Perceived Instructional and Assessment Practices as Related to Academic Achievement of Mathematics Students in Jimma University, 2004 E. C.

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Abstract

Science and technology are currently becoming a very dominant means of development worldwide in which mathematics is its fundamental tool. This study tried to investigate the learning situations of mathematics students in Jimma University (JU) in 2011/12 G. C. academic year based on a cross-sectional survey using all the three batches of 255 students as respondents. The finding shows that lecturing is still the dominant teaching method teachers frequently using and students enjoying most in the current mathematics classes of JU. Tutorial sessions of mathematics classes are wrongly used for lecturing and assessments which was meant for active exercises and feedback exchanges. On the other hand, continuous assessment is found habitual in most learning situations in the department. In general in this study, it is recommended to design ways of conducting intervention to improve the teaching learning situations at department level since it is the concern of everybody there.

Key-words: learning situation, academic achievement, active learning, tutorial session, continuous assessment.

INTRODUCTION

1.2. Background

As civilization progresses through the development of society, use of applications of mathematics has been increased in the field of Science and Technology.

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Mathematics is being used as a tool assisting other science areas in which these science and technology trying to solve livelihood problems. Because of this, the core mathematical courses like Algebra, Calculus, Differential Equation, Numerical Analysis, Number theory, etc are required in various studies of mathematics for undergraduate level. Now a days, it will be difficult to science and technology courses to solve problems without mathematics knowledge which is fundamental by its nature; as it could be verified in the harmonized curriculum documents of Departments of Mathematics (2009) and Civil Engineering (2011) of Jimma University.

Mathematics is a fundamental tool that can be used in our daily life to solve physical problems we face. Due to this mathematics has been considered as one of the most important core subjects in a school curriculum. More mathematics lessons are likely to be taught in schools and colleges throughout the world than any other subject (Orton A., Orton D., & Frobisher, 2004). However, results of the standard tests and evaluations revealed that students do not perform to the expected level.

Mathematics educators worldwide, for example, Burton, (2004) have identified a serious problem. Despite the importance of the mathematical sciences and the opportunities available to graduates of mathematics, fewer students are enrolling for degrees in mathematics. Furthermore, many of those who enroll do not have a clear idea of what professional work as a mathematician entails in the future they have to go about. We do not find this surprising that the job of "mathematician" is not obvious, visible or well defined. For many students, the nature of a mathematical career is not at all clear, and hence it is not easy for them to make a connection between what they are learning at university and what they will be doing as mathematicians.

From our day to day experience this is also true in our domain in many of the high schools and universities where students are afraid of mathematics and physics in which we are interested to verify it through conducting this study. Though this prevailing movement against mathematics in specific and the hard sciences in general is influenced by many factors, our interest is directed to investigating the instructional practices and their assessment methods going on to be specific. This study also gives emphasis on mathematical knowledge especially on students' achievement in mathematics learning. Working and communicating mathematically is being encouraged as part of everyday mathematical learning in universities.

Research shows students' perceptions of mathematics learning reflect the way they have been taught mathematics (Thompson, 1984; Knuth & Peressini, 2001; Schell, 2001). In addition, pedagogical decisions teachers make about teaching and assessment are influenced by their mathematical beliefs. Typically, an authoritative perspective views mathematics as a body of knowledge with classroom practices, simply a transmission of information. In contrast, cognitive and social perspectives view mathematics learning and understanding "as the result of interacting and synthesizing one's thoughts with those of others" (Schell, 2001,p. 2), suggesting mathematics knowledge is a social construction that is validated overtime, by a community of mathematicians.

Lesh (2000) argues that, "mathematics is not simply about doing what you are told" (p. 193) rather it is based on students need to learn mathematics as social knowledge which is meaningful; but this meaning must be coherent with those socially recognized and related to the existing problems with mathematics learning perceived as related to students' perceptions of mathematics, ability to communicate mathematically, enhancing critical problem solving abilities. It is rather full of activities independent work supported by the teachers as facilitating agents from behind if successfully implemented. And when we want to investigate the extent in which such student dominated learning activities are going on or not.

The narrow view most undergraduate students have, reflects their school mathematics experiences, found to be mostly rote learning, a problem consistently raised by national examiners. Even the top students consistently struggle with applications of basic principles to solve equations and/or graph functions (Afamasaga-Fuata'i, 2002, 2005a,).

Finally, students may be proficient in solving familiar problems. However, the lack of critical analysis and application becomes evident when they are given novel problems. Such approaches are symptomatic of authoritative classroom practices in which students typically do not question, challenge or influence the teaching of mathematics (Knuth & Peressini, 2001). The examination-driven teaching of secondary mathematics naturally inculcates a narrow view of mathematics (Afamasaga-Fuata'i, 2005, 2002).

The purpose of this study is, therefore, to investigate the current dominant learning practices and assessment methods used in mathematics classes of 2004 E. C. JU students in relation to their academic achievement. The study anticipates to go for conceptual and practice changes if still we are in traditional exercises or strengthen if the active learning activities are in place.

1.2. Statement of the problem

This study is needed to understand the learning situations of mathematics focused on the delivery and assessment practices related to students' achievement level. In our situation, JU, it has been long since instructors have been trained to implement active learning through one year on job training at Higher Diploma Program (HDP) level which still is questionable in many aspects whereby some researchers like Walelgn & Fantahun (2007) and Bekele (2008) revealed that the current situation of implementing the HDP training skills is found unsatisfactory at these tertiary levels. We are then liable to see whether it is happening or not following scientific procedures, the need for this study. As indicated by Burton (2004) many students did not like to enroll in mathematics learning in which the teaching and assessment systems could be part of the many possible factors. Burton said that even students who are enrolled are confused to predict their future position in the real life after graduation. All mathematics teachers and the department are concerned in helping their students to come up to the area for bright future. This conceptual change could be done by improving the delivery and assessment methods through consecutive intervention in a piece meal based on the existing learning problems. For this, base line survey need to be worked out to investigating what is going on currently at least in learning practices and assessment methods corresponding their achievements which is the main target of this study. This study is then a preliminary survey that will help to identify the existing problems at hand so that the intervention phase could follow. It then assumed that it will assist as one of the components of the process to improve for better quality of mathematics education which will reflect to science and technology learning too. Such improvements will enhance the situations of learning mathematics attracting students towards the subject. The following gaps are therefore expected to be improved by this study.

The need for improving the traditional learning system going on for many years in mathematics classes which is also basic issue for almost all other sciences is one important issue of interest for this study. It is likely to contribute as a spring board to change the current conventional ways of learning mathematics based on the results of this study or keep it intact if the learning practice is encouraging. Enhancing the learning situations attracts the interest of students towards the subject. In return, it qualifies the capacity of students' knowledge and skill in solving practical and abstract problems which implicates the improvement of their achievements. Therefore, this survey tries to answer the following questions.

- What are the dominating delivery systems usually used in mathematics classes?
- What are the existing assessments practices both in the regular and tutorial classes?
- What are the methods students enjoy most in learning mathematics?
- What are the roles of students and teachers in learning activities?
- What are the rates when students' academic performance in mathematics compared at different levels?
- What could be the possible challenges in learning mathematics and possible solutions?

1.3.1. General Objective:

Investigate the instructional practices and assessment methods of the year 2011/12 Jimma University mathematics students corresponding to their achievements, as perceived by the students themselves.

1.3.2. Specific objectives

- Examine the dominating delivery systems usually used in learning mathematics.
- Examine the existing assessment practices both in the regular and tutorial classes.
- Determine the focus of attention students enjoy most in learning mathematics.
- Distinguish the roles of students and teachers in learning activities.
- Compare students' academic performance in mathematics at different levels.
- Investigate the challenges in learning mathematics and suggest possible solutions.

1.4. Significance of the study

The following importance is expected to follow this study.

- Teachers could be aware of the learning situations currently going on under their responsibility and this study will help them to adjust their delivery methods according to the findings through appropriate intervention.
- This study could be used as a base line of action research to intervene for improving the learning and teaching

situations in this particular subject if need be.

- It will help teachers to flexibly redesign their delivery system which helps to encourage students mainly with negative attitude towards the subject and those with low academic performance.
- Other science and technology areas could also be initiated by this study to do the same and improve the quality of delivery system followed by intervention.
- Furthermore, other researchers could also use the information for further deep study in line.

METHODOLOGY

2.1. Study design and site: This study is a cross-sectional study design investigating the learning situations of 2004 E. C. mathematics students at JU. The study subjects are purely mathematics students of years I, II & III in that academic year. The study approach is mainly quantitative through a well designed questionnaire. The study was conducted (the data collection) in the same year second semester.

2.2. Sampling design: All 255 students were involved as respondents of which131 (51.4%) were 1st year, 59 (23.1%) 2nd year and 65 (25.5%) 3rd year.

2.3. Instrument development and administration: Questionnaire was developed and examined for its validity and reliability through experts review and pilot study done on 30 students whereby the Cronbach alpha lies on 7.1 on an average. The instrument was then refined according to the experts suggestions and the examination of the pilot. The questionnaires were distributed to the three categories of students (Year I, II & III) self administered and collected right away. Explanations were given to some unclear questions which were beyond the understanding of students due to language problem or so right at the spot.

2.4. Analysis: The analysis was mainly descriptive using basic statistical methods like frequency distributions, comparative rankings, means and standard deviations, correlations and the like in which data were encoded, edited and analyzed through SPSS package version 16.

2.5. Ethical issue: Permission was officially granted by mathematics department followed by the consent of the students to give the necessary information noting that no one will be exposed in the report.

RESULTS

3.1. Background Information of Students
A total of 255 mathematics students responded for this investigation in which 131(51.4%) were year I, 59(23.1%) year II and 65 (25.5%) year III students in the academic year of the study. Of these respondents, 242 (96%) were males while the rest very few were females. Age wise, the majority of the students (94.5%) were found 20 years old and above, the age range running from 16 to 27 years old. These mathematics students were also investigated the origin of their region they came from and the majority of them came from Oromia (53.7%) and Amhara (40.2%). Looking into their religion, 54.5% were Orthodox, 20.2% Islam and 23.5% other Christians like Protestants and Chatholics. Besides, the mother tongue of the majority of these students found to be Afan Oromo (52.9%) and Amharic (42.9%). Coming to their guardian status, many of them (85.3%) were supported by

their parents and family relatives (12.4%). The economical status of the majority of these guardians were founded very low, 58.9% of them with the average monthly income were below Birr 500, while 23.7% of them with average monthly income of Birr 500-1500 and only 13.8% of them at medium level (Birr 1501-3000). In this issue, students were also asked the amount of financial support (in Birr) they earn from their guardians per semester. Accordingly, most of them (47.7%) earned less than 500.00 birr per semester from their guardians whereby 29% earning 1,000.00 birr and above per semester.

3.2. Students' Perceived Instructional and Assessment Practices in Mathematics Classes

This section conveys the results on learning situation focused on learning practices and assessment methods going on in mathematics classes as per the perception of the 2004 E. C. mathematics students from 1st year to 3rd year.

3.2.1. Delivery system (Instruction & Assessment)

Mathematics students of the year 2004 E. C. were asked to indicate which of the delivery systems were the dominant ones during the regular classes given about eleven styles to be measured using five options (always, usually, sometimes, rarely and not at all) where the first two combined together under most of the time. As can be seen in the table below, the dominants as per their order of priority were lecturing (81.9%), question and answer (44%), observation on class activities (42%), project assignment followed by demonstration (40.1%). On the contrary, project work and demonstration used to be practiced rarely or not at all at the rates of 54.4% and 51.8% respectively.

Table-1: Rate of delivery systems in regular classes of mathematics teaching, in percent

Delivery methods for Regular Class	Most of the time	Some times	Rarely	Not at all	Number of respondents
Lecturing	81.9	12.4	5.0	0.8	242
Class act. observation	42.0	46.1	9.1	2.9	243
Group activity	25.7	42.6	20.7	11.0	137
Individual class work	38.4	35.0	21.5	5.1	237
Discussion	29.7	37.7	21.3	11.3	239
Question and Answer (Q & A)	44.0	33.8	13.8	8.7	207
Demonstration	21.3	26.9	18.8	33.0	197
Project work	18.9	16.7	23.2	41.2	228

In similar manner, students were asked to reveal their experience on the delivery systems during tutorial session. Using the two parameters (always and usually) as dominant ones, still lecturing became the top by the rate of 76.5%, followed by assessment purposes at the rate of 60.7%, then teachers giving the answers of the exercises right way with no student participation (54.9%), work sheet distribution activity (52.2%), the teachers working out the exercises (50%). Again here, individual tutorial work and project guide discussion were respectively rated

60.1% and 58.1% happening rarely or not at all in aggregate. Many of the activities that were expected to happen during tutorial like students doing exercises out on the board (33%), group activities (45.7%), discussion (36.2%), question and answer through the teacher leadership (36.4%), feedbacks and reflection (35.3%) were said practiced sometimes by at least 33%.

Table2: Rate of delivery systems in tutorial classes of mathematics teaching, in percent

Delivery methods for Tutorial Class	Most of the time	Sometimes	Rarely	Not at all	Number of respondents
Lecturing	76.5	13.8	6.9	2.8	246
The teacher working the exercises	50.0	43.1	10.6	5.3	246
The student doing the exercises out on the board	19.6	33.1	31.0	16.3	245
Group activity	21.0	45.7	21.4	11.9	243
Individual tutorial work	19.5	20.3	24.5	35.7	241
Discussion	24.6	36.2	22.3	17.0	224
Question and answer by the teacher leadership	31.6	36.4	20.2	11.8	228
The teacher giving the answer right away	54.9	29.1	9.4	6.6	244
Project work guide & discussion	20.5	21.4	26.9	31.2	234
Worksheet distribution	52.2	36.3	9.8	1.6	245
Home work feedback and reflection	31.3	35.3	20.7	11.6	241
For assessment purposes (quizzes, tests)	60.7	30.8	6.2	2.2	224

3.2.2. Focus of attention during learning

Eleven learning activities of mathematics were given for the respondents to rank them 1st, 2nd, and 3rd according to their focus of attention given during the learning practices of which the six ranked top depicted in the table below. According to the students' perception, focusing on the objectives of each course was ranked 1st at the rate of 64.7% followed by the focus on the understanding of mathematical concepts rated 52.7% and then developing the skill of problem solving based on postulates and theorems 36.7% (Table 3). Similarly, looking into the second rank, stating and understanding theorems comes top and then many of the focus areas of activities like understanding terminologies and postulates, proving theorems, memorization and appreciation of the realm of mathematics application follow at similar range of 32% and more.

Table 3: Ranking the learning activities according to the focus of attention during learning mathematics

Items	The rate of ranks (%)			Number respondents
	1st	2nd	3rd	
Objective of each course	64.7	17.6	15.3	85
Understanding mathematical concepts	52.7	32.7	13.9	165
Understanding postulates	10.3	38.5	48.7	39
Understanding terminologies	25	39.3	35.7	28
Stating and understanding theorems	15.1	52.1	31.5	73
Proving theorems	14.9	37.9	43.7	87
Developing skills of problem solving based on the above concepts	36.7	27.7	33.9	109
Appreciating the realm of mathematics and its application	14.9	31.9	53.2	47
Memorization	17.9	35.7	46.4	28
Reading and sitting for the exams	23.1	19.2	53.8	26
Frequent exercises	20	22.9	51.4	35

3.2. 3. Perceived assessment Methods

Using the same parameters mentioned above, students also rated the assessment methods most frequently appearing. As a result, they revealed that final examination and consecutive assessments were the most frequent at the rate of 65.7% (always or usually) and (65.1%) respectively while group activity evaluation (20%) and project work (12.3%) rarely frequented by the teachers. Assessments during class activities (40.2%), assignment evaluation (51.9%), group activity evaluation (44.3%), surprise tests (35%) appeared sometimes at the indicated rates.

Table 4: Rate of assessment methods exercised in mathematics teaching, in percent

Assessment methods	Most of the time	Some times	Rarely	Not at all	Number of respondents
Consecutive tests and quizzes	65.1	31.9	2.1	0.9	235
Class activity	35.4	40.2	17.1	7.3	234
Assignment evaluation	36.2	51.9	9.8	2.1	235
Group activity evaluation	20.0	44.3	23.5	12.2	230
Mid-exam	30.2	20.9	23.8	25.1	235
Project work	12.3	18.2	26.4	43.2	220
Final exam	65.7	10.4	22.2	1.7	230
Surprise test	26.6	35.0	20.6	17.8	214
Assignment	40.1	45.2	12.1	2.5	239
Home work	50.4	34.0	13.5	2.0	244
Class work	38.9	36.8	20.7	3.7	242

3.2.4. Students' practice in learning Mathematics

As revealed by this study, the majority of students confirmed that they attend the regular (97.3%) and tutorial (83.5%) classes during learning activities by saying 'yes' in answering the yes or no question.
Furthermore, students provided information on the frequency of their involvement in different learning activities using the five parameters explained above. Many students then attended regular classes (96.3%) and tutorial sessions (79.2%) regularly (always or most of the time). About 60% of them participated in class activities, home works and discussion, group work, doing assignments and worksheets, tutorial discussions, collaborative learning.

Similarly, activities like answering questions (89.5%), giving reflections (78.6%), asking questions (85.5%), doing home works and assignments (94.9%), doing work sheets on time (92.1%), demonstrating answers of work sheets out on the board (82.3%), actively participating in discussion for tutorial (87.8%), taking the corrections right away (90.2%), doing exercises with friends inside and outside classes (95.5%) at least some times (I. e, sometimes, most of the time and always). On the other hand, some of the activities like demonstration (25.8%), student reflections (17.5%) and doing project work (14.7%) are done rarely at relatively high rates indicated which cannot be ignored.

Table 5: Rate of frequency of students' involvement in learning activities in percent

Class activities	Always	Most of the time	Some times	Rarely	Not at all	Number of respondents
Attending regular classes	87.3	9.0	3.3		0.4	244
Attending tutorial sessions	58.5	20.8	12.3	3.4	5.1	236
Active participation in class discussion	27.4	33.6	330.7	5.8	2.5	241
Class activities/class work	33.1	30.5	31.0	2.9	2.1	238
Group works	30.1	28.9	28.5	8.8	3.3	238
Demonstration/doing on board	12.7	14.8	28.8	25.8	17.8	236
Answering questions	16.3	32.2	41.0	6.7	3.8	239
Reflections/giving ideas	13.1	24.5	41.0	17.5	3.9	229
Asking questions	21.7	25.5	38.3	10.2	4.3	235
Doing home works/assignments	49.8	29.1	16.0	3.4	1.7	237
Doing the project work on time (seminar or SRP)	23.6	15.6	22.2	14.7	24.0	225
Doing work sheet on time	42.9	30.8	18.3	5.4	2.5	240
Trying to show the answer on board	31.2	26.0	25.1	10.0	7.4	230
Active participation in tutorial discussion	15.8	30.8	41.2	4.1	8.1	221
Taking the corrections right away	30.2	31.6	28.4	7.1	2.7	225
Doing exercises with friends inside and outside class	41.5	36.6	17.4	2.7	1.8	224

Again students distinguished the role of teachers to that of students from 21 listed activities usually going on in regular and tutorial classes. Many of them identified the following teachers' roles at higher rating. These were introducing the lesson at the beginning of each lesson (82%), presenting the lesson (67.6%), consolidating the lesson (84.7%), doing examples (52.9%), giving feedbacks and corrections (72.2%), facilitating tutorials (68%), lecturing (82.7%), preparing tests, quizzes and exams (78.7%). Here though some of the activities like presenting the lessons, doing examples, and leading class activities were suppose to be the role of teachers a reasonable amount of students (greater than 40%) think that they are also responsibilities of students. Similarly, a good number of activities were distinguished as roles of students. These were doing actual class activities (58.5%), stating theorems (9.9%), working assignments (85.5%) and worksheets (58.4%), active participation in doing tutorials (79.3%), raising questions to clear unclear ideas (67.6%), doing assignments, tests, quizzes and exams properly (82.3%), solving problems on the black board (25%). As expected, some activities were distinguished to be done by both parties: asking questions (32.6%), answering questions (32%), writing important notes (11.8%) and proving theorems (28.8%).

Students were also asked to share their experiences on how they do the learning activities listed using six categories. Accordingly, they do home works individually (42.8%) and in groups with friends (54.1%). They also do long term assignments mainly in groups with friends (45.4%), consulting senior students (19.7%) and individually (18.3%). Work sheets are done mainly in groups (62.8%) and individually (27.4%). Project works involving class presentations are done in groups (41.8%) and individually (25.4%). Project works like SRP are also done in group (35.5%) and individually (20.7%).

At the end, through open ended questions, students were asked to reveal challenges in learning mathematics which was the next issue expected from students reflection. The following were issues raised by students challenging their learning practice.

- In this line the majority respondents (53 in number) complained that there was deficiency of learning materials like books, manuals, references, journals, internet access and economical the bases of all these.
- Difficult assessments like tests, quizzes and exams following lots of assignments and exercises were the next challenging issues raised.
- Again, lack of skills solving challenging problems and in ability to prove theorems were other issues mentioned.
- Teachers' problems like lack of punctuality of teachers, not coming to class regularly, lack of making the lessons active, lack of doing more exercises, assignments and providing feedbacks at all were some of the problems raised from the side of the teachers.
- In adequate time allocation for exams, the speed of lectures of teachers, large student population and unexpected behavior of teachers were some other challenges of learning mathematics mentioned.

Academic Achievement of mathematics students

These mathematics students were requested to expose their mathematics academic achievements both in preparatory and university levels. To this issue, about 200 students volunteered to tell their preparatory level mathematics grades and overall yearly averages while only 80 to 128 of them were willing to expose their university level grade points measured in letter grades. According to the information collected from students themselves at least 99% of them scored 50% and above in mathematics subject and yearly averages in both 11th and 12th grades. To be specific, 88% in 11th and 80% in 12th grades scored 70% and above in mathematics subject while 87% in 11th and 83.6% in 12th grades scored 70% and above in overall yearly averages. As can be seen in the table, the majority of them lied between 70 and 100 in both subject wise and yearly average.

Table 6: Achievements at preparatory levels in mathematics subject

Scores	Mathematics subject (%)		Overall grade average (%)		Achievement categories
	11th grade	12th grade	11th grade	12th grade	
<50		2(1.0)	1(0.5)	2(1.0)	Below average*
50-69	25(12)	39(18.7)	25(12.5)	31(15.4)	Average*
70-79	74(35.6)	51(24.4)	81(40.5)	67(33.3)	Good
780-89	81(38.9)	81(38.8)	75(37.5)	81(40.3)	Very Good
90-100	28(13.5)	36(17.2)	18(9.0)	20(10.0)	Excellent
Total	**208**	**209**	**200**	**201**	
Mean	79.39	78.78	78.52	78.38	
St. dev.	9.85	10.87	8.68	9.07	
Maximum	100	100	98	100	
Minimum	50	47	49	45	

- Below average=unsatisfactory
- Average=satisfactory

Looking into the statistical analysis of the students during their preparatory levels, the means and st. dev of mathematics subject were 79.39% (st. dev.= 9.9) and 78.78% (st. dev.= 10.9) respectively in 11th and 12th grades while the overall yearly average scores were found 78.5% (st. dev.= 8.7) and 78.4% (st. dev. = 9.1) for 11th and 12th grades respectively.

Table 7: Descriptive Statistics on academic performance of mathematics students, 2004 E. C.

	N	Minimum	Maximum	Mean	Std. Deviation
Preparatory level maths					
grade in 11th	210	50.00	100.00	79.3874	9.85193
grade in 12th	210	47.00	100.00	78.7814	10.87451
Yearly grade average in 11th	201	49.00	98.00	78.5152	8.68393
Yearly grade average in 12th	202	45.00	100.00	78.3840	9.06577
University maths courses on average					
Fund. concept of college maths	115	1	4	3.06	.843
Geometry	117	1	4	2.45	.749
Algebra	125	1	4	2.93	.785
calculus	128	1	4	2.91	.794
Number theory	80	1	4	2.79	.758
Numerical	114	1	4	2.51	.767
Differential	81	1	4	2.55	.854
University overall grade average					
Year-I semester-I GPA	209	1.50	3.53	3.0170	.52449
Year-I semester-II GPA	101	1.90	4.00	2.8970	.45735
Year-I CGPA	96	1.70	3.90	2.7749	.44394
Year-II semester-I GPA	100	1.90	4.00	2.8159	.46078
Year-II semester-II GPA	48	1.99	4.00	2.6921	.40376
Year-II CGPA	45	1.85	4.00	2.6269	.40035
Year-III semester-I GPA	47	1.83	4.00	2.6385	.38474

Students revealed their academic performance during their stay in Jimma University on average in selected major mathematics courses like fundamental concept of college mathematics, algebra, calculus, geometry, number theory, numerical and differential equations. Almost all of them (more than 95%) were successful in each of the above courses scoring C and above, on average.

Only 2.6% to 7.4% failure (scoring D) was seen in each course listed in the table. To be specific, 71.4% scored A & B in fundamental concept of college mathematics, a basic course. In the same two letter grades, 72% scored in algebra, 70.3% in calculus, etc. [Table-8].

Furthermore, the association between the students' academic performance in these seven core mathematics courses one another found to be positively correlated at r >= 0.5 significant at P=0.01 for most of them.

Table 8: Students' academic achievement in the core mathematics courses at University level

Math course	Rate of students scored in math courses (%)				Number of respondents
	A	B	C	D	
Fundamental concept of college mathematics	35.7	35.7	24.3	2.6	113
Algebra	24.0	48.0	24.8	3.2	125
Calculus	24.2	46.1	26.6	3.1	128
Geometry	10.3	29.9	54.7	5.1	117
Number theory	16.2	50.0	30.0	3.8	80
Numerical analysis	11.4	33.3	50.0	5.3	114
Differential equation	16.0	29.6	43.2	7.4	81

Furthermore, 198 (77.6%) of these students exposed their university level general achievement with respect to the level of year and semester. Accordingly, the means of their 1st year achievement in semester I & II (SGPA) were3.01 (st. dev.= 1.5) and 2.9 (st. dev.=0.46) respectively while the yearly CGPA was 2.77 (st. dev.=0.44). In the same manner, in year II their 1st and 2nd semester achievements were 2.82 (st. dev.=0.46) and 2.69 (st.dev.= 0.40) respectively, the CGPA of 2.63 (0.40). Since the data were collected before 3rd year students completed the year, it was only possible to get the first semester record whose average was 2.64 with st. dev. 0.38. In general, only 3.1% of the students scored below 2.00 in the year I CGPA in which 68.8% were below 3.00 grade average. Similarly, those scored below CGPA 2.00 in year II were 2.2% while 80% of them scored below 3.00. From this result it seems that when courses are going to higher level the rate of student achievement tends to decrease.

Associating university level performances year and semester wise from year I semester I to year III semester I in which the data was available by the time of the study all of them were positively correlated for r>0.5 and significant at P=0.01, in which the correlation was strong (r>0.7) for many of them showing their performance at the university level was consistent. Here, the above core mathematics courses performance positively correlated (r>0.5, P=0.01) with the yearly semester GPA and CGPA grade averages. Similarly, the above university level academic performances compared to the preparatory level achievements, the pearson correlation analysis showed significantly (P=0.01) positive correlation (r>0.5) showing the same consistence performance starting down from the basic levels.

Table 9: Correlations among the preparatory and university levels yearly averages

		Preparatory level total grade average in 11th	Preparatory level total grade average in 12th	Year-I CGPA	Year-II CGPA	Year-III semester-I GPA
Preparatory level total grade average in 11th	Pearson Correlation	1	.787(**)	.550(**)	.471(**)	.437(**)
	N	201	201	78	34	35
Preparatory level total grade average in 12th	Pearson Correlation	.787(**)	1	.456(**)	.445(**)	.525(**)
	N	201	202	78	34	35
Year-I CGPA	Pearson Correlation	.550(**)	.456(**)	1	.824(**)	.582(**)
	N	78	78	96	44	43
Year-II CGPA	Pearson Correlation	.471(**)	.445(**)	.824(**)	1	.743(**)
	N	34	34	44	45	40
Year-III semester-I GPA	Pearson Correlation	.437(**)	.525(**)	.582(**)	.743(**)	1
	N	35	35	43	40	47

** Correlation is significant at the 0.01 level (2-tailed).

With regard to the influence of students' feelings to that of their academic achievement, the Pearson correlation showed no significant correlation in most cases. In the same line, the influence of students' interest and involvement in activities of learning compared to the performances of mathematical subject areas the analysis showed no significant correlation except one or two courses like fundamental concept f college mathematics negatively correlated (respectively r=-0.312, and r=-0.433 for P=0.01).

DISCUSSION

Learning Situations

Learning activities are pedagogically encouraged to focus on active learning activities during regular classes not only in mathematics which needs such activities very badly but also any other related courses. One cannot learn mathematics unless the learning situations are fully dominated by student participation like class exercises (individual & group), reflections through questions and answers (Q&A) through teachers' facilitation, different model of assignments like homework, worksheet, project work to be followed by students' demonstration out to the class.

Teachers provide a variety of instructional methods and techniques for helping learners construct their learning and develop a system for applying knowledge and theory (Brown *et al*., 2003). Teachers with "an integrated, conceptual understanding" of mathematics tend to organize their classrooms and learning activities that encourage students to engage and interact with the conceptual aspects of mathematics. Furthermore, the depth of the mathematics taught correlates highly with the depth of the teachers' mathematical knowledge (Fennema and Franke, 1992).

Student-centered instruction [SCI] is an instructional approach in which students influence the content, activities, materials, and pace of learning. This learning model places the student (learner) in the center of the learning process. The instructor provides students the opportunities to learn independently and from one another collaboratively and coaching them in the skills they need to do so effectively. This approach includes such techniques as substituting active learning experiences for lectures, assigning open-ended problems and problems requiring critical or creative thinking that cannot be solved by following text examples, involving students in simulations and role plays, and using self-paced and/or cooperative (team-based) learning. Properly implemented SCI can lead to increased motivation to learn and attracts the students towards the subject in question (Collins & O'Brien, 2003). However, to our wonder, this study revealed that currently in JU mathematics classes still the dominant one is lecturing in both regular (81.9%) and tutorial session (76.5%) which is a very serious concern for the need of the pedagogical intervention which will become more concern when students also found enjoying this traditional method too. In this study, the other relevant mathematical learning activities like homework Q&A, class activities and assignments tend to decrease from the rate of 50% down to 40% while project works, demonstration of practical exercises individually as well as in group are practiced rarely or not at all.

According to this investigation, the tutorial session which was supposed to be a conducive forum for active learning in mathematics courses is fatally dominated by lecturing to cover the contents of the course syllabus and for giving assessments (65.7%) like tests, quizzes, mid-exams and the like. This really needs a systematic intervention to revisit the delivery systems at department level.

If at all the tutorial sessions are sometimes used for its purpose, practical activities, the study indicated that teachers usually tend to do the worksheet exercise by themselves without thoroughly involving students, a divergent from its goal.

Delivery system is not the only component in learning activities, rather, the assessment methods are also important issues a teacher should implement very systematically corresponding to the level of the course using to measure students performance level through time. Here, it is obvious that continuous assessment is recommended for every teaching learning activities now a days, the assessment to start right from their class participation assignment performance, quizzes, tests in a piece meal consecutively and then finally the summative evaluation.

According to this study, the JU mathematics instructors tend to follow continuous assessment steps mentioned above most frequently given, followed by the final exam at about the same 60% rate. According to this study, most mathematics teachers assess their students through class activities, frequent quizzes & tests, assignments (group as well as individual), and of course some project works like SRP at senior level. This is actually encouraging even though we have yet to go up the 40% of the ladder, which is relatively significant.

The study also revealed the focus of attention, usually given during mathematics learning activities through ranking several possible items. Here it is found encouraging the major mathematical activities like, attention given to the learning objectives primarily, defining terminologies and understanding their concepts, stating and understanding theorems and developing the skills of problem solving were ranked top either the first or second rank, which more or less meets the goal of the subject specific focus of attention. The department needs to strengthen this learning situation upgrading the rest like proving theorems and appreciating the learning of mathematical applications.

Introducing the objective of each course, understanding mathematical concepts and developing problem solving skills specifically ranked first.

Practice in learning

It is not only the teachers facilitation of activities that creates lively interaction in learning situations but also students play a great role in enhancing their participation in the activities created for them. Unless students are motivated to participate in different activities the learning will not have its life by the teachers only. Of course teachers need to choose instructional activities that integrate everyday uses of mathematics into the classroom learning process as they improve students' interest and performance in mathematics but it has to be dominated by student participation.

Teachers should concentrate on providing opportunities for students to interact in problem rich situations. Besides providing, appropriate problem rich situation teachers must also encourage to find their own solution methods and give them opportunities.

To share and compare their solution methods and answers, one way to organize such interaction is to have students work in small group initially and share ideas and solutions in whole class discussion. Research suggests that whole class discussion can be effective when it is used for sharing and explaining the variety of solutions by which the individual students have solved problems. Students are expected to be active listeners who participate in discussion and feel a sense of responsibility for each other's understanding (Wood, 1999). Accordingly therefore, this study reveals that the mathematics students under this study are found in the right truck regularly attending their classes (97.3%) and tutorial sessions (83.5%) which is important for conducting active learning explained above. These students frequently (always or most of the time) participating their normal classes (96.3) and tutorial sessions (79.2%) is actually encouraging though teachers have to work hard to increase the rate of participation in tutorial high above 79%. The lower rate of coming to tutorial sessions compared to the regular could be due to that the session is not properly used for the activities it was meant for, and some students may think that they have enough understanding and hence they do not need to go in the tutorial sessions regularly which would be a fatal exercise could go against the above saying of Wood (1999).

Teachers maintain student engagement in doing mathematics at a high level if they select appropriate tasks for the student, support proactively the student's activity, ask students consistently to provide meaningful explanations of their work and reasoning push students consistently to make meaningful connections, and do not reduce the complexity/cognitive demands of the task. On the other hand, student engagement in mathematical activities declines if teachers remove the challenging aspects of the tasks, shift the students' focus from understanding to either the correctness or completeness of an answer, or do not allow an appropriate amount of time for students to complete the task (Henningsen and Stein, 1997) in which this study showed to the contrary that one of the major problems for learning activities that students mentioned was that teachers are not punctual, they are not working hard for promoting active learning and so on. Here, the intervention at department level should consider a mass mobilization.

In a review of 80 research studies on grouping in mathematics classrooms, Davidson (1985) concluded that students working in small groups significantly outscored students working individually in more than 40 percent of the studies. Students working as individuals in a mathematics classroom performed better in only two of the studies (Davidson suggests that these studies were faulty in designs). According to this study therefore, 50% of the respondent students regularly (always or most of the time) participate in different learning activities like; collaborative learning, doing exercises with friends outside the class (78%), participating in class activities doing exercises (individually as well as in group) and taking the correction of worksheets and other home works right from discussion. Though this students' participation in the major mathematics learning activities is a green light, both teachers and students who are the major agents of learning need to work hard flexibly changing the systems and approaches to increase the rate of participation up beyond 50%.

The research conclusions on the effect of cooperative learning in mathematics classrooms are quite consistent (Davidson and Kroll, 1991; Leiken and Zaslavasky, 1999; Slavin, 1985) in such a way that students with different ability levels become more involved in task-related interactions, students' attitudes toward school and mathematics become more positive, students often improve their problem solving abilities, students develop better mathematical understanding. So, as it can be seen from this study, it is the area where teachers have to give emphasis for improving student participatory learning in the area of problem solving and proving theorems which are the challenges of our students at hand.

Sometimes in learning activities there could be confusion in defining the role of teachers and students. That is to say, students may think that all exercise to be done on black board by their teachers, theorems to be proved by instructors, important notes to be given by the teachers either due to lack of understanding their roles or merely laziness. In any way, it is essential that the two parties shall be able to distinguish their important learning roles.

From this study therefore, it is found that majority of students could identify the obvious roles of teachers like, introducing, presenting and consolidating the lessons, doing examples, giving feedbacks to assignments & exercises, lecturing, facilitating tutorials, preparing tests and exams very easily, many of them at the rate of about 80% or so. Similarly, many of students understand that important activities like working worksheets, assignments, doing quizzes, tests and exams, active participation during tutorials, raising question to clear unclear ideas are their roles which are good but not enough by themselves. This is because there seems some confusion on many of some other important roles like writing important notes, proving theorems solving mathematical problems coming to the board. As the result conveyed on tables above, students think the above activities are all the teachers' role (as the rate indicates). Rather, students at university level are expected to take their own brief notes following the delivery whatever the case maybe. In the same way, proving theorems is not the teachers' responsibility only. At university level almost all courses are full of theorems and proofs, and hence, proving theorems is also part of the student activities, teachers are there to show basic examples so that students shall processed from there on. Again a reasonable amount of students do think that solving mathematical problems are the task of their teachers expecting the spoon feeding style they have been exercising in their lower grades. Of course asking and answering question are the common roles for both in which many students agreed.

Apparently, it is obvious that the progress of these all learning activities are to be monitored and evaluated through time using continuous assessment. This type of assessment is to be practiced through variety of assessment methods some of which considered in this study as conveyed by Table 4. As depicted in this table, though consecutive tests and quizzes, and final examination are the dominating assessment methods used at the rate of about 65% each, it is observed that only very few teachers tend to use group activity (20%) and project work (12.3%) which are very essential elements of activities to play as part of continuous in mathematics learning to be specific. This low rate of exercises in evaluating group activities and project works implicate the need for interventions not only in merely learning practices but also process the assessment practices effectively, appropriately and frequently to be able to correspond the quality of the outputs, the learning achievement. Furthermore, the high rate of students involvement in not doing project works (24%) and demonstrating it (17.8%), conveyed by Table 5 are indicators to work for improvement through a variety of interventions suggested above.

Here, a constructive intervention program must be designed by the department teachers either through awareness creation for some of them and strict guidance and follow up for some others like proving theorems and solving problems.

In any way, this study revealed that students usually do their homework and assignment in either individually or collaborative ways with their friends, the long term assignments in the same manner and consulting senior students which tells us they are in the right truck.

Academic Achievement

The final goal of making the learning situations conducive and giving attention to students attitude to attract their feelings towards mathematics learning is to be able to achieve their academic performance at acceptable level and standard. Unless the students' academic achievement is acceptable at the standard quality of professional human power production who could contribute to the development of the country and the world at large, it will be a waste of resources and fatal at the end.

Findings of research suggested that several class room instructional activities were associated with achievement and noted that the ways in classroom context affects students achievement (Anderson and Brophy, 1998). Moreover , Sommer (1999) found that the quality of instruction influences achievement at class level instructional activities include variables that describe aspects of classroom instruction such as quality of teaching style and opportunity to learn (Belay , 2006). In this study, we see that the students mathematics performance in both preparatory and university levels are promising and relational to most of their learning situations and attitudes. This could be justified by looking into their preparatory level mathematics achievement 50% of them scoring 70% and above in 11th and 12th grades on an average (yearly average); with the means 79.39% (st. 9.9) & 78.78% (st.d 10.9) 11th and 12th respectively.

Accordingly, Derbssa (2004) said that particular attention should be paid to the actual process of teaching. However, a number of studies in classroom activities provide the critical link between students' achievement data and teacher practices at classroom level. This link is unfortunately lacking in most national education surveys. Nevertheless, it is good that mathematics achievement at basic preparatory level is also reflected in their university performance on some selected major course taken so far by the time of this study (basic preliminary courses, Algebra, Calculus, etc) more than 95% of them scoring C and above on an average, more than 70% As & Bs to be specific which are correlated positively $r>0.5$ at significant level $P=0.01$ except geometry.

The yearly CGPA 2.9 (st. dev. 0.48) in 1st year level performance of these students further supports the idea that the more the learning situations are conducive and the more students are interested towards the subject the better academic achievement is reflected in the end, as conveyed by this study.

CONCLUSION AND RECOMMENDATION

CONCLUSION

From this study therefore, it could be deduced the following conclusions which could help us to design means of improving our learning activities.

- As can be seen from the delivery system the dominant methods is still lecturing in both the regular and tutorial classes which is going on against the current advocated active learning methods to enhance student center approach of learning. This becomes the worst when we come to understand that students are enjoying it most.

- From the study one can understand that the tutorial sessions are out of the line, mainly used for lecturing to compensate content coverage and providing assessments sessions consecutively which were meant for student active learning facilitation doing their worksheets and demonstrating what they have done at home by themselves in support of the teacher guide. This is a very dangerous move that destroys the main goal of tutorial session for students' active participation and independent work forum.

- The major challenges of learning mathematics as depicted by the students is lack of learning materials like books, references, journals, internet access and teachers lack of punctuality beyond ignoring some classes.

- Mainly students know their roles from the roles of their teachers in which some are common responsibilities except some confusion in some responsibilities like taking notes, doing things on black board, proving theorems in which students think they are merely the roles of teachers.

- As noted from the study, many mathematics instructors are habitual in using continuous assessment regularly and most students attending the class and tutorial sessions regularly, which is a very good exemplary move to be encouraged.

- From the very nature of the subject, the focus of attention of learning areas include understanding concepts, defining terminologies, stating and proving theorems and developing the skills of problem solving is in line to its target. Specifically, students using collaborative learning, doing exercises and assignments with friends outside the class enhance self regulated learning.

- According to the study, the basic mathematics performance of students at preparatory level is reflected at the university level only 3.1% scoring CGPA less than 2:00 which corresponds to the constructive learning based on previous experience is essential.

RECOMMENDATIONS

To alleviate such challenges stated above in this study it will be wise to work for intervention based on the findings so that the learning systems could reduce the lecturing method to the minimum, at least geared to active lecturing emphasis on student interaction based on inquiry method. Tutorials should be used for their real purposes, confused roles between teachers and students to be cleared, necessary materials to be facilitated and other strengths to be encouraged so that others could imitate it.

This intervention is likely to be long term plan where the problem could not be alleviated easily, since traditions are very tough to break. But as a short term plan a sort of workshop presenting this result to create awareness among the academic staff is essential as soon as possible or even this result to be delivered in the regular seminar period of the department as one of the sensitive issues.

In addition we could start the intervention by making secondary survey to confirm the problems still exist, may be through FGD to be followed by sequences of gatherings like workshops or seminars for designing the action plan for intervention involving both teachers and students, the major actors of learning activities. The department of mathematics shall play the major coordinating role here since the issue is the concern of everybody in the department.

Since students did have complaints on teachers, punctuality, giving regular classes and the like there seem a need for further study on such issues from the teachers perspectives.

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