CONCERNING CONSTRUCTIVIST SCIENCE TEACHER EDUCATION IN KERALA SCHOOLS

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Abstract

This paper attempts to put together implications of some of the observed drawbacks the author as an educator and researcher has observed in science teaching practices in school of Kerala for the benefit of student teachers, and science teachers. While the observations mostly in the earlier half of this note are situated in the context of Kerala and bases on empirical data obtained through research, others mostly in the later half are ideas accumulated from reading and analysis of literature especially on constructivist science teacher education practices overseas.

Context

A study was conducted by this author at the outset of this decade (2010) on the perception of stakeholders-students, teachers, student-teachers and parents- on constructivisteducation practices in Kerala subsequent to the radical modifications suggested by National Curriculum Framework (2005). It was observed that high majority of teachers reported difficulty to fulfil the requirements. Teachers, then, attributed overcrowded classrooms, decreasing facility with three R's, disorganized learning and inadequate infrastructure. Student-teachers too reported lack of basic knowledge among students, lack of time and being not able to involve all students. Students and parents reported indiscipline, inadequacy of time, learning becoming silly and teacher partiality. Parents reported more difficulties than others and cited more responsibilities to them, and deficits like decreasing reading habit, spelling errors and less respect towards them. Most of these observation will hold true for our school education at present also. Problems of overcrowded classrooms, inadequate infrastructure, teacher partiality, inordinate responsibilities to parents might have come down for causes beyond the walls of school. Hence, further suggestions on school reforms especially for shaping real constructive school practices will not be out of place.

While the above remark on school education practice holds true for all subjects, there are more recent symptoms of these glitches specifically in science teaching-learning. I shall site an example each from biological and physical sciences. In biology, even terms used in day-to-day life are

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found difficult for majority of for secondary students especially in areas likecell biology and genetics, and taxonomy and evolution is indicative of unrelenting lack of basic knowledge among students. In physical sciences, condition is further intricate as intrinsic cognitive load inherent in nature of physics and to a fair extent in chemistry interacts with extrinsic factors in teaching. This makes students' effort to learn these subjects more difficult. And, a good share of student difficulties in physics, chemistry and biology originates from what students feel generally about nature of content included in school science and the way science is taught.

Luckily, most of the key issues in school science education can be controlled by teachers themselves. However, despite exemplary knowledge in the content area, teachers' pedagogical knowledge and disposition in applyingdifferent classroom practices are still uncertain. Hence, deliberation on effective, motivating, useful curricular and instructional practicesworkable with the existing facilities are still relevant. Thoughtful and properly designed practices and strategies will benefit students, teachers and community.

Implications of Constructivist Principles for Science Teacher Education

The following account is on applying the suggestions from literature for improving and making science education in schools of Kerala. Different aspects of constructivism in science teacher education namely goals, methods and models, Specific strategies and techniques, school and class environment and evaluation are concisely discussed. .

Goals

Constructivistpracticesin school science and hence in preparation of teachers may focus on:

1. Developing in students the ontological natureof science
2. Considering students' needs while planning the curricula and lessons
3. Giving learners meaningful, concrete experiences in which they can look for patterns, construct their own questions, and structure their own models, concepts, and strategies

4. Enhancing extent, the richness, and the integrity of students' cognitive structures and the usage of meta-cognition, and information processing strategies
5. Providing opportunity to reflect on own beliefs and experiences and peers' views, and promoting argumentation on ideas with the assist of group works, brainstorming, and discussion
6. Encouragingstudents to use diverse resources in their assignments.

Classroom practices

Constructivist pedagogy requires teachers to be equipped to encourage and facilitate:

1. Attention to what students already know before they try to construct a new knowledge
2. Constructivist-oriented hands on and minds on science experiences through
    a. Prompting questioning
    b. Probing into the nature (the what and how) of learning
    c. Processes by which a groups arrives at a common understanding
3. Atmosphere for positive social interaction and free exchange of ideas amongst students and the teacher.
4. Interactive-constructivist teaching in learning cycle (engage, explore, consolidate, assess) and oral, public discourse, as well as written, private discourse, to help students construct an understanding of science.
5. Use of situation, groupings, bridge, questions, exhibit, and reflections for learning (Gagnon&Collay, 2005).
6. Use of techniques such as
    a. Word association, tree construction, concept map, and the flow map method.
    b. Cognitive maps to connect bodies of knowledge and understandings
    c. Analogical reasoning
    d. Conceptual change teaching (Conceptual change teaching attempts to convince students to change their alternative conceptions. Conceptual change text should be reinforced by using additional strategies such as concept mapping, laboratory activity, drama, group discussion, and so on)

e. Worksheets (They help students to engage in actively in learning, and provides opportunities for students to summarize and revise the concepts)
f. Generative learning model of teaching (Osborne, &Wittrock, 1985)

Other Techniques

Teacher education needs to equip student teachers with following techniques useful in constructivist science classroom.

1. Negotiation, Group teaching techniques including demonstration, question-answer, role play, drama, creative drama, simulation, pair work, group work, micro teaching, observation, description, evaluation, written and verbal feedback, and educational games; and Individual teaching techniques such as individualized education, programmed-education, and computer- assisted teaching
2. Activities requiring divergent thinking, cooperative learning, problem solving, everyday decision making, issue-based debating and discussion and School–home collaboration.
3. Enable group working, brainstorming, discussion, and development and presentation of a product
4. Relating science topics with life experiences
5. Analogies and concept cartoons helps in understanding topics (like chemical bonding in secondary school chemistry).
6. Use of information communication technologies for interactive and reflective learning

Classroom environment

Environment of teacher education should echo one that is required for learning science through construction and accordingly prepare future teachers in using such environment for students' construction of knowledge.

1. The classroom is converted to a micro-society. A small class size with enough resources and time to engage students in creative and constructive activities is needed.
2. Herbarium, terrarium and aquarium furnished with various habitats, biomes and ecosystems established in all schools including life science laboratories in elementary schools

3. Effectively organized and presented related books, booklets, newspapers, periodicals, encyclopaedia etc. (in addition to art songs, puppets, and role-playing, and visitors, story-telling and rhythmic activities).
4. Both science teacher education and school science education need to emphasize major concepts in science, exploring the depth, not the breadth of scientific knowledge.
5. Avoid gender stereotyping of the topics by pointing to examples, illustrations, assignments and the like that apply equally for boys and girls.

Evaluation techniques

Teachers using constructivist strategies in their activity needs to change the practice of traditional evaluation and needs to be equipped to adopt evaluation activities of teacher and student together, by effectively coupling with conventional evaluation tests, assignments (Iofciu, Miron, &Antohe, 2012). This requires student teachers to have competence with:

1. Portfolio collections, performance assessments, peer assessments, group assessment and self-evaluation.
2. Authentic assessment techniques such as project, diary, rubric, checklist, poster

Good settings for teacher learning whether preservice or in-service—in colleges of education and schools—needs to provide rich opportunities for research and inquiry, for trying and testing, for talking about and evaluating the results of learning and teaching (Darling-Hammond, 2008). The "rub between theory and practice" (Miller &Silvernail, 1994) occurs most productively when questions arise in the context of real life of learners and work in progress, and where research and disciplined inquiry feed one another.

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