Original Article

Qualitative Exploration on the Application of Student-centered Learning in Mathematics and Natural Sciences: The case of Selected General Secondary Schools in Jimma, Ethiopia.

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Abstract

This is a qualitative study as a part of general study conducted to assess the enactment of student centered learning in Mathematics and Natural Sciences. Hence, this article intended to explore qualitatively the implementation of student-centered learning in Mathematics and Science subjects from the perspectives of students and teachers in the selected schools. To this end, Interviews and Focus Group Discussions were used to solicit information from teachers and students participants, respectively. The collected data categorized into different thematic areas and analysis was done accordingly. The result depicted that students and teachers participated in study have clear conceptual understanding of student-centered learning. However, the implementation was not going smoothly to the required level. This was attributed to constraint of learning materials, large class size, the need for covering contents in the syllabus, lack of interest from student's side because of various reasons and scarcity of professional teachers. Based on that, action for enhancing the implementation of student-centered learning as well as areas for further research were identified and implied.

BACKGROUND OF THE STUDY

Focusing on the Science and Technology Education is becoming common goal for nations disregarding their developmental level (Weil-Barais, 2001) since advancement in science and tchnology help as a tool for boasting countries economic, social and political development. Teshome (2007) consolidated the forerunning ideas mentioning that to be competitive in knowledge based economy, adoption, adaptation and utilization of science and technological innovations, strengthening and expanding science and technology education is imperative. The same author presents the aggressive action taken by middle level income countries such as China, Japan, Korea and Taiwan in establishing new higher education and research institutions for science, engineering and technology education as well as expanding the existing programs. With regard to Africa countries, the Commission for Africa report recommends African countries to take specific action that strengthen Science, engineering and technology capacity for such knowledge and skills help countries to find their own solution to their own problem (Teshome, 2007).

In response to this intent, Ethiopia has held a new direction in higher education training and intake capacity. Accordingly, since September 2008, 70 percents of the higher

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education entrants assigned to science and technology while only the rest 30% goes for social sciences (humanities and business). However, production of quality professionals in science and technology influenced by entrants repertoire, which in turn influenced by the extent to which secondary education laid foundation in Mathematics and Natural Sciences (Swail, Redd and Perna, 2003). They went on discussing that academically less prepared students of secondary schools prefer Humanities and social sciences than science and technology.

In line with this, there are several points that need to be in place and realized in order to prepare effectively secondary school students for science and technology education. *In puts* in terms of qualified teachers, availability of learning materials and curriculum documents and *process*-the how of teaching, learning and assessment proceed greatly impinges the way secondary schools students prepared for science and technology education *(output)*. In the face of these realities, currently there have been paradigm shifts in the arena of education in two ways. The first has been a shift of emphasis from pure knowledge to knowledge for application and practice (Maharasoa and Hay, 2001). The second has been a move away from teacher-and textbook-dominated instruction towards more activity-based and autonomous instructional approaches (World Bank, 2000). Barr and Tagg (1995) expressed such kind of change as a shift from *instruction paradigm* (whereby academic institution delivered instruction to transfer knowledge from experts or teachers to students) to *a learning paradigm* (in which academic institution provide learning through student discovery and construction of knowledge). While there is no consensus on the naming of these innovative instructional approaches, various terms have been used to describe them. To mention some but not all, constructivism, problem-based learning, inquiry approaches, active learning, learning-centred assessment and student-centred approach to emphasize transition in the focus of instruction and assessment from teaching to learning. The education quality improvement packages developed by Ministry of Education has also underlined the need of implementing these modern methods of classroom instruction so as to achieve the intention of producing qualified graduates at all levels (Ministry of Education, 2007).

All the aforementioned terms have communality in letting students put their minds and hand actively in action in the processes of learning than merely absorbing what the book or teachers dictate them although the term student-centered approach was preferred for this study. However, this doesn't imply that students' should not learn through listening and observing the work of teachers. Rather Ertmer and Newby (1993) connoted that effective utilization of this approach depends on level of cognitive processing skills demanded by the task and the prior knowledge of the learner. On other hand, teachers dominated method is helpful in one or two of the following situations: when the task is simple and doesn't require higher order thinking. It is also useful when students' don't have prior knowledge about the task. However, for effective learning to take place in the later case, students' should move to step of learning by doing (Jonassen, 1991; 1999) either in group or individually.

On this background, this article intended to explore qualitatively the application of student-centred methods in Mathematics and Natural Science subjects from the perspectives of teachers and students. To

this end, the following questions used to guide the investigation:

- How student-centered learning is conceived in General Secondary Schools?
- How is the utilization of the student-centered approach in teaching of Mathematics and Natural Sciences in General Secondary Schools?
- What are the potential threats for the application of student-centered approach in teaching Mathematics and Natural Sciences in General Secondary schools?

Objective of the study

In general, this article attempted to explore the application of student-centered approach from the perspectives of students and teachers of the selected schools.

Specifically, the study tried to;

- describe the conceptual understanding of student-centered learning in General Secondary Schools.
- elaborate the utilization of student-centered approach in teaching of Mathematics and Natural Science subjects from the teachers and students perspectives
- identify factors impairing utilization of student-centered approach in teaching Mathematics and Natural Science subjects
- identify possible suggestions that enhance the application of student-centered learning in General Secondary Schools.

The significance of the study is one of the issues of concern of this study; hence, the recommendation to be drawn particularly will have multiple benefits either directly or indirectly in fostering the philosophy of Jimma, i.e. community based education (Jimma University, 2006). Accordingly, this condition may pave ways for the university to take part in intervening problems pinned by the study. The study is also hoped to benefit the school teachers so that they can revisit their teaching methods. The administrators of the school may also utilize the finding in taking administrative measure. These all are geared toward enhancing students' learning of Mathematics and Natural Sciences that pave ways for preparing competent entrants to the university's science and technology education.

Last but not least, the study might help as a stepping stone for those experts who want to carry out further investigation in similar arena or for those who want to design and implement intervention action.

METHODOLOGY

Study design

A qualitative design was employed to investigate the application of student-centered approach in teaching Mathematics and Natural Science Subjects in selected General Secondary Schools. In this study an attempt has been done to explore and understand qualitatively the implementation of student-centered learning from the perspectives of teachers and students. To this end, interview and Focus Group Discussion were employed to solicite information from teachers and students side, respectively.

Area of the study

The study covers General Secondary Schools (grade nine and ten) in Jimma town and the surrounding which were using non-televised instruction. Accordingly, Jimma University Community School from Jimma Town and Yebu and Bilida schools from Manna district, located at 18 km south west of Jimma town were selected. Yebu

School had used televised instruction but interrupted for about more than a semester during the study period.

Participants of the study

All teachers teaching Mathematics and Natural Sciences (Chemistry, Biology and Physics) in the three schools were source of the study. Besides, all students of the selected schools were also the target of the study.

Sampling techniques and procedures

The sample for the study was drawn from all Mathematics and Natural Science subjects (Chemistry, Biology and Physics) teachers of grade nine and tenth and students of similar grades. The overall samples in qualitative research judged according to their ability to meet specific criteria than targeting the representativeness of members included in the study so as to make sound generalization (Given, 2008). Thus, teacher participants for this study were selected purposefully based on their willingness to participate in the study, gender, and subjects they are teaching. Accordingly, an attempt was done to locate one teacher for each course (Mathematics, Chemistry, Biology and Physics) at each grade level (grade nine and ten) for each school provided that different teacher teach a given subject at both grade level. In this way, a total of 24 teachers, where female participant was only one, participated in the study.

Similarly, a purposive sampling technique was used to select students for FGD. FGD participants identified from both grades based on the merits of their academic achievement. The FGD was separately commenced for both grade levels, except that of Bilida school, where 7-10 students drawn for each FGD. The logic behind picking only best students from each grade is that these outstanding students would better in explaining themselves, and understanding the right approach of learning. Therefore, in order to identify these outstanding and extrovert students, Mathematics and Natural Science teachers were consulted.

Data quality control mechanisms

According to Denzin (1989) quality of qualitative research can be ensured via employing combinations of methods that enable researchers see the phenomena from different angles or perspectives. To this end, we utilized combination of methods

(interview and Focus Group Discussion), sources (students and teachers), and investigators (two investigators have been involved together in facilitating interview and Focus Group Discussion as well as in transcribing and analyzing the findings).

Data analysis

According to Leedy and Ormrod (2005) qualitative analysis of case study involves categorization and interpretation of data in terms of common themes in the way it serves the overall portrait of the case (cited in Fekede, 2009). For the present study, themes for analysis were identified from re-reading of the interviews and FGD scripts. In other word, data collected with the help of interview and FGD were transcribed verbatim, categorized into the corresponding theme.

In general, data were analyzed in terms of the following major themes: conception of student-centered approach of instruction, utilization of student-centered teaching in maths and natural science subjects, factors impairing implementation of students centered teaching, actions for enhancing implementation of student-centered

earning. In this way analysis was presented in the subsequent sections.

Ethical issues

The consent of school directors of the respective schools was secured first by explaining objectives of the study by submitting clearance letter from the Faculty of Education. Similarly, willingness of

teachers and students participants was asked before each interview and FGD. Moreover, Gibson (2007) point out that in qualitative data analysis participants' viewpoints shouldn't be represented in a manner that might jeopardize their reputations among their colleagues or administrators. To this end, we opted to present the data in a general way than portraying in the way it implies the identity of teachers.

Result and Discussions

This section presents result obtained through interview and FGD linking with the existing literatures on similar arenas. For that purpose we prefer to present result and discussion simultaneously though this journal prescribes to present both parts separately.

Conception of student-centered approach

Literatures show that implementing education reforms can only be done effectively when teachers understand the idea and rationale for the reform and be able to apply it in their classroom teaching (Fullan, 2001, Unesco, 2006 cited in Hogenbosch, 2009). This is specially so from learners' side (Adula, 2008). Additionally, Thamraksa (2003) denotes that the first step of implementing student-centered learning is reconceptualizing the how of teaching and learning. Hence, question addressing what student-centered approach meant for them was forwarded to teacher and student participants in order to explore their understandings. Accordingly, teachers and students participated in the study portrayed their conception of student-centered approach using various but interrelated terms, which is depicted by figure 1:

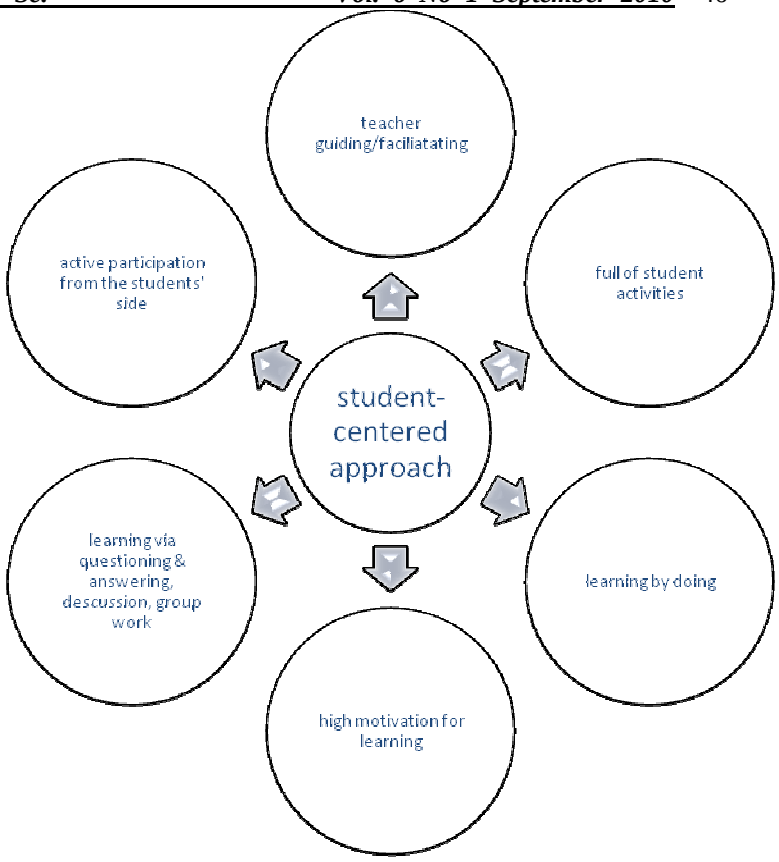

Figure 1: *Student-centered approach as characterized by respondents.*

Thus, for them, student-centered approach is a learning approach that invites students to learn by doing, rich of relevant activities, put the role of teachers as a facilitator and that of student as active participant with the help of questioning and answering, discussion, group or individual work and so on. Here is an example of extract reported during in-depth interview with teachers:

> "…I believe that my students learn actively when I provide them a chance of explaining things for themselves and got feedback, engaged in relevant activity that help them master the content, when they help as well as challenge each other than merely learning through listening and taking notes of my speech".

Similarly here is an excerpt that commonly expressed during almost all FGDs with students:

> "We learn in a student-centered way when teachers relate the topic to what we know or easily understand, inform us the relevance of the content and give us opportunity for practice through continuous exercises……"

These witness that participants have a clear understanding of the concept student-

centered approach. John Dewey, the pioneer of student-centered approach of instruction, described it as learning by doing (Dewey, 1896, discussed in Westbrook, 1999). Halloun (2006) described this kind of learning as a ways of learning either through interacting with materials or by discussing with other about the tasks to be learned, which he termed as traded knowledge. Likewise, Altan and Trombly (2001) stated that traditionally people agreed that student-centered approach put students at a center of learning than teachers. Moreover, Bender (2003) revising previously done researches set five principles that mark student-centered learning, which are similar to the characteristics summarized from respondents' responses in figure 1. Accordingly, student-centered learning occurs when learning is social, active, contextual, engaging, and student owned. Thus, portrayal of participants' clear understanding of student-centered approach is evidence at least for readiness for the use of student-centered learning.

Utilization of student-centered instruction

Regarding the utilization of student-centered approach teachers and students participants were asked to describe their views and feelings around the teaching and learning process going on in the respective Mathematics and Natural Science subjects. Further discussion points like students participation and teachers facilitation tendency, materials used to support teaching and learning, laboratory conditions and worksheet facilitation were raised in a piece meal.

Student's participation and teachers' facilitation tendency

All interviewed teachers claimed that they were implementing student-centered approach through different mechanisms such as questioning and answering, providing class work, home works followed by feedback or students' demonstration, and discussion in a broad sense. However, when asked to dichotomize their teaching either as student-centered or teacher dominated approach, except Bilida school teachers who reported that their approach were relatively teacher dominated if it is must to dichotomize in such manner, others insisted that they were using mix of the two. Although situations hampering the realization of student-centered learning are treated under separate section somewhere in this paper, it is worthwhile to cite here the experience of one teacher from Bilida School:

> "…. I believe in the value of student-centered approach but I am constantly switching back to note giving and explanation since students are not interested in such practice; and parents are also complaining during parent-school meeting when teachers give assignments/exercises that students need to practice at home in subjects like physics and mathematics. It is not clear for me how students master such hard sciences unless they take ample time at home and schools to practice. But now, due to this fact I reserved myself from giving home take exercises on a regular basis".

Data solicited through FGD with students in all schools went in line with the idea of Bilida school teachers. When they were asked strictly to dichotomize the approach each subject teachers were using as a student-centered vs teacher-centered, their response inclined to teachers' dominated method. This is in line with the classroom observation conducted in the similar areas (Adula and Kassahun, in press), study at Jimma Universty Faculty of Education

(Adula, 2008) where in both cases, teachers were shown in starting the lesson in participatory way but glided back to the teacher-centered method soon while progressing through the lesson.

However, the FGD participants witnessed the inconsistencies across teachers in enacting student-centered approach although the general notion inclined to teacher dominated way of teaching. The FGD characterizes teachers they thought as relatively good in implementing student-centered learning and those they believe as not sound not only in implementing student-centered learning but in general nuisance in facilitating learning at all. The following is sample of extracts that FGD participants used in describing teachers they encountered making learning student-centered:

> "..are very punctual, give continuous exercise with proper and in time feedback, involve students in discussing points, and prolonged group work activities…regularly provides class work and home works with constructive feedback, enhance students' participation using question and answer, discussion, relating subject matter concept to immediate experience or real life of students and create positive atmosphere for collaborative learning".

On the contrary, here is the way FGD participants described efforts of teachers whom they considered as passive in implementing student-centered learning:

> "…coming late and leaving class early; other time rushing merely to cover portion, explaining points beyond the understanding of students, doing things as it seems only for themselves, usually writing notes and leave the class at least without explaining it"

Although there is mixed feelings in FGD participants of other schools, participants from Bilida School were relatively more frustrated regarding teaching and learning processes. They justify this stating that all things they have learned were theoretical concepts. "No laboratory, at least to see its physical set up and no plasma demonstrating experiments, equipments". They kept on mentioning that there were no adequate reference materials. They mentioned that the very few existing references were bought by students. Having said that, they concluded that their school was totally hidden from the sight of government since what the government was doing for the school was merely assigning teachers and textbooks. As they said, all other things from the beginning have been shouldered by the community. They said that the cumulative effective of these all made them feel empty when they viewed General Secondary Education Qualifying Examination lying in front of them.

Despite this, Bilida school students participated in FGD were highly acknowledging attempts made by their mathematics and Natural Science teachers in helping them to succeed in their education. One of the participants put as " …our teachers are our laboratory, plasma, reference books…" .They described their teachers as "enthusiastic, energetic in helping students' learning and that is why they are constantly arranging tutorial classes in the afternoon shift at the expenses of their time."

As one can easily deduce from the above discussions, some of teachers were showing maximum effort in creating

conducive environment for making their lesson student-centered including managing the class well by coming regularly on time, attending classes and running classes as planned, which are of course prerequisite for effective learning to take place (EQUIP, 2006, MOE, 2007). Making the lesson relevant, tap upon students prior knowledge, chunking the lesson to the level of students understanding, and providing opportunities for practice in and outside of the school whether in individually or in group, which are the heart of student-centered learning according to significant people in the arena of education (Bender, 2003; Halloun, 2006; Kohonen, 1992; Thamraksa, 2003; Wellington, 2006) were reported to be manifested by teachers.

Almost the difference depends not on subject or school wise but more by the individual teachers. Different teachers teaching the same course at the same grade level even in the same school were acting differently. For instance, One of Biology teachers in one of the selected schools reported of missing classes at his own time and simply rushing through the lesson merely to compensate for missed classes at the expense of students' understandings. However, the other teacher of the same course running his job properly through chunking lessons to the level of students, providing ample activities, supporting his teaching with demonstration, and using of assignments with feedback. The same pattern with different courses has been also reported from the study schools. This situation put in question the quality assurance mechanisms employed by the selected schools in order to run the teaching and learning duties to be as it intended. Current literature suggests that academic institutions need to establish quality assurance system that identifies those people who are successful from those who are not performing well (HERQA, 2006). Fullan (2001) added that in implementing innovation in the school, there must be mechanisms in place that enforce or reinforce teachers in order to implement changes in their teaching. Therefore, exploring the existence of such mechanisms in the selected schools is a fertile area for further investigation.

Use of instructional aides/materials

Students learning become effective when their teacher supports his/her explanation with instructional aides, when students themselves got an opportunity of learning by manipulating the simulated or real tools that expert in the real world are using (So, 2002; Choi and Hannafin, 1995; Jonassen , 1991). Moreover, instructional materials are useful not only for putting students hand and mind in action but to make the lesson immediate, tangible, relevant and motivating for students' learning. Nevertheless, reality in the selected schools was quite different from this notion. Although teachers participated in the interview were claiming that they were using instructional aides sometimes in their teaching, students participated in the FGD revealed that only two teachers from two different schools were shown up with instructional aides just sometimes. Thus, the others were using only chalk and black board as students reported. Even they were not use materials which were already exist in the Pedagogical Resource Center, let alone producing new one. We have also observed only one teacher from Bilida School who was going to class with instructional aide at hand.

Use of laboratory

General secondary school is the base in preparing students for science and technology education. It is at this level where they were exposed to laboratories equipments, activities and precaution or

safety rules. It provides them opportunities to test theoretical or science concepts that they have learnt in a class room or read from books (Canterbury Christ church University, 2005). Despite the fact that laboratories have multiple benefits ranging from making learning concrete to lying basis for science education in the subsequent levels, students in the selected schools were deprived of such opportunities as witnessed from interview with teachers and FGD with group of students. Jimma university community school and Yebu school have already laboratory but not functional while Bilida school has no laboratory set up at all. Thus, these schools at a disadvantage compared to students who are receiving televised instruction who have at least exposure to laboratory equipments, demonstration of experiments which are useful for conceptual understanding of the practice (Federal Democratic Republic of Ethiopia, 2004).

Arrangements of practical works for students

Arrangements of practical works for students like tutorials, worksheets and feedback, home works, field trips and the frequency of their utility at large were analyzed from the perspectives of the selected students and teachers. It is believed that practice is at the heart of mastery of science discipline. If there is no practice either individually or in a group all what have been learnt become inert knowledge (Jonassen, 1991). Thus, provision of tutorials being supported with worksheets and consistent feedback is imperative. However, interviews with selected teachers and FGD with students showed that except Mathematics teacher of Yebu school and somewhat teachers of the Bilida School of all focused subjects, use of tutorials were not witnessed.

Yebu school arranged tutorials in a special way by dividing the students in three categories; slow learners, average and fast learners and run to support them in different approach based on their category pace; in a motto of "*Abdiboru*" in Afan Oromo meaning *the future hope*. The frequency and procedure of the tutorial explained by participants as follow:

> "..the tutorial was done regularly twice a week in extra time. These tutorials are based on the text exercises which are found at end of each chapter, corrections given for home works and assignments".

Although students who were participated in FGD liked the approach, as expected for they were smart compared to their classmates, literatures don't support since it fosters lower self-esteem, lower aspiration and to the extent of hating school from the low achievers side (Greenfield, n.d) .

Regarding Bilida School, teachers and students participants agreed that there was a frequent tutorial exercise on Mathematics and Natural Science courses. They reported that students paid two birr per month for the tutorial services that was delivered in the afternoon of all weeks. They added that students who couldn't afford the tutorial fee were also allowed to attend. In general students put their feeling of that tutorial as "…we like the tutorial except when sometimes teachers merely gave notes to make only explanation at a regular class to cover portion".

As per the provision of worksheets and mechanisms for feeding back, almost all schools under these interview, let alone in Biology, Chemistry and Physics it is not the culture even in Mathematics, except for one school of grade tenth physics where worksheets were given without tutorials and Bilida grade 10^{th} mathematics where

the teacher sometimes wrote the worksheet and post on the wall in a visible place where all students get an access for copying.

Of course in most of classes mentioned above class exercises and home works reading assignments followed by feedbacks are common at different paces of the school and grade levels. On the other hand, except in Yebu high school where there was general environmental visit school wise in biology department, almost all of them had no experience of conducting field visits and the like.

Opportunities for group learning

As per the issue of condition for group discussion, students participated in FGD and teachers took part in the in-depth interview reported that teachers were making their best in encouraging student's participation in group as well as in whole class discussion. Despite the attempt, students were not benefiting from group work. As one male student participated in FGD put this as follow:

> "… when teachers order us to discuss together and report back, it is only outstanding students who speak now and then while others remained listener".

Respondents agree that the problem is highly pronounced around female students particularly in Mathematics and Natural Science classes. Female students participated in the FGD reflected this in the following manner:

> "…Mathematics and Physics requires regular exercises however female students are not getting such opportunities for they are engaged in indoor activities at home. As a result, they lack sound background that fuels them to engage in discussion".

Thus, as one can easily understand from the above scenario, favorable situation for group learning is not observed. Even if students participated in FGD acknowledged teachers as showing attempts to engage students in discussion, empirical study conducted in similar area revealed the opposite (Adula and Kassahun, in press). The students may not conceptualize well what, why and how of group learning.

Factors impairing implementation of student-centered approach in the selected schools

Participants of the study were asked to forward factors they believe impairing the smooth implementation of student-centered learning in their teaching. Accordingly, as before, views of teachers presented being triangulated with data obtained through FGD with students.

Constraint of learning materials

In student-centered approach, students need to have unrestricted access to learning materials such as textbook, worksheets, handouts, laboratory equipments, models and the like so that they may learn through interacting with the learning materials (Adula, 2008). That is why Ethiopian government has also a plan to make one textbook to one student in its five year Educational Sector Program of 2005/06-2010/11 (Ministry of Education [MOE], 2005).

However, except Jimma university community school, where students expected to buy textbooks, students in the other schools were complaining about the access to the textbooks. Despite the fact that Ethiopia categorized as underdeveloped countries, textbook distribution for public schools in the

country is for free. There is no laboratory setup at all in Bilida School. However, other schools have the setup and reported that they were functioning sometimes in the past but for unknown reasons they were not functioning at the time of this study, as reported by teacher participants. Moreover, teachers participated in the study complained the lack of resources inhibited them from preparing worksheets, handouts, and instructional aides.

Large class size

Although the largeness of the class determined not only by number of students but also by factors such as teachers experiences, availability of resources, nature of learners, subject matter or instructional objectives (EQUIP, 2006; Canterbury Christ church University, 2005; UNESCO, 2006; University of Queensland ,2002). ministry of education set the class size limit to 60 students per a class (MOE, 2005). However, similar study conducted on the same area revealed that class size in these schools exceeds the limit set by ministry of education (Adula and Kassahun, in press). However, what so ever the size is and other associated situation, large class is a class which is difficult to teach, asses and manage (Canterbury Christ church University, 2005). Accordingly, all teachers participated in interview and FGD participants (students) perceived large class size as one of the major obstacles in implementing student-centered learning in their teaching. One interviewee put this situation as follow:

> "…due to large number of students in a class it is difficult to handle active learning like group works, demonstration, presentation by students, class exercises, and in time feedbacks".

However, growing body of literatures shows the possibility of implementing student-centered learning through different mechanisms. To mention but a few, Cooper and Robinson (2000) devises informal strategies such as think-pair share, peer instruction, quick-thinks and minute papers that would be used in large class to facilitate student-centered learning. By and the large, Smith (2000) recommends the formal strategies such as in-class project work, Jigsaw strategies, structured academic controversy, Buzz groups, problem based learning and restructured lecture-recitation-laboratory. Thus, the door is open for educational researchers to reflect on how can these strategies adapted to our context.

Content coverage

Teachers participated in the study complained that the coverage of the course syllabus don't allow them to implement student-centered learning. To put what one Biology teacher said as it is "…using active learning methods, by no means you cannot cover all topics of the syllabus". Students participated in the FGD were also agreed with this notion. Participants from Jimma University community school exemplify one teacher whom they believed use student-centered learning in the following way:

> "…even if he is good in practically relating all points he is teaching to the level of students' understanding, he is always lagging behind the teacher teaching the same course sometimes by three units at the end of the year/semester"

It is true that adopters of student-centered learning are worried about the amount of content covered by the approach (Tien *et*

al., 2002). In most cases teachers using student-centered approach are covering less content than when they exclusively lecture but students' learn more. Thus, ignoring student-centered approach is a matter of opting for surface learning that targets on information feeding than deeper learning that equip learners with transferable knowledge and skill (Willington, 2006).

Lack of interest from students' side

Students participated in FGD from the selected schools agreed on the need for student-centered approach of instruction. They verbally articulated well about the advantages of learning through student-centered instruction and expressed their preference for it. However, almost all interviewed teachers complained that they couldn't implement student-centered instruction mentioning problems from students' side such as shyness, language barriers, lack of confidence, and lack of awareness about the value of student-centered approach, which are directly or indirectly linked with interest. One interviewee summarized the forerunning idea as follow:

> "…medium of instruction used change to English language at grade nine. As a result, it is especially difficult for grade nine students to read, discuss or ask a question in English. As a result, they were simply formed a group and sit until I interpret the question or activity to their mother tongue".

Scarcity of professional teachers

Teachers and students participants point out that one of the bottlenecks for the implementation of student-centered approach attributed to scarcity of professionals who are well trained to implement student-centered approach.

Literatures on teacher development showed that quality of teacher (in terms of qualification level as well as professional development) directly influence teachers' facilitation skills than student achievement (Day, 1999). As discussed in Adula and Kassahun (in press) majority of teachers teaching in the school were qualified and most of them were undergone through the New Education and Training Policy (1994), which has been directing teachers Education program to be in a student-centered approach. However, the same documents showed that on-job training was hardly available for these teachers. Thus, this could be the factor that impairs the utilization of student-centered approach.

Actions for enhancing implementation of student-centered learning

Participants of the study were asked to forward suggestion regarding the how of tackling those perceived bottlenecks. Accordingly, they forwarded a series of action addressing accessibility of learning materials, creating conducive learning environment, creating awareness in students about the value of student-centered learning, mechanisms of controlling the implementation and staff development in details. The details are indicated hereunder:

Accessibility of learning material

It is true that students learn by doing provided that there are authentic and relevant learning materials (Adula 2008; Surikava 2008). Participants of the study have also stressed the same. The following points jointly expressed by participant teachers and students.

> "if application of student-centered learning is required the school

need to establish appropriate laboratories equipped with relevant materials and make them functional. Text book distribution should come up to a one-to-one ratio supported by references, worksheets, manuals etc along with regular tutorial sessions. Teachers must also and encouraged to produce and use teaching aids. To this end, pedagogical centers must be functioning".

Creating conducive learning environment

Having conducive, relaxing and non-threatening environment is a prerequisite for an effective learning to take place (MOE, 2007). In line with this teachers participated in an in-depth interview were suggested "the need of reducing the class size to the manageable number. They proposed maximum of 40 students in a class although Ministry of Education has proposed the limit to 60 per class for this level. They also stressed the need of raising students' awareness as a part of creating conducive environment for realization of student-centered learning. Here is an example of what one interviewee reported of using to this end.

" ..I raised and maintained awareness of students on the advantage of student participation through frequent and close discussion with them on why they need to learn the way they are learning, followed by motivation and encouragement when trying to attempt; even by giving some marks to be counted as part of continuous assessment".

Moreover, students participated in FGD suggested ways of ensuring conducive classroom environment for student-centered learning to take places. Here is a suggestion vividly mentioned in almost all FGDs.

"Teachers must approach students, counsel them as primary schools teachers are doing. They should give activities, exercise not to revenge students rather to help them progress. Especially they must encourage female students in group work/discussion in non-threatening way".

Mechanisms of controlling the implementation

According to Fullan (2001), teachers need something that enforce or reinforce them so as to implement innovations in their classroom teaching. In a similar pattern, participants of the study forwarded different strategies they think to ensure the implementation of student-centered. For example, "rewarding those teachers regularly implementing student-centered learning on parent-school meeting, giving certificate and considering these as a criteria for selecting teachers for further training or other opportunities".

Opportunities for on the-job training

Teacher participants of the study strongly stressed the need of on the job training on the how of implementing student-centered learning in the existing situations of the school is mandatory. Although all have similar sentiment, this is an extract drawn from one interviewee:

"… I learnt the concept and how of active learning in college. However, I almost forget them since I am not using them currently. This is so because it is not the culture for all teachers in my schools to use student-centered learning. For that matter, I hope short training and tailored training may work if really

all teachers are required to practice student-centered learning.

Conclusions and Implications for practice

This article intended to explore qualitatively the application of student-centred methods in Mathematics and Science subjects from the perspectives of teachers and students. To this end, interviewed and FGD discussion were used to collect the data. In this way, the collected data was discussed. Thus, conclusions and recommendations drawn from the discussion are presented in this section.

Students and teachers participated in the study demonstrated clear understanding of student-centred learning. This is encouraging since knowing the concept and understanding the rationale behind the reform is landmark for translating it into action. However, teachers participated in the study were complaining that lack of interest from students' side due to several but interrelated factors such as shyness, language problem, lack of time for practices, and labour demand from parents side as bottlenecks for implementation of student-centred learning. These may be handled in a systematic way through orienting students and parents about the rationale behind implementing the student-centred learning and the need for practising outside of the school at home. Besides, teachers need to tap or adjust their approach to the level of students, considering individual student's need but trying to bring the majority if possible on board as per the aspired goal. To this end, establishing strong emotional bond, where school counsellors are helpful here, with students is advisable.

Based on general question posed to teachers in an interview guideline and to students during FGD to explain about the situation of their respective school in utilizing student-centred learning in Mathematics and Natural Science subjects, thematic areas were identified. These are students' participation and teacher's facilitation tendency, use of materials, arrangements of practical works, and opportunities for group learning.

In a net shell, it seems that teachers' utilization of student-centred learning is still at an infant stage in the selected schools. Teacher dominated lecturing was surpassing student-cantered facilitation; laboratory and pedagogical centres were not serving properly hence their education became more of theoretical and no attempt to use aids in order to make the lesson tangible. Tutorials, provision of worksheets and process of giving feedback on a continual basis were not the culture in the study schools. Besides, students were deprived of opportunity to learn from each other, since conditions for that were hardly available.

From the responses of the participants as well as general analysis of the situation, some factors attributed for the impairing the implementation of student-centred were identified.

In the first place, there is variation even within the school or subjects in making student-centred learning. Teachers teaching the same course in the same school of the same grade differed in implement student-centred learning as well as making preconditions favourable for that. This situation put in question the quality assurance mechanisms employed by the selected schools in order to run the teaching and learning duties to be as it intended. Therefore, this can be area for further research.

Large class size and the need for covering contents in the syllabus were vividly indicated as barriers of implementing student-centred learning. These problems are prevailing everywhere even if the degree differed. Thus, there are strategies by which they can be handled (mentioned in the body of the report). Thus, it is up to the educational researchers or teachers themselves to tray and adopts these strategies in the way they fit to our context.

Fair distribution of learning materials, use of laboratories and pedagogic centre and establishing or strengthening tutorial services in the way students benefited from must be given priority.

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