 0**
Teacher T2	3,0	3,0	1,0	2,0	3,0	3,0	3,0	**18,0**
Teacher T3	3,0	3,0	3,0	1,0	3,0	3,0	5,0	**21,0**
Teacher T4	5,0	5,0	3,0	4,0	3,0	4,0	3,0	**27,0**
Teacher T5	1,5	1,5	1,0	1,0	3,0	3,0	3,0	**14,0**
Summative Average	**3,1**	**3,1**	**2,2**	**1,8**	**2,8**	**3,4**	**3,8**	**20,2**

Key to codes: the values in the row are the mean score for the inter-raters' scores

A. Teacher as facilitator
B. Student engagement
C. Student experience
D. Novelty
E. Textbook dependence
F. Student conceptualization
G. Student relevance

ESTEEM rankings:
>25 Constructivist
25-20 Transitional
<19 Traditional Teaching

A. Teacher as a facilitator

5= Students are responsible for their learning experience. Teacher facilitates the learning process. Teacher-student learning experience is a partnership.

3= Students are not always responsible for their own learning experience.

1=Teacher directs the students more than facilitates the learning processes (Teacher-student learning experience is directed towards students).

B. Student engagement in activities

5= Students are actively engaged in initiating examples, asking questions, and suggesting and implementing activities throughout the lessons.

3= Students are partially engaged in initiating examples and asking questions during the lessons.

1= Students are seldom engaged in initiating examples and asking questions during the lessons.

C. Student engagement in experiences

5= Students are actively engaged in experiences (physically and/or mentally).

3= Students are moderately engaged in experiences.

1= Students are seldom engaged in experiences.

D. Novelty

5= Novelty, newness, discrepancy, or curiosity are used consistently to motivate learning.

3= Novelty, newness, discrepancy, or curiosity are used sometimes to motivate learning.

1= Novelty, newness, discrepancy, or curiosity are seldom used or not at all to motivate learning.

E. Textbook Dependence

5= Teacher does not depend on the text to present the lesson. Teacher and students adapt or develop on content materials for their lessons.

3= Teacher does depend somewhat on the text to present the lesson. Teacher and students make some modifications.

1= Teacher depends solely on the text to present the lesson. Teacher makes no modification with the students.

F. Student conceptual understanding

5= Lesson mainly focuses on activities that relate to student understanding of concepts.

3= Most of the time the lesson mainly focuses on activities that relate to student understanding of concepts.

1= Much of the time the lesson mainly focuses on activities that does not relate to student understanding of concepts.

G. Student relevance

5= Student relevance is always a focus.

3= Teacher drifts away from student relevance, but brings the lesson into focus quickly.

1= Teacher drifts away from student relevance, the teacher does not bring the lesson into focus quickly.

The ESTEEM SCOR research on Table 1 ranks two of the teachers as didactic teachers. Two other teachers – Teacher T1 and Teacher T3 are nearly on the border of being "transitional" teachers whereas Teacher T4 is ranked as a constructivist teacher. The constructivist teacher and the transitional teachers are graduates of the Chemical Faculty teacher education program of Sofia University. The teacher that received the lowest ranking (Teacher T5) was a chemical engineer prior to becoming a chemistry instructor. The education background of the other didactic chemistry teacher was similar to the constructivist teacher, but because of school culture and student discipline, a more structured environment was necessary. Support of the school administration and mutual cooperation and respect between the students and teacher was very evident in the success of the constructivist teacher's program.

The ESTEEM SCOR observations provides an effective follow up to the evidence from interviews from the Teacher's Pedagogical Philosophical Beliefs (TPPI) of Secondary Science Teachers in Sofia Public Schools, Sofia, Bulgaria study (Boiadjieva et al., 2009; Tafrova-Grigorova et al., 2012a) and surveys of students and teachers of their perceptions and expectations in the classroom measured by the Constructivist Learning Environment Survey (CLES) (Hollenbeck et al., 2009; Boiadjieva et al., 2011; Tafrova-Grigorova et al., 2012b). The ESTEEM research conducted by the same researchers with the same teachers in the previous studies (TPPPI and CLES) confirmed the teachers' self-reported data and checked the information provided by the teachers and the students of teachers.

In the constructivist teacher's (Teacher T4) classroom students were observed sharing control of the classroom, interacting with each other, sharing learning experiences, and taking charge of their learning. Apparently this teacher has utilized her pre-service preparation and becoming more aligned to the visions characterizing standards in using constructivism in the classroom.

Bulgarian classrooms will become more effective if teachers are reintroduced to the constructivist, inquiry, problem solving teaching methodology. Teachers need in-service education sponsored by the education departments from chemistry, biology, physics and mathematics faculties. Teachers need content knowledge and well as up-

dated teaching methodologies. Classrooms and laboratories need computers, adequate supplies for laboratory experiences and safety equipment. In our observations, we never saw students wearing goggles for eye protection. Laboratory safety absolutely needs to be addressed as well as teaching methodology. Chemical Education was one the highlight of Bulgarian secondary education and it is reasonable that Bulgaria can reclaim its prestige in science if teachers will make the move to teaching with the students, rather than at the students.

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