

PROFESSIONAL DEVELOPMENT FOR INNOVATIVE SCIENCE TEACHING: A CASE STUDY OF A PRIMARY SCIENCE TEACHER

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As a teacher educator and a teacher-researcher I am interested in professional development of teachers. I am particularly interested in the experiences that teachers undergo when exposed to a teaching strategy for the first time. This study was initiated to look critically at the experience of primary science teachers taking part in the Certificate in Education in Science (CE-Science) offered by the Aga Khan University, Institute for Educational Development, Karachi. The research question under study was: What is the experience of primary science teachers when exposed to a new teaching strategy and the process that they follow in using the strategy in the classroom for the first time? The four-member teaching team/research team[1] undertook to develop four independent case-studies under the leadership of the author. The case of Farhana Batool[2] a primary science teacher in a private English medium school in Karachi is presented.

AKU-IED was established in 1993 as part of the Aga Khan University. The Institute's programmatic activities include a PhD programme in Education, a two-year Master of Education and in-service Certificate Programmes. The Certificate in Education is an eight-week in-service program offered in five curriculum areas (science, mathematics, English, social studies and primary education). The CE-Science, was offered every year to primary and secondary science teachers. One of the objectives of CE-Science is to expose science teachers to new and innovative teaching strategies in science in line with a constructivist approach to teaching. One promising approach is through the use of 'discrepant events' (Kavogli, 1992, Mustafa, 1998). Discrepancy refers to a dissonant situation where the outcome is contrary to what the learner expects. This results in arousal of conflict with a consequent need for the learner to assimilate the unknown or incongruous material into his or her cognitive structure. This concept of discrepancy can be traced to the early work of Festinger (1957) and his Theory of Cognitive Dissonance in which he stated that the creation of dissonance is psychologically very uncomfortable and motivates individuals to actively reduce the level of dissonance and thereby return to a state of greater equilibrium or consonance. Hence, discrepant event is included in the repertoire of strategies introduced to teachers enrolled in the CE- Science.

The participants of the study were drawn from the twenty-two teachers taking part in the CE-Science. These teachers could be categorized into four groups: Teachers from the government schools, private schools, Aga Khan Education Services both within Pakistan and the region[3]. One teacher representing each sector was selected to participate in the study after making sure that they had studied science in school, had been teaching science at the primary level for at least three years and were doing well in the inservice programme. Farhana was a bright and articulate teacher who participated enthusiastically in the inservice programme asking questions and raising issues both during class and in her reflective journal. She had the ability to grasp new ideas relatively quickly and was a very conscientious teacher.

The four teachers participating in the study were treated no differently from other participants of the Programme except that they had to sit for a 30-45 minute interview conducted after practice teaching. The data collection was spread over a four-day period in which the primary teachers were taught how to use discrepant event for the teaching of science for first time. The schedule that was followed for teaching was as follows:

DAY 1: The four member teaching team developed a hands-on six-hour teaching session using discrepant events to help the teachers attending the CE-Science to understand atmospheric pressure and related topics. A part of this session required the teachers in groups of four to engage with pre-selected discrepant events, understand the science behind it and explain it to the whole class.

DAY 2: The teachers selected a topic from a list that was provided by the school being used as practicum site and develop a lesson plan to teach a science lesson at the primary level using discrepant event as a teaching strategy. They were also expected to present their plans to their peers in the form of microteaching to obtain feedback.

DAY 3: The teachers taught the planned lesson in a real classroom using discrepant event while being observed by a member of the teaching team. They were then given feedback after the lesson.

DAY 4: The teachers improved the lesson plans and the discrepant activities.

Support and help was provided to the teachers throughout the planning and developing stage of their lesson plans. The whole lesson was observed by at least one member of the teaching team.

Data for the study was generated in the form of field notes, reflective journal and interview of the teacher conducted at end of the four day teaching unit. The teacher was also interviewed for 30-45 minutes; the interview was audiotaped and transcribed. Data analysis involved reading and coding the transcribed interview. Comments, remarks and emerging categories were noted in the margin. The themes that emerged from the codes were collapsed into large categories forming a part of the conclusions of the study.

After introducing the new way of teaching science on the first day, the second day was given over to lesson preparation. The teachers were given time to look up resources in the library to prepare their lesson plan using a discrepant event. I saw Farhana and one of her colleagues at the photocopier getting some activities copied. I asked them how they had located the activity. They told me that they looked for an activity that they could do easily, for which the materials were easily accessible and then looked in the textbook to see the absence or presence of that topic; after that they came up with an objective for the lesson.

In essence the sequence was exactly same as the one that we as the teaching team had followed in planning this session and also interestingly it is also the exact opposite to what we profess to teach, i.e. make the objectives first and then develop the lesson. In the course schedule the four days were designated for teaching some concepts in biology. However, we found very few discrepant events suited to teaching biology and even fewer resource materials that could be used to help develop the events. Hence, it was decided to teach atmospheric pressure, as there was lots of material available in this area. Does it mean that in some strategies like the discrepant event it is easier to first locate the activities and resources and then select the topic area? Is there any harm in following this practice?

Farhana was expected to teach convection current in air to class four pupils for her practice teaching. She selected a discrepant activity “hot air rises” to demonstrate to pupils how convection currents are set up in air. Her lesson was very successful in that it achieved the main objective of letting the children see that hot air rises. Her management of the class and the materials was excellent, though initially she faced some difficulty when all her students could not see the demonstration. However, the best part of the lesson was the manner in which she had used the Predict Observe Explain (Woolnough, 1991) sequence of questioning to enhance student engagement and suspense. My analysis shows that Farhana went through at least three stages:

The appreciation stage which I have called the wow and vow stage!

The application stage which I have called the muddling through stage

The analysis stage which I have called the second thoughts stage

The wow and vow stage is the initial euphoria where Farhana was delighted with the presentation made by the teaching team, she called it almost magical. She was fascinated by the activities presented, the manner in which it was presented to create disequilibrium in her mind and the way it was resolved by teaching the content. She also vowed to teach in a similar manner. The second stage comes into play when a teacher like Farhana is given time to develop her own lesson plan using this strategy. Immediately, there is almost a sense of panic and she with her colleagues is seen in the library and at the photocopier making copies of potentially suitable activities. During this time Farhana made two decisions that helped her to succeed. She decided on a topic and did not change it even if the activity that she had selected did not work.

The second stage, I have labeled as the muddling through stage where Farhana tried a number of activities and different ways to develop it so that the discrepancy was highlighted to generate student disequilibrium and motivation. She took her time in selecting an activity and when that did not work she chose to select another activity covering the same topic rather than change the topic and the activity. This is where a number of her colleagues had difficulty. As soon as an activity did not work they panicked and chose another activity that they thought would work unmindful of the topic area. That meant that not only did they have to work on a new activity they had to read up and understand a new topic area. Successful passage through the muddling stage defined success for Farhana. She needed the time and space to work on her activity and materials, to fail at it and work more on it to improve it or change it. However, support and pressure both are required at this stage – if no support is provided the teacher would soon become frustrated trying to do a task for which she is not well prepared. However, if there was no pressure it is possible that Farhana might have not been able to prepare a discrepant even so soon after introduction to it. The pressure was provided in two ways, (a) by requiring the teachers to prepare a lesson to teach in a real school and (b) by expecting teachers to demonstrate a part of the lesson in front of their colleagues. Farhana reported that microteaching from the whole teaching sequence was most helpful in clarifying ideas, removing confusions and improving the lesson planned.

The last stage was the stage where Farhana had second thoughts about her ability to engage and use this strategy in her own classroom. Despite conducting a successful lesson, Farhana reflected on the effort required to prepare a discrepant event suited to the needs of the lesson. She felt that it might not be possible to expend the time and energy required in her own school.

The biggest challenge for teacher educators is to devise means where the teacher can undergo two or three cycles of the muddling through stage – each iteration would help them to get closer to the stage which Bonsetter (1998) has called the phase III. He states that teachers go through three phases as they try to implement reform in education:

Phase I: The pre-reform stage where the teacher is "doing what you have been doing"

Phase II: The teacher is exposed to a new way of doing something via a one-day workshop. S/he tries it out and it does not work and s/he concludes "this stuff is just another short term educational trend". And they revert back to phase I

Phase III: The teachers do not stay long enough with the reform to reach the phase III where teachers reflect on what they are doing and how they might integrate these new ideas into their pre-workshop repertoire of teaching tools.

To keep the teacher engaged with a new strategy until she becomes comfortable using it, is the challenge that is facing teachers educators at AKU-IED too. One of the reasons that the Certificate in Education has transformed into a more field-based format is to extend and lengthen the Phase II and support the muddling process so that the teachers reach the Phase III.

Additional Information

[1] I acknowledge the contribution of the Ms. Shahida Javed, Mr. Idrees Ahmed and Mr. Saeed Nasim in working with me on this project.

[2] A pseudonym has been used to protect the teacher's identity.

[3] The region comprises Afghanistan, Bangladesh, India, Kenya, Pakistan, Kryghistan, Tajikistan, Tanzania, Uganda, Uzbekistan.

References

- Baker, D. B. (1997). *Constructing science in the middle and secondary school classrooms*, London: Allyn and Bacon, 1997.
- Bonstetter, R. J. (1998). Inquiry: Learning from past with an eye on the future. *Electronic Journal of Science Education* 3 (1):1-5, 1998.
- Collette, A. T. & Chiappetta, E. L. (1989). *Science instruction in the middle and secondary schools*. Columbus: Merrill.
- Friedl, A. E. (1991). *Teaching Science to Children: An Integrated Approach*. (2nd ed.). London : Random House.
- Gunstone, R. F., Loughran, J., Berry, A. & Mulhall, P. (1999). *Inquiry in science classes- Do we know "how, when and why"?* Paper presented at the annual meeting of AERA in Montreal, CA. in April 1999.
- Kavogli, Z. (1993). Discrepant events: An alternative teaching process. *Science Education International*, 3, (3), (10-13).
- Liem, T.L. (1991). *Invitations to Science Inquiry*. Enterprises : Science Inquiry Chino Hills Enterprises.
- Liem, T. L. (1987). *Invitations to Science Inquiry*. (2nd ed.). Science Inquiry Chino Hills Enterprises.
- Martin, D. J. (1997). *Elementary Science Methods: A constructivist approach*. New York: Delmar Publishers.
- Mustafa, S. (1998). *Discrepancy: An innovative strategy for promoting students' learning in science*. *Unpublished master's dissertation* of the Aga Khan University Institute for Education

- Ruck, C., Young, P. & Crocker, B. (1991). Using discrepant events to inspire writing. *Science Activities* 28 (2):27-30, 1991.
- Ruck, C., Young, P., & Crocker, B. (1991). Using discrepant events to inspire writing: Creative ideas, 28, (2), 27-30.
- Shrigley, R. L. (1987). Discrepant events: Why they fascinate students. *Science and Children*, 24-25.
- Woolnough, B. (1991). *Practical Science*. Milton Keynes: Open University Press.