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Teaching Strategies to Enhance Science Learning among Diverse and Multicultural Learners

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Abstract - This paper presents teaching strategies in science for students having "deficits", negative attitudes, with inadequate content knowledge and communication skills in learning science. It provides teachers useful ways on how to enhance teaching among students with varied needs in a multicultural context. These strategies were recommended based from Sarmiento's (1998) case study on the specific needs of multicultural learners across multicultural setting. The study was done on three case schools identified with deficits in learning science. The students deficiency were caused by cultural factors specifically language and values on schooling shaping students understanding thus a substantial level of their interest, performance and achievement in science were affected. The results of the same study also revealed that the effectiveness of teaching science depends on the teaching practice and the strategy used by the teachers irrespective whether a class is non ethnic or multiethnic. To enhance the effectiveness in teaching to similar group of learners, the use of various teaching

pedagogy will help them become successful in science. From the case study results, the following strategies were recommended to promote science interest, build positive self concept to raise levels of achievement among diverse learners in multicultural context including teacher related limitations.

Keywords - multicultural/diverse learners: teaching strategy

INTRODUCTION

The school learning environments in their very nature seeks to increase student performance by improving the school organization. The learning environments vary from school to school though generally they produce the same level of performance. Collectively many learning limitations have an impact on the individuals' ethnicity, and the nature of the school culture. The improvement in the learning environment will only be successful to an extent when the interventions are able to outline models for instructions and practice.

The case study revealed an intimate relationship of science education with respect to culture. Science education has an important role to play in the educational outcomes of students who are culturally, economically and linguistically diverse, to enable them to succeed in science classes in school.

Teaching practices are both similar and different across countries according to Le Tendre and his colleagues from TIMMS study (2003), based on teachers from Japan, Germany and US has similarities with regards to "cultural-script". The teachers in all countries reported similar proportions of whole-class instructions, seatwork, individual guidance and pair-work. This was also found from the findings of the Classroom Environment Study by Lorin Anderson and his colleagues on actual practice in eight countries (Anderson, 1987; Anderson, Ryan and Shapiro, 1989).

Today, the most commonly posed education issues are on bureaucracy or administrative accountability and professional

accountability (Adams and Kirst, 199; Darling and Hammond and Acsher, 1991; O Reilly, 1996).

Professional accountability is rooted in the assumption that teaching involves completion of specified teaching and learning activities and procedures which are governed by bureaucratically defined rules. However, it is common knowledge that effective teaching rests on professionals acquiring knowledge and skills and being able to apply such knowledge and skills to the specific learners they teach.

In education, the focus of professional accountability is described in three folds:

1) First, centered on the process of instruction- the work of the teacher as they interact with students around instructional content (Cohen and Ball, 1999; Mc Laughlin and Talbert, 2001).
2) Second, much of the process of professional accountability concerns ensuring that educators acquire and apply the knowledge and skills needed for effective teaching. Acquisition of knowledge is first and foremost duty of teachers.
3) Third, professional accountability involves more professional interchange. These norms include placing the needs of the students at the center of the professional work, collaborating with other professionals to address those needs and in ensuring that high standards of practice are maintained which all form part and parcel of their professional responsibilities. At the system level, professional accountability centers on professional interaction with colleagues and students. Mentoring, collaboration and collaborative problem solving in response to student needs and peer review to ensure quality practice are also part of professional accountability.

Advocates for teacher's accountability, argue that this approach holds a most promise for the improvement of teaching and for the improvement of the student learning in science. Teacher preparation draws attention both to instructional practice (agent strategies) and to the teachers' responsibility to the student in learning process. The norms of collaboration around instruction enhance patterns of interaction at the school level and allow the dissemination of effective strategies and information.

FRAMEWORK

A qualitative study documented three multiethnic high school biology classrooms using ethnographic techniques to find out the influence of selected cultural variables affecting students' performance and attitude towards science.

The sample constituted 28 students from different ethnic backgrounds. The research focused on three main areas: (1) cultural factors influencing science attitude and performance, (2) types of interactions and learning opportunities offered by the curriculum of the schools, and (3) teaching practices and how these affect performance and attitude of students.

The data gathering techniques were classroom observations, exploratory and probed interviews on the lessons during the 6 months observation period. All classroom discourses were tape-recorded. Field notes were taken down to record classroom scenarios, community and campus observations and document events particular to the schools. Other documents collected constituted students' laboratory reports, assignments, concepts maps and teacher-made test.

The research findings revealed that the school attributes did not demonstrate differences in their performance and attitude towards science. The students' diverse learning deficiencies when grouped according to their ethnicity, gender and multicultural background were much related to the limitations of the Learning Environment, as well as teacher related limitations such as:

1. Large class size, inadequate facilities, equipments and instructional materials, multi-ethnolinguistic background of the learners;
2. high rate of absenteeism, very limited communication skills, poor comprehension and poor attitude towards schooling in general;
3. teachers' inadequate content knowledge and teaching strategies; with pressure on teachers to adhere strictly to the school policies.

OBJECTIVES OF THE STUDY

This paper outline similar strategies cited by Alexakos (2001) to help teachers met the diverse needs of the students. It is hoped that these similar approaches will equally help develop positive self concept among students with such problems and to work effectively, in similar classrooms where science teachers can employ these outline strategies to address the particular needs of students with such backgrounds.

METHODOLOGY AND DISCUSSION

Strategy I. Using the A multi- approach in science learning maximizes the learning of students with language comprehension problems.

Learning is most effective when students are treated as individuals with different learning strategies, approaches and capabilities (American Psychological Assn, 1995). Science teachers have a variety of classroom measures that may be used to make the lessons interesting, and in this way decrease learning problems associated with boredom, and slow learning.

1. Teach Science as a natural subject for hands on in (Kinesthetic) learning experiences that will appeal to the visual and auditory senses.

2. Use the physical, pictorial and symbolic examples that can be integrated for multi-sensory approach to teach students with language problems. In addition, hands on scientific experiments that reinforced scientific concepts are appropriate. Such task attracts students' attention and interest (NRC 1996).

3. Create learning environments where the learning is "student centered" with tasks that are not only challenging but also relevant to the learners.

An example to such approach is a lesson in "friction" with multi-sensory appeal. How the word is used in common speech can also be discussed. Teachers can mention the expression "causing friction between friends," and compare it to the scientific usage of the word friction. Scientific and common definitions can be written in class. Interdisciplinary topics such as how friction influences car design can also be discussed.

4. The integration of the multimedia technology, such as computers equipped with speech synthesizers and voice recognition software should be employed when appropriate. Such technology can decrease the feelings of inferiority, reduce language barriers, frustration, and increase self-esteem among students. Multimedia software has an advantage over pencil and paper as students can easily include visual and aural representations of themselves, their interests, and their beliefs.

Strategy II. Create a learning environment that is nurturing and supportive for all type of students.

Positive emotions, curiosity and expectations can increase students' interest in learning, while excessive stress has negative effects on motivation (American Psychological Assn, 1995). A sense of belonging, relevance of task, hands on experiences, curiosity, humor and fun all contribute to classroom interest (Bergin, 1999). In classrooms where teachers show interest on students needs, students are more likely to ask for help (Ryan et al., 1998). The following strategies are recommended for teachers:

1. Planning appropriate lessons and making modifications in the teaching style, utilizing freely the physical space in the room. Encourage students to achieve success and competence in the subject by peer collaboration. A conducive learning environment can be created when students discuss among themselves in which stress, anxiety and disorder are reduced if not eliminated altogether.

2. Providing task done cooperatively on skills. In addition, display an interest for diverse ideas and learning styles of students by where students learn the give and take of interaction during work.

3. Allow participation among students and consciously encourage volunteerism. Students may not be willing to volunteer to answer, however, teachers must encourage and ensure that all students including those with learning disabilities participate in the learning process.

4. Furthermore, encourage collaboration among students to make them aware of the importance of learning new skills from peers. This

will reduce individual competition and inferiority complex. Beneficial gains can be achieved when students are encouraged to participate.

In a conducive environment, students view learning as a stepping stone to further their mastery rather than failures (Ames and Archer, 1988). The laboratory is the most suitable place where collaboration can be applied especially when doing group task.

5. Group students in teams of three or four to do experiments which can achieve positive interpersonal relationships and use their strength to contribute to the required task on hand. A student with slow comprehension could learn from the ideas of others from the group. Such positive interdependence promotes a sense of belonging and feeling of accomplishment.

Strategy III. Students can develop scientific knowledge overtime through repeated exposure and integration of a particular scientific concept.

There is a limit on how much an individual can learn at any one time. An effective method of learning a concept involves breaking information into smaller chunks and then relating the smaller information into larger units. With topics covered in manageable proportions, students can easily process, internalize and remember concepts.

Students' knowledge can be expanded and reinforced over time if they can relate knowledge learned from the past to gain insights into the new material (Shuell and Lee, 1976).

1. Teach science using the active process. Students need to learn how to integrate many different ideas, draw relationships and use them to explore and understand new phenomenon. Such processes help those students with language and learning difficulties to understand things better.

2. Further engage students to active participation, they can be asked to stand up, walk and run, discuss among their peers. As the lesson, progresses the concept can be applied to their daily life.

3. Provide each students topics where they are given chances to reflect on the relationship of a concept, internalize their knowledge and

its application to everyday experiences through sharing their views.

For teacher-related limitations such as inadequate content knowledge and teaching strategies, with pressure on teachers to adhere strictly.

Teachers with poor level of training are unlikely to fulfill such task effectively. De Fieter (1995) asserts, poorly trained teachers cannot cope because they don't know what and how to teach. Improving the quality of science education for an ever increasing school population with no trained teachers and within limited financial resources is often a difficult task. Peer coaching is also described as a collegial approach in teaching aimed at integrating new skills and strategies in the classroom practice for untrained teachers (Joyce and Showers, 1982).

Joyce and Showers (1995) make a distinction between peer coaching that supports teachers with implementation of a specific innovation, and peer coaching with more general focus aimed at demonstration and practice purposes. This support is needed to help teachers integrate new skills within their existing teaching reportoire, and to assist them in overcoming initial uncertainties created by the required change (Loucks-Horsley, et. al., 1998). Beside supporting individual learning, peer coaching can also foster collegiality in schools (Sharan and Hertz-Lazarowitz, 1982; Sparks and Bruder, 1987).

Strategy IV. Creation of peer coaching for non-specialized teachers as an innovative method with the provision of an activity-based approach where teachers are encouraged to do hands-on.

1. Initiate peer coaching among teachers as an important component where teachers are encouraged to organize peer coaching activities to support each other especially in the implementation of the activity-based teaching.

2. Provide teacher training on how to coach on the use of new teaching strategies more frequently and with greater competence. Allow the coached teachers to experiment more with the strategies, to have greater long term retention of the new teaching skills adapting them to the needs of their students.

3. Encourage peer coaching to enhance mutual sharing and assistance among teachers. To create such conditions strong leadership

at school level is essential. Teachers should receive training in activity-based approach where they are encouraged to do hands on, learn coaching skills, like classroom observation and discussion.

4. Practice inter-group collaboration among teacher being coached using sharing strategies. Provide scaffolding in sharing models, which can be used to jointly solve class-related problems through exploration and discussion. The discussions on the issues and problems among teachers with peer support for each other in relation to the content and process to integrate the new skills in the classroom practice.

5. Provide appropriate and authentic outlets and audiences for the collaboratively created products among teachers. Collaboration allows coaching teachers to play multiple roles in learning. Thus, coach teachers will develop more confidence in the area they felt adequate building on the strengths of each other as a learner, as those who are good at certain topics will do the majority of the leading in these areas. Other teachers will move to the fore, as their strengths are needed.

CONCLUSIONS

Today, science educators face a formidable task of developing science and technology education curricula that is self attained, responsive to the needs of diverse learners within many context. Science education must provide students with adequate preparation according to various educational needs.

This paper has attempted to highlight the source of problems most public schools faced with diverse learners. It describes the three related limitations specifically on the learners, teachers and the learning environments that relates to culture with suggested strategies that will work out to similar classrooms mentioned. Although unique in the Philippines, it has somehow notable similarities with other Asian countries faced with the same problems. It is the contention of the author that the various strategies will help on similar problems faced by almost all multicultural classrooms within the formal curriculum system.

It is clear that enhancing effectiveness in teaching can be achieved through the applications of these strategies, to empower and promote change among multicultural learners in next school generation. To

increase interest in science among multiethnic learners the challenges to responds to their needs has to be tackled simultaneously.

Moreover, science education must be delivered in a way which is both accessible and attractive to the multiethnic learners with diverse needs. Any form of formal education cannot afford to overlook or avoid the wider and uncomfortable realities and issues in education. It should equip learners with the necessary knowledge and skills in meeting their needs. Science education must to be practically useful and relevant to attract and retain learners particularly those from the underrepresented groups.

Furthermore, it allows aspects of adverse cultural practice and traditional attitudes to be addressed which have a critical influence on the perceived benefits of schooling and consequently improve positive self concept among diverse forms of learners. A well thought curriculum is, it is only as good as teacher who delivers it.

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