ORIGINAL ARTICLE

Goal oriented Mathematics Survey at Preparatory Level- Revised set up.

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ABSTRACT

This cross sectional study design on mathematical syllabi at preparatory levels of the high schools was to investigate the efficiency of the subject at preparatory level education serving as a basis for several streams, like Natural science, Technology, Computer Science, Health Science and Agriculture found at tertiary levels. The study was done for long period from January 2005 to April 2006 due to some societal inconveniences disturbing university academic situations.

The study was based on the information collected from appropriate students and teachers of the university faculties mentioned above selected based on the purposive and random samplings through self administered questionnaires and Focus Group Discussions.

The study reveals that vast contents of preparatory courses designed in the new education policy have been completed partially due to various reasons, like lack of time, not using of advanced methods of teaching, insufficient infrastructure facilities and shortage of qualified teachers generally in the schools and particularly in the rural area schools.

In the same time, it is known, the Mathematical area contents of preparatory courses were not much supportive to much needed Mathematics faculties in the universities, like Technology, Computer Science and Applied Sciences.

It is studied of hypothesis in-depth by splitting natural Science stream in to two steams Mathematical and Natural Science, was accepted by most students and teachers moderately with modification and orientation. It is observed in all the way, standards in the education was decreasing day by day. It is recommended that suitable steps should be taken to rectify all the shortages and strongly suggested for implementation of our HYPOTHESIS on urgent basis because it has advantages than disadvantages.

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INTRODUCTION

As Modern Society progresses, use of applications of mathematics has been increased in the field of Science and technology. Mathematics is being used as tool to assist in solving science and Technology problems. Because of this, the courses like Mathematics, Physics, Engineering and Computer Science in Science and Technology field require various studies of mathematics at graduate level. Now-a-days, it will be difficult to science & Technology courses to solve problems with out mathematics [1].

High school education is very important to every student because it provides basic education at preparatory level. It helps the student to acquire higher level of education. Generally, educational programs provide every youth with knowledge and skills, which students need and can use[2]. Due to this, suitable curriculum at preparatory should be set up to gear the objectives and the ability of the students at higher level of studies.

The study of different mathematical Areas at preparatory level will have impact on each course at university level[3]. In this phenomena, some courses in science and technology faculties require more varied and deep concepts of mathematics. It is noted that study of different and suitable mathematical areas at preparatory level play important role in university level. This is being realized, under the new educational policy changed by ministry of education for academic year 1996 E.C, freshmen program cancelled and all academic and curriculum requirements has been adjusted with in the specified time in a compact way. Here students are forced to learn more in a small duration of specified time changes from faculty to faculty [4].

Here, it was planned to find relevant mathematical areas and suitable set up at preparatory level, which covers the short gap formed by closure of freshman programme at university level[4]. The plan was to do research to introduce appropriate educational programs/streams, which are to be useful and flexible to study from preparatory level to catch directly the revised educational programmes at first degree level. The study was meant to find suitable curriculum so that the student to acquire sufficient related knowledge in specific way in that particular and relevant field.

It was observed that the present social science and natural science courses at preparatory level may not provide much required at university level courses of computer science, technology, mathematics, physics and which are having world level curriculum[5]. It was noted that big research was required to find appropriate set up at preparatory level to cover all short comings mentioned above based on the feeling the out put of research will help the students community.

As it is stated in education sector development program II of Ethiopia; syllabi are dynamic for change, and revision of grades 9-12 is essential and text books shall be of high quality. High quality implies students at preparatory level shall have no problem when they join different fields at tertiary level. For this studies are assumed important to be conducted on content, relevance and quality of curricular materials, whence the need for investigating the mathematics syllabi its relevant compared to higher studies in the future [6].

So the statement of the problem of the study could be summarized as follow.
The recent changes and university level made by Ministry of Education, supported by high school preparatory levels in the two streams, namely Natural Science and Social sciences may not provide much required mathematics for courses like Computer Sciences, Information Sciences, Technology and Physics at the university level subjects to world level standards. In order to meet this problem, appropriate and more specific and varied streams are likely to be designed. For this, basic and appropriate investigations must be done to suggest and design a change.

Thus the research about " Goal oriented mathematics at preparatory level- revised set up" was taken significant because some courses in science and technology not having sufficient mathematical areas due to closure of freshmen courses at university level; planning to do relevant research to find and introduce new set up at preparatory level which covers specific needs of science and technology course students like Physics, Mathematics, Computer Science and Technology; hopping that the research out put would have solutions of above mentioned problems and which help to the science and technology students in large at university level in Ethiopia.

The study then started based on the general objectives; evaluate the existence of gap between the preparatory and tertiary levels and to look in to structure of existing two streams namely social science and natural science at preparatory levels; to suggest appropriate and most specific stream designed at preparatory level to meet requirements at university level.

Specifically the study looked in to the different areas of mathematical topics at present in the preparatory level; accommodate most relevant and useful mathematical areas at preparatory level to make science and technology students most effective at university level; proposing new set up with new streams at preparatory level to cover gap (if there existed) in some areas of studies due to closure of freshman at university level; assessed the performance and attitudes of the current preparatory level products (the new students) at the university level; inquired the professional problems of the concerned teachers at preparatory and university levels, involved in running this new change made by MOE; at national level.

METHODS OF THE STUDY

The study sites were all universities entertaining the new preparatory level second year students (PPCII) coming through the new educational system of Ethiopia, where by Jimma, Addis Ababa, Bahardar, Gondar, Mekele, and Alemaya universities involved in this study except the southern university which was not included due to inconvenient time for data collection. Further more, appropriate faculties; technology, natural sciences, health sciences and agriculture PPCII students and their teachers were the target of this study as sources of information. The subjects for source of information specially the students were randomly selected proportionally from each section, but all teachers in these fields were taken for the same purpose. Some students like in Education Faculty of Bahir Dar University could not be found due to professional practice out from the campus. Some like in Addis Abeba University students specially in health area specially medical students were not cooperative both for the questionnaire and FGD due to unknown reasons. Similarly some teachers like in

AAU and Alemaya were not ready for FGD due to certain inconveniences.

The study design is a cross-sectional based on the purposive stratified sampling of university faculties and respective departments assumed relevant to mathematic whose students were selected randomly using appropriate sampling method and their teachers taken all since they were few in number. The study specially data collection was done for a long period from April to October 2005 due to country inconvenience, disturbing university academic situations.

Data collection was processed using appropriate questionnaires to be self admistered by teachers and students of the sites selected. Focus group discussion (FGD) based on the forum created faculty wise teachers and students taken in separate groups were also conducted to collect information. That is, one FGD group of students for each faculty two students per department and one volunteer and appropriate FGD group of teachers of the faculty. Documentary information regarding the curriculum comparison of the old and the new version was done for base line data at the beginning, list of contents given to the respondents during FGD.

Data were processed and analyzed using appropriate basic statistical method and chi-square test for significant testing, summarized and organized using appropriate computer software like spss-pc.

Ethical considerations were taken care by getting the concent of the universities selected through official communications from our university (JU).

RESULTS

I. Student-Response

In this study; Natural sciences, Technology, Health Sciences and Agriculture faculties were used, assumed to be related to the subject of the study, mathematics. Six universities namely JU, AAU, Bahirdar, Gondar, Mekele and Alemaya were used as sites of the study with the basis of random sampling in departments of each faculty. Out of a total of 833 student respondents 37.7%(314) from JU, 18.6%(155) from Gondar were the highest responded to the questionnaire distributed. From all these respondents 17.5% (144) were female students, the highest 33.3% (48) and 32.6%(47) in natural science and health sciences respectively.

Looking into the background of the students, 77.4%(645) students indicated their origin where they came from, in which 24.5%(158) came from Addis Ababa, the big city; 30.9%(199) from the main towns, 22.3%(144) from district towns and the rest from the remote areas. Comparing their origins and the universities in which they were assigned, 57.8%(134) of JU and 80.2%(65) of AAU came from urban areas (city and main towns); while 40.5%(30) of Alemaya and 57.5%(50) of Mekele from rurals (districts and remotes). Majority 77.2%(122) of students whose origin in the city Addis Ababa were streamed in technology and health science areas. Similarly 51.8%(103) of the main towns were assigned in the above two faculties where most students would like to join at the first choice. On the other hand 72.9% (105) of those from remote origin were found assigned mainly in natural sciences and agriculture, where natural sciences in most universities were meant for teaching.

From the total respondents, 75.9%(632) and 75.6%(630) of them responded to expose their 11th grade mathematics scored on 1st and 2nd semester respectively. Majority of the respondents 91%(576) scored 60% and above in mathematics in 11th grade of first semester, while 95% (599) of them scored same range in 2nd semester. Taking the same range of scoring in mathematics, 92.2%(497) of males and 84.9%(79) of females scored in first semester of 11th grade while 81.8%(439) of males and 86%(80) of females scored in 2nd semester of the same grade level, where the difference in mathematics between males and females was found significant in both semesters $p<0.01$. All in all at the final year average of 11th grade 95%(459) scored at least 60% in mathematics where the female rate was 91.4%(64) and male rate was 95.6%(395), the difference significant at $P<0.01$.

Coming to 12th grade mathematics performance, 93.7%(591) of them scored the same range 60 and above in 1st semester with 92.5%(86) female rate and 93.9(505) male rate their difference not significant $p>0.05$. Besides, 93.3(582) of the total scored in semester 2 whose female rate 84.8%(78) and male rate 94.7%(504) in the same range in mathematics score and significantly different at $P<0.1$. In general at the end of the year in 12th grade 94.4%(458) students scored with in the same range where by the female and male rates were found 91.3%(63) and 95%(395) respectively with p. value = 0.024.

Looking into the yearly mathematics scores in 11th and 12th grades negligible number of students, 5 in 11th grade and 2 in 12th grade scored below 50%, of course it went down to 28 when it come semester wise. In general, the mathematics scores of preparatory classes were noted with the mean of 76.4 (st. dev. = 31) in grade 11 and the mean of 75.3 (st. dev. = 10) in grade 12; where there was no significance difference observed between the two sexes in general ($P>0.05$).

For the inquiry raised to know students performance in mathematics at first year level (PPCI) in the university; 465 responded for the first semester performance, 426 of them for second semester, and the mean score of CGPA at the end of 1st year academic performance found to be 2.7 (st. dev. = 0.6). In year one, the first semester, 56.2%(263) of the respondents scored above average ($\geq$B), and 4.9% (23) below average (D&F) in mathematics, where by 42.6%(29) of the females and 58.9%(234) of males scored above average; and 7.4%(5)of females and 4.5 (18) of males below C; with no significant difference sex wise $P>0.05$. In year one second semester, majority 58.5%(249) scored above C and very few 3.3%(14) below C but no F. In this same semester, 61.3%(223) of males and 41.9%(26) of females scored above average while 2.5%(9) of males & 8.1%(5) of females below average, no significant difference sex wise $P>0.05$.

Comparing their mathematics performance of the two semesters with their background, their origins in which they came from 57%(81) the rural and 54.9%(124) of the urban scored B and A, above average in the 1st semester, while 57.5%(73) of the rural and 56.5%(117) of the urban originated scored A&B in semester two; the difference was not significant in both cases, $P>0.05$.

Coming to the cumulative grade point average (CGPA) of PPC I in all courses of the year (semester I & II), the majority 94.8(292) were successful scoring 2 and above. From these successful students 95.4(249) of the males and 91.5%(43) of

the females scored 2 and above. Only 3.6%(11) were dismissed academically scoring below 1.75 in which 5 of them for good. Besides, some of students were distinction (≥3.25) and great distinction (≥3.75), 19.8(61) of them in both cases. There was no significance difference seen in this comparison CGPA and sex P>0.05 (P=0.186)

Based on their origin 95%(134) from urban and 94.2(97) from rural were successful scoring 2 and above, no significance difference observed related to their performance and origin, (P = 0.08). Comparing 11th and 12th grades yearly average results in mathematics improvements were observed in each class interval grouped. Say for example, in the range of 60-69, 40.8%(40) improved by moving to the ranges 80-89 & 90-100 when coming to 12th grade. Similarly 22.6(43) students who scored between 70 and 79 in 11th grade, scored 80 and above in 12th grade, indication of improvement in the subject. On the contrary, 11.2%(11) and 19.5%(37) decreased in the above respective ranges 60-69 and 70-79. In any way the difference of the two grade scores is significant showing the overweight of the improvement p<0.01 (P=0.000)

Again comparing 11th and 12th grade mathematics performances to the CGPA of PPCI; 7.0%(14) students of which scored 60 and above in mathematics at the end of 11th grade have scored below 2 in their CGPA at the end of year one in the university, only 3 of them saved by academic warning. Similarly 5.7%(12) students scored 60 and above in 12th grade dismissed, their CGPA <2.00 only 3 of them warning.

Taking 12th grade final year mathematics result and PPCI semester one and two scores in the same subject for comparison, 93.6%(265) of those scored 50 and above in 12th grade were successful scoring C and above in mathematics during first semester at PPCI, 97.8%(263) of them in semester 2. Besides, 93.8%(195) of those scored 50 and above were successful scoring CGPA 2 and above at the end of PPCI; no significance difference in all three cases; PPCI, semester 1 and 2, and CGPA, (P>0.05).

Looking into the success rate of PPCI, first year university students performance (CGPA) 94.8%(292) scored 2 and above, 93.8%(90) in JU, 98%(50) AAU etc ≥ 90% scored in all of them (Table-1)

Table-1 **Success rate of students at 1st year university (CGPAI)**

CGPA	JU	AAU	B.Dr	Gond.	Alma.	Mku	Total
	Universities						
<1.75	5	-	1	2	-	3	11
1.75-1.99	1	1	-	1	-	2	5
2.0-2.99	56	34	15	23	37	27	192
>3.0	34	16	21	14	7	8	100
Total	96	51	37	40	44	40	308
Success rate (≥2)	93.8	98	97.3	92.5	100	87.5	94.8

Table-2 **Comparison of mathematics grades in preparatory and PPCI**

	Range of Maths scores in preparatory school							
Let. grades	**≤50**	**50-59**	**60-69**	**70-79**	**80-89**	**90-100**	**Total**	
							#	%
F	-	-	1	1	-	-	2	0.7
D	-	-	6	6	-	-	12	4
C	2	5	36	51	19	1	114	52
B	-	2	14	42	31	5	94	3.4
A	1	-	2	19	25	8	55	20
T	3	7	59	119	75	14	277	100

Comparing the success of preparatory students when coming to PPCI at university level: 5%(14) failed to score C and above in mathematics at first semester from those scored 50 and above both in 11th and 12th grade scores. In semester II of PPCI 2.7%(7) of 11th and 2.2%(6) of 12th mathematics successful grades failed to score at least C (Table-3).

Table-3 **Students' mathematics performance at preparatory level before and after joining universities**

	Scores				
Grade level	**Number of students**	**Min score**	**Max score**	**Mean score**	**Std. Dev.**
11-Sem. 1	635	16	100	74.9	12.02
11-Sem. 2	634	36	100	77.3	11.11
12-Sem 1	634	32	100	76.6	11.51
12-Sem. 2	629	35	100	77.4	11.36
11-yearly average	512	50	100	75.2	9.24
12-yearlt average	507	20	98	75.3	9.62
PPC-I Sem. 1	468	0.00	4	2.75	0.88
PPC-I Sem. 2	429	1.00	4	2.73	0.79
PPC-I CGPA	308	1.00	4	2.73	0.60

Table-4 **Students level of understanding mathematics by their origin they came from**

	Rate of understanding maths				
Origin	**Above AVG**	**AVG**	**Poor**	**Total**	
				#	%
City	100	40	5	145	25
Main town	142	38	2	182	31.5
District	108	17	1	126	22
Remote	80	41	4	125	22
Total	430	136	12	578	100
%	74.4	23.5	2.0	100	

Students were asked to rate their level of understanding mathematics and 738 of them were willing to respond to this question using the parameters excellent, good, average and poor. Accordingly, 73.8%(545) of them rated their level of understanding above average (excellent and good) and 2.2%(16) poor; comparing their level of understanding with their background of high schools; 74.4%(430) said their understanding above average of which 56.3%(242) in urban areas. From those whose level of understanding of mathematics found poor 58.3%(7) of them were originated in urban areas (Table -4).

Similar question were raised to rate how they relate learning of mathematics related to other related applicable subjects, by rating normal, difficult, easy and others; 15.5%(109) out of 704 respondents said it was easy to learn and 58.5(412) said normal, while 25.1%(177) said difficult, no significance difference when compared to their origins they came from $p = 0.235$. According to the question asked to express their feeling of learning mathematics at PPCI compared to preparatory level (27.8%(198) of them said it was difficult or very difficult while 11.5%(82) said easy; 93(13.0) said they did not take mathematics at PPCI.

Tble-5 **Learning materials used by students at preparatory level**

Material resources	**Number of students**	**%**
Text books	484	85.81
Reference books	261	46.28
Teachers notes	303	53.72
Modules	22	3.90
Others	15	2.66
N = 564 respondents for this question		

Out of the total students indicated, 63.9%(564) of them indicated their major sources of materials in learning mathematics at university level. As in table-5, majority of the students 85.8%(484) were dependents of text books, then next 53.7(303) teachers notes, (Table-5). Here on the choices given as observed from the table, one respondent can select more than one items, the reason why the sum of the percentage was not 100%.

Inquiry was made to know factors affecting their study of mathematics at first year university level, choice like discontinuity in curriculum between preparatory and PPCI, high standard of courses at university level, lack of basic knowledge at high school levels, others to specify were given, where by a maximum of 272 responded; and more than one choices were possible. Most of the respondents 72%(196) said that their mathematics study was affected by lack of basic knowledge at high school level and then the gap between preparatory and PPCI curriculums 61.8(168), high standard of courses at PPC level 58%(158). Besides, 146 of them specified several other factors like **lack of**: teachers ability to teach and evaluate (90), course burdened above the level of students (3), comfortable places and exchange of information (4), learning style, study plan and techniques, understanding weakness of my own (9), material, references and finance (17), shortage of time, uncovered portions, bulky and congested contents (16), family support and appreciation, health problems, no

mathematics course given to suggest (9); where the number of responses indicated in the bracket.

Table-6 **Mathematical areas students missed at preparatory level and found weak**

Subjects	Missed	Weak
Algebra	117	11
Calculus	198	160
Geometry	158	320
Statistics	249	169
Others	9	13
	n = 282	n = 333

Students were also asked to suggest major area of mathematics they missed from preparatory level, and identify areas in which they felt weak (deficient). A maximum of 282 students responded giving the areas of mathematics in which they though missed in preparatory level choices given Algebra Calculus, Geometry, statistics and others, more than one choice possible to select. Majority of them 88.3%(249) viewed that statistics was missing, next 70.2%(198) calculus (Table-6). Regarding areas of weaknesses identified, many of them 95%(320) exposed their weaknesses in geometry and then statistics 51.2%(169) followed by calculus 48.5%(160).

Several yes or no answer questions were raised regarding the subject matter in question; as a result, 68%(499) said preparatory level mathematics was sufficient to support tertiary level mathematics and other mathematical applicable subjects. Some (n=104) reasons were given by those who did say it was not sufficient. Some of the major reasons were: no sufficient knowledge at preparatory level, there was no deep treatment in calculus, it was introduction only, things were not standardized, it was definitions only; no proof for theorems by 29 respondents; ability of teachers was not efficient, many of them were not professional, and many of them were at diploma level, their teaching not student centered, above all these shortage of teachers was critical problem by 35 of them; materials like books references, not sufficient, not proportional to students population by 15 of them; and some important topics/subjects like statistics are missing and some are new in content by 23 of them.

In addition, 49.0%(347) students agreed that the preparatory level syllabi to be modified to support the university level, of course the others who did not agree the modification were 50.8%(360). They argued that; to make things simplify and make it at student level; there must be good and well trained teachers with full of variety methodology who could complete the course in time,and make it applicable; all prerequisite courses like algebra, geometry and statistics must be considered; and adjust by adding some and dropping some unnecessary contents.

Equivalently, 55%(382) were against this idea where by 44.7%(310) agreed for restructuring the subjects at preparatory level to meet the requirements at university level under the new educational policy, where by ideas were forwarded in what ways it could be restructured. They said; introduce basic courses prerequisite for the university students like algebra, computer science, ICT; and topics must be covered in

time including practical works like laboratory work, application, problems solving exercises and simplified learning; adjust topics to appropriate fields, some topics like matrix essential for natural sciences are given to social science only but not given to natural science part. Drop some unrelated areas like drawing from health and natural sciences. Some topics at preparatory are very hard must move to university level. Training should focus on professional teachers.

The next closed ended question was what students think on re-modifying the two existing streams, natural and social sciences steams in preparatory, say adding a third one like mathematics stream emphasis given to those who need mathematics deeply. In this part choices like; justifiable and agree, not justifiable and disagree no idea were presented in which 739 respondents responded. Accordingly, 61.7%(456) agreed completely on the stream modification at preparatory level commenting justifiable and essential. This question was extended presenting the hypothesis of three streams proposed: tream-1, mathematical science stream consisting of deep mathematical areas for Technology, Computer Sciences, Physics and Mathematics itself; stream-2, natural sciences stream with more basic science areas like Agriculture, Chemistry, Biology, Pharmacy, Health Sciences (Medicine, Pharmacy, given emphasis) Management, Accounting etc; and stream-3, social sciences stream as it was for economics, law, language, behavioral sciences, and other related social science areas. Consequently, 46.7%(326) agreed completely on the hypothesis of re-streaming the preparatory level into three, 41.8%(292) agreed the change with some modification resulting 88.5% agreement on the hypothesis in aggregate. Moreover, opinions were asked in open ended question on why respondents agree or disagree on the hypothesis, and the following views were given. Very huge amount of the respondent (133) said that the hypothesis/proposal is very good for curriculum modification at preparatory level which is essential and could help students' choice to be based on their interest. Some said that unnecessary contents should be discarded and important ones added adjusting the syllabi like dropping biology and chemistry for mathematics and technology, putting drawing for technology only and adding matrix and computer sciences for Natural Science.

At the end, general views about the issues raised were asked and the following open comments and suggestions were for warded. Most of them (55) suggested that contents should be adjusted at the level of student to be bases for the university level study and simplified, applicable, easy access for information; adjusting major and minor areas.

FGD with students

Focus Group Discussion [FGD] with students was conducted at different universities of various faculties. Each Focus Group has 2-students (1996 E.C. batch) from each department of respective faculty. Major faculties of FGD were medical, Technology, Public health, Agriculture, Science and Education. The main objective of discussions with students of all over the country was to know the problems of the new generation students (1996 E.C) with new education policy of ministry of education. Students were questioned at each FGD of various universities regarding: Whether there is 1. Content gap, problems of sequence of topics, unnecessary courses and missed topics between preparatory courses and their respective departments at the

university level. 2. problem of facilities at Preparatory level like teachers, Laboratory/Library and Teaching material. 3. Orientation of course completion at preparatory level. 4. and at last forwarding the idea of the hypothesis regarding the division of present natural science into two streams like (1) mathematical (physical) stream supposed to be prerequisite for Engineering, Computer Science, Mathematics, Physics, Chemistry fields. (2) Life/Natural science stream, supposed to be prerequisite for Medicine, Agriculture, Public Health, natural and Education areas. (3) social sciences stream as it is.

Courses and contents

Regarding preparatory courses, students of different faculties of different universities have expressed problems over the courses at preparatory. It was noticed from the students of different faculties of various universities, as Technology, Applied Science and Computer Science were being highly affected, where as Medicine, Agriculture, Public health and Natural Science were not this much affected by present preparatory level. It was known from the experience that Technology, Applied Science and Computer Science have required much mathematics back ground, where by other faculties have not required more advanced basic mathematics. Because of this difference, students from Medical, Agriculture, Public Health and natural science have not faced big problems with existing curriculum at preparatory as well as year-I of university. In the same time, Technology, Computer Science and Applied science students faced much problems at the university level.

For example, Jimma University Medical faculty students commented that there was no content gap between preparatory and PPC and 50% of the group supported the present arrangement both preparatory and university to remain as it is while the rest supported some modification due to missing topics like Probability, Bio-statistics, Epidemiology, Matrices, Micro Biology, Bio-chemistry, Organic and Analytical Chemistry, applicble with respect to their faculty. On the other hand, Education Faculty of Jimma University students did not come into agreement to any one of the discussions like content gap, missing topics, sequence and unnecessary courses; except they were all for the modification worried some courses like organic chemistry geometry offered at early stage at 9^{th} and 10^{th} grade only not spirally developed in the 11^{th} and 12^{th} grade and it was noted that some unnecessary studies like drawing were incorporated in the present existing system for all studies while important topics like matrices are given to social science students only and calculus which is very basic course for sciences and technology is not deep. When we come to the Natural science and Medical Faculty/Public Health students of Gonder University had been observed they explained that there was big gap between contents at preparatory to the university level. Specifically, applied science students strongly argued that they had poor performance at year-I of university courses, because of lack of supportive courses like mathematics at preparatory in the current curriculum.

Regarding sequence of topics, missing topics and unnecessary courses at preparatory, almost all students from various faculties of different universities expressed different problems as per their experience with existing arrangement which are specific to their field areas. According Bahardar University Technology students for example, some course/topics like Discrete mathematics, Mathematical logic, fundamentals on

computer science and basic level programming courses indicating their need for application oriented mathematics more at basic level. They strongly argued for smooth connection between preparatory level courses and university level courses with respect to Technology and Computer Science courses.

Qualified manpower and facilities

Discussions were also made with all students in each and every FGD of students over running of courses at preparatory, and different opinions/ideas/problems have been recorded/observed at each and every FGD of students from different faculty of various universities. In each and every FGD with students, 90% of them expressed same problem of vast course contents at preparatory; expressing that the present allotted time was not sufficient to study all contents with present existing methods of teaching. Regarding implementation and running of preparatory program, they have expressed common and similar problems like: lack of qualified and experienced teachers and traditional methods of teaching specially in rural area, time shortage to finish courses, no sufficient facilities at schools, no skilled manpower to operate laboratories etc. They also had different opinions over the preparation of students to university programs. Here, it was observed deeply that students feelings in line with their interest to compete for field selection to join universities, and complained conditions were not supportive to them. They said that more diploma teachers in rural schools was a big cause of deficiency for proper preparation at preparatory, creating the gap between rural and urban. They suggested to readjust all topics at PPC level as per topics arrangements at preparatory or vice versa.

According to the technology faculty students for example, there was problem to follow university system because of time constraint and other problems. According their experiences with university system, courses were vast and more standard, they have to study more courses with in a small period of time which challenged them. This was due to lack of proper study at preparatory suitable to their field, might be due to shortage of facilities, like books in libraries and materials in laboratories. Even if some schools have them, trained people were not available to handle them properly. The Education Faculty students furthermore noted that materials like computer laboratory and other science laboratories supporting to their courses were insufficient specially at some rural high schools. Because of all these and other reasons at preparatory level, it was identified as most of the students coming to university with deficient knowledge to easily cope up university courses. They complained largely as urban schools have almost all facilities but not the rural ones, the difference between rural and urban students at university level was inevitable. Rural students were not competing with urban students in most of good courses at university. Students also viewed that some teachers were not showing any interest on teaching even if they are qualified and there was no any proper authority to take measures.

Orientation of course completion at preparatory level

It was commented that even if some schools have proper facilities like laboratories/Library, they were not being utilized properly. According to them, there was no proper communication language (English) teaching at rural area schools. This was being barrier to them to follow university system. They explained as all science courses are very important with

laboratory practice with respect to their specialized department, it is not given properly to students at basic level as scheduled. According to them, almost all students were facing many problems from different courses because they have had no confidence on their studies clearly on all subjects with respect to what they are learning at university. It was noted from their comments as some courses at University level have no prerequisite basic courses at preparatory either independently (or) with combination. On the other hand, almost all students have agreed about excess of co and extra curricular activities given at present preparatory level assumed all unnecessary activities, taking their time to study other hard courses basic for university level and teachers rushed up all topics only for sake of examination due to shortage of time.

The hypothesis

In each FGD, **hypothesis** was proposed about the division of present existing natural science stream at preparatory into two streams i.e 1) **Mathematical/physical science stream** with assumption supporting those with much need of mathematics stream like Technology, Computer Science, Applied sciences Faculties. 2) **Natural science/Life science stream** with assumption supporting to Medical, Public Health, Agriculture Faculties, and of course the third Social Sciences stream remain as it is. From each and every FGD with students of various faculties from different universities, it was noted that only 60% students supported this hypothesis directly with out any hesitation, and 20% students hesitated to support this idea fully because of fearing over selection of stream at preparatory could be premature and they like serious care to be taken when changing. On the other hand, 20% students have not agreed this hypothesis due to various reasons where some of these included the following.

1. Students may loose various chances of field selection.
2. Rural students may be affected in course selection due to lack of awareness.
3. Broad study of general knowledge is reduced.
4. Students will be confined to limited courses at university selection.

In general, it was observed from all over FGD's of various university mostly Technology, Computer Science, Applied students welcoming this hypothesis, except other faculties like Medicine, Public Health, Natural Science, Agriculture faculty students have not completely accepted this hypothesis due to various reasons mentioned above.

Accordingly, Technology Faculty students of Jimma University for example expressed that all the problems now students are facing in the new education policy may be solved up to some level, if the hypothesis is implemented perfectly. They felt that preparatory students did not have the capacity or knowledge to choose their field areas according to their interest right at premature level. So orientation must be needed about the various fields like Technology, Health, Natural Sciences etc. They felt that the hypothesis might help the students by creating awareness of their fields specifically from early stage and it saves time and it avoids study of unnecessary courses, but it might result low general knowledge of other areas.

Medical students have accepted the field selection at preparatory since at the age of 16 years, the present generation of students have sufficient knowledge to know their interest and make proper choice. According to their opinion, almost all students have general knowledge due to advancement of information technologies like TVs and

other media, not neglecting the existence of injustice to rural area students.

Technology faculty students of Baherdar University inparticular, have accepted the hypothesis with modification and strong orientation at early stage of school education. Parents' influence must be discouraged in the course selection. Students should select the field according to his/her interact and his/her capacity only. They emphasized for suitable target oriented system to reach the university level, with good and sufficient knowledge in his/her selected field. Similarly, from the experiences of Gonder University students, 70% of applied sciences faculty students accepted the hypothesis with out any argument or suggestion. The rest suggested that some basic common courses should be given at all streams. They complained against the present placement of field areas by ministry of education according its own methodology without interest of students. They also suggested that rural areas students may be given importance in any selection. Health science students of this university expressed their fear about proper implementation and appointment of good qualified teachers after accepting the hypothesis.

The very few students strongly opposed the hypothesis reasoning that students may loose various field selection choices at university and also rural students would not have sufficient awareness in field selection after 10^{th} grade which could be to their disadvantage. Of course some students refuted the above fear by saying it will be solved by providing orientation through different personalities and organizations assumed to be supportive; like, educated parents, school environment, University senior' programs, Mass Media and the like.

Chances were given to them at the end of each FGD to comment regarding general problems/suggestions/different experiences which could be useful to future generation of students. Accordingly, some students from all over universities were telling about the orientation of the fields found at university level, and they were convinced the hypothesis would be reasonable if first awareness of parents be done to families/parents to give free chance to their children in field selection since some parents usually force their children to the field against their interest. An important thing observed during the group discussion was some students of educational areas were seen ashamed of being teacher while going for vacation, they were telling lies of their original fields to their friends. It was noted from students opinion even at university, some faculties not having sufficient/ well experienced staff, which was another major problem suggested in the discussion. Specially, computer science study as basic course was recommended and quite necessary to be offered to all faculties in each university.

Students also complained in this general opinion session that urban students (for example from Addis Ababa) have taken good fields like Medicine, Technology and Computer science. From their points of view, rural students are sadly neglected in the central selection system, so injustice is being done to rural areas students in getting good field areas. They proposed for quota system to rural area students in valuable courses like Medicine, Technology and Computer Science. According to their opinion, good field areas were occupied by urban school students with help of good facilities and qualified teachers, and as Education Faculty of Jimma University students stated, government placement system (central admission) with out students interest must be revised.

II. Teachers-Response

In general some teachers were not voluntary to reply the questionnaire; rather, the focus group discussion was energetic and 130 university instructors were found volunteer to respond the questionnaire properly. Of these respondents 98 of them indicated their academic status; assistant lecturers 19.4% (19), lecturers 55.1% (54), assistant professors 7.1% (1), associate professors 17.3% (17) and professors 1.0%. Comparing academic status of university teachers, 88% of Bahirdar University were the highest in lecturer and above and then next 84% Jimma University. Looking the same comparison faculty wise the highest was 98% natural science with status of at least lecturer and then 67% technology. The Alemaya University instructors did not respond at all in this line. Among these respondents 125 instructors indicated their teaching experience in the university, and 80.8% (101) confirmed they have had the experience teaching at PPCI level showing the relevance of their judgment, many of them 94.5% (69) by teaching in the class, laboratory work and practical supervisions.

Instructors were asked to suggest whether they had difficulty in teaching the new batch of students and 65% of 117 instructors said they faced difficulty when teaching the new generation at PPCI level. Some reasons were forwarded by 68 of them as to how teaching had been difficult for this group. Most of the respondents (39) revealed that students could not express themselves very well indicating lack of communication; most students are slow learners, they lack understanding basic concepts due to background in mathematics specially calculus. Ten respondents said that these students have little interest in learning, little motivation to reading, dream to get their degree without working hard; and they do not take any note of their own. Some said there is gap between their origin, coming from different localities, and they do not have experience of problem solving.

Majority 60.7% (71) of those who had difficulty in teaching PPCI said that the level of understanding of this generation was low or very low; only 5.1% said high or very high, the rest 34.2% at an average. On the question raised whether there was gap between the PPCI and preparatory level subject areas under the new educational curriculum 65.3% (64) said yes there is gap which is one of the factors of difficulty in teaching at university level. In what ways the existence of the gap could be expressed was the next issue in which the following ideas were forwarded by the teachers, numbers in bracket are respective frequencies.

- Depth of education at high school level is not enough to cope up with the university courses; they cannot write even a paragraph properly; they come with no sufficient basic knowledge; there is very big knowledge differences among students themselves; they lack study mechanism skill. (33)
- They need make up classes to build their confidence; they should be brainstormed by easier courses in university campus like in the freshman program. Culture is one factor dominating their activities so they need some awareness about university courses (17)
- Other ideas like spoon feeding at preparatory teaching made them loose. Some essential courses not given at preparatory and freshman courses are missing. Teachers moral must also be considered by providing incentives and encouragement (14)

As to the question raised whether the preparatory mathematics is sufficient for the field area where the respondents are

involved; 53.9% (48) said not sufficient providing the following remedy.

- We need applied mathematics, numerical mathematics, problem solving, pre-university mathematics, binary numbers for computer application(13)
- Students seem to have profound difficulties in dealing this subject (mathematics) due to lack of basic areas at preparatory; their level of understanding is low. (11)
- The quality of teachers must be improved, material supply, texts must be sufficient evaluation methods, promotion policy must be revised. (3)
- Remedial classes before major courses at university level shall be given (10)
- The time to cover courses is short, must be improved, and more credit hours for major courses is essential (2)

In addition, students weakness in areas in which mathematics is needed as application were suggested by instructors. The following are summary of these areas in which students were found weak. The majority (60) of them said that these students have had lack of mathematical areas like: calculus, algebra, geometry, numerical methods, symbolic calculations, mathematical operations and deriving equations, working on statistical and epidemiological calculations, numerical for computer sciences, lack of logic and set theory in basic mathematics, elementary probability theory. Some (9) said lack of relating theory and practice in other science areas, lack of systematic approach, usage of theories; analysis and visualization of different views; lack of understanding word problems were observed as basic weaknesses.

The inquiry went further asking university teachers if there was a need for changing the new preparatory level curriculum to make students background strong. Accordingly 59.8% (61) supported for a change and suggested of changing the curriculum in the following ways.

- Curriculum at high school level must be changed in such a way that strengthening students background (emphasis on basic areas) at high school level including relevant and important concepts that can support university courses but must be at the level of students considering the age of students at each level; curriculum design must involve students teachers and stake holders; time extension must be considered up to four years, it must enable students to work independently and practically (25)
- Deep mathematical knowledge areas must be added, and it must be applied towards problem solving in other fields. (5)
- Quality of professional teachers, proper evaluation, sufficient materials (resources) must be available (5).

On the contrary very few people suggested to use the new curriculum as it was but work on proper implementation (1)

- Teachers at university level were also asked to suggest new mathematical topics to be added to preparatory level to make successful education at PPCI. Thus mathematical areas like; Calculus, Algebra (abstract algebra, matrix in linear algebra), Geometry, Applied mathematics like linear measurements to medicine & health in general, computer sciences, discrete, numerical, triangulation, solving transcendental equations by numerical methods; Basic mathematical topics like logic for computer sciences, trigonometric functions, computational mathematics, Statistics and probability, Differential equations were suggested.

A hypothesis designed on restructuring the two natural and social sciences streams of preparatory level into three streams, adding one more for those field areas in need of deep mathematics like physics, mathematics itself, technology and computer sciences was given to teachers like it was done for students. Accordingly, 77% (77) teachers agreed on the hypothesis given in general by saying agree or agree with modification (25%) followed by some suggestions and comments on how it should be modified or restructured.

- Detailed data based study must be done to modify the streams (37)
- Care must be taken when contents of mathematics are designed to fit into other areas, say mathematics for health, mathematics for technology, for natural sciences, for information technology etc; and avoid duplication emphasis given on the theoretical part of proofs and formula derivation. Further more, it must be applicable and solve the language problem (57)
- Students from rural areas are forced to determine their future with out any exposure to different options of field areas; thus students interest must be considered when joining the university (4).
- Students at preparatory must work hard by themselves and there must also be appropriate and relevant teachers (4).

At the end of the questionnaire the following general comments were given by the teachers through the open ended question given.

- Appropriate duration of the training at the university level is essential to strengthen the background knowledge of students at fresh level. So three years for degree level training is short; it destroys quality of teaching, at least one semester revision courses must be given.
- Workout for increasing students level of understanding at high school level is essential. There is significant difference between old and new students in this line, say, lack of good English communication. Thus restructuring must be done, policy and curriculum must be modified at least if not changed, but the restructuring must be done based on study such as this one. When modifying establish extra-curricular activities, courses to be covered in time, encourage students to document (take their own notes) of what they have learned.
- Adjust mathematical courses; by adding extra topics like in calculus algebra, computational techniques for computer, software, chemical industry, electrical industry, etc; and provide deep mathematics. English language for teaching mathematics must start right at 7^{th} grade, and make it practical and applied.
- In Ethiopia we have no system of compromising quality and quantity, so instructors at preparatory level must be highly competent, methodologically equipped. Human and material resources must match. There is a need of high standard of training in the future, teachers at high school level are not able to make them grasp the main concepts.
- The evaluation must be at high standard, specially 10^{th} and 12^{th} grades. Promotion policy at university must be changed, the current evaluation system makes students dependent .
- We do not agree on this modification or change it is early to say, the problem is proper implementation, no need for restructuring.

IV: FGD with University Teachers:

Like that of the students, Focus Group Discussion [FGD] with university teachers were conducted at various universities of

different faculties. Main faculties for grouping the FGD were Medicine, Public Health, Technology, Science and Education. Each group consisted of two teachers from each department (preferably teaching to year-I and the head of the department). The aim of Focus Group Discussion with university teachers was to know about

(i) Comparison of performance of the old and the new batch of students.
(ii) Follow-up of the new (1996 Eth. C entry) batch of students and course structure in the new education policy.
(iii) The effects of freshman program closure in the universities.
(iv) The Hypothesis, division of natural science stream at preparatory in to two streams as explained in the students section.
(v) General comments.

The old and the new batch of students

In each Focus Group Discussion at different universities, all teachers have expressed their different opinions regarding new generation students' academic performance. Most of the teachers from different universities who have been teaching to new generation students have explained that the present new generation batch (1996 Eth. C entry) under the new education policy were academically weak in so many aspects where reasons were not explained clearly why they were academically weak compared to previous batch students. Nevertheless they felt that new generation batch of students also have come from same community and same schools as that of previous old batch of students came from, but the wonder was why the difference drastically. New batch of students did not follow the teaching-contents of teacher which were delivered in the class teaching. According to teachers' opinion, students were poor in communicative language (English). They felt that most of the students have come from rural areas where they were no facilities. So they suggested that students should be prepared at preparatory in communicative English through different advanced methods.

Though some agricultural staff of Jimma University revealed that they have no idea about facilities and teachers' qualification at preparatory level, some other teachers complained that teachers at school level not concentrating on teaching and other academic activities properly due to various reasons. Technology faculty teachers of Jimma university suggested that new generation students have no sufficient mathematical/analytical capabilities to solve simple problems. It was noted that teachers of all departments were unsatisfied with performance of new generation students. Computer science staff of JU complained that the new fresh computer science students have no basic relevant knowledge to study computer science at 1st degree level. They suggested for proper arrangement of the system at preparatory level.

According to Bahardar Engineering teaching staff, the new setup had some positive aspects, but lack of co-ordination in implementation was giving problem to student community at large. Computer science staff of the same university told that present PPC students were unfit so they have difficulty to learn. Bahardar Education Faculty teaching staff commented that the whole curriculum starting from elementary level must be revised in-depth, width and sequential way. For example elementary kid is being asked about acid with chlorine and hence quality of teaching must not be compromised. They told specifically about English language was a big problem to teach than

other subjects. Its impact had more influence on the present generation students. They suggested that a grade 7 and 8 must learn in English media and texts translated found giving different meaning from language to language, thus must be given due consideration.

The Technology Staff of Baherdar University revealed that there was large gap between the PPC and FPC in terms of application say for example; use of mathematics and physics concepts have not been applied by PPC students where ever they are needed and it was observed that there was big difference between rural students and urban students except in which case some departments had no such problems simply because best students were admitted. Almost all teachers accepted the lack of proper communicative in English Language.

According to applied science faculty of Gonder University, they accepted that the present new generation of students are not well qualified to take university courses. According to them, major communicative language (English) should be given to students beside basic mathematics.
Applied science faculty of Gonder university have expressed as current PPC students have no idea about relevant basic calculus courses, teaching method must be changed at preparatory level and sequential arrangements of all topics is essential. It was noted from University teachers that the performance of new generation students was unsatisfactory currently. Medical faculty staff were unhappy over new generation students and English language is to be improved in due course.

The course structure in the new education and the missing of freshman program

About 80% of University teaching staff of all different universities have expressed that performance of new generation students was unsatisfactory. As a result, they recommended for well organized preparation of students at preparatory level according to the needs of the universities, otherwise, it would be difficult to run the courses at university level in-depth department wise. Opinions, doubts, suggestions and recommendations have been recorded from each FGD with university teachers from various universities regarding course structure/ revision of curriculum. And according to education faculty of Jimma University teachers, contents were available at preparatory syllabi and the depth of the study was questioned. According to their opinion, students were joining in the university with out sufficient knowledge relating their department. Previously there was freshman program in the campus, so students had some chance to improve their basic knowledge relating to their faculty/department/ field. Proper English communication might be improved due to the freshman program. In particular, Biology and Chemistry department teachers also said that content related to their department were sufficient and vast, but it was very difficult to handle at preparatory because of some topics beyond their level of understanding of both students and teachers. Besides, lack of laboratory facilities at high schools (mainly from rural schools) led to problem at university.

The present gap may not be only from the content but may also be due to various factors like: in-sufficient, qualified and experience of teachers, lack of facilities at rural high schools, no command on English language, lack of suitable methods of teaching to complete vast contents at preparatory, high school teachers might not have concentrated up to their level due to various reasons. According to opinion of

some teachers contents at preparatory are better than before, but all may not be finished with in a year due to in appropriate design and vast contents.

Technology Teaching Staff of Jimma University viewed that every field level must be specifically given at the basic level according the need of students. For example computer science courses need contents of mathematics at various levels more and more, so it should be given properly from preparatory level. Some teaching staff from technology said basic concepts at preparatory were almost acceptable. But the problem was on how deep they are given to students which was questionable. They suggested important points to improve quality of education, such as; (1) quality of teachers in the subject and methodology (3) laboratory and library facilities (4) closing the gap between rural and urban schools (5) handling of all things correctly was a problem because of lack of experienced teachers. They felt for applicable areas/topics that were given at fresh level must be given attention when revising the preparatory curriculum. The opinion of agriculture faculty was that students at preparatory should be well prepared before going to university and added their feeling that teachers at schools were not concentrated on the course completion, and academic year finished before completing important contents. Thus they recommended clearly that English should be improved on urgent basis; students should be prepared well at preparatory with laboratory practice; proper authority should supervise all the activities of school functions. The health staff of JU also explained their experiences and suggested that the content at preparatory is vast but may not be enough to meet the requirement, thus knowledge gap was observed currently; specially, preclinical external examiners commented on the weakness of present PPC students found weaker than previous students, particularly week in mathematics and statistics; the criteria saying that maximum of 5% failure for the new generation (PPC) allowed by authorities will be difficult to determine the real weakness. They observed main defects due to facilities for teaching like lack of laboratories at preparatory level. They felt that instead of going to our hypothesis, it would be better to give widely, deeply, qualitative teaching and learning activities to students at preparatory with existing system and aired their fear that field choices will be narrowed if the hypothesis is applied at this early stage.

Education faculty of Baherdar University teachers have viewed that students were seen mixed at 2nd year level currently (PPC+FPC) the difference was clearly seen from their performances. They felt that student had no practical knowledge because of no proper laboratories, no facilities and no quality of teaching at preparatory. They had observed students' weakness in writing practicum reports. They wanted that sufficient and necessary mathematics and statistics to be given in chemistry, Biology and Physics departments. They talked based on the university special survey over this problem conducted by university early in this year. It was observed that, some schools have proper equipment/laboratory facilities but skilled persons not available to handle them properly.

It was observed from teachers comments that only urban school students were fellows of university system beneficiaries. Present system is more advantageous to urban school students than rural school students who are sadly neglected. Due to this difference, gap has been formed at universities. They told that rural students

have no confidence on their study because quality of teaching in some schools is questionable. They expressed unhappiness over present policy of bridge of education system between preparatory and university. They suggested for proper modification, necessary and immediate remedial to cover the gap formed due to various reasons including the class size which is also another problem. There were problems of laboratory utilization, for example some students did not know what a microscope is. Health teachers commented over national examination and said that there must be entrance examination nationally to screen the best students and keep the reasonable number in each class; as they said, quality is more important than quantity.

Most teachers shared their experiences as new generation students are dependent in every aspects from time to time, which is dangerous attitude of students and thus some thing has to be done. They commented as current students are not using mathematics and statistics properly because of insufficient training from preparatory; and some students are being trained by diploma level teachers in some rural area schools, the revision of the system would be inevitable. Some teachers expressed that there is problem in every aspect, program was good but now it is not properly delivered to students, so proper set up is necessary to rectify the problems simultaneously. They recommended for some modification so that basic/simple mathematics to Medical/Natural/Agricultural/Public health faculties and in-depth mathematics to other required faculties like Technology, Computer/Applied Sciences. Furthermore, some teachers argued that university students need to learn according to their orientation but at preparatory level the subjects/sciences must be basics and general that could help them choose their fields/areas flexibly during the two years of preparatory.

On the contrary, some staff suggested their reservation saying that the concern for special need for those streams needing mathematics in depth could be acceptable but students selecting their fields at early level (11^{th} and 12^{th} grades) before they comprehend their interest and capacity to choose the actual field area they meet would be a problem according them; and preparatory level would be too early to place them to their field area hence the current general natural science stream will do for all science areas to come at university level. Besides, they said that this additional mathematics if they need it, must come into university curriculum but not at preparatory level. Students must be given chance of flexibility to shift from choice to choice depending on the basic sciences taken at 11^{th} and 12^{th} grades. They emphasized that preparatory students do not have the capacity or knowledge to choose their field areas (to their interest) right at this premature level. On the other hand, some teachers even expressed that information (orientation) at early stages from 8^{th} grade must be given about various faculties and their applications. So the new idea may help the students to choose their interest field areas appropriately.

From medical faculty comments, currently Ministry of Education does not care for quality as it is working only for quantity. Thus things must be changed to progress for both quality and quantity simultaneously with appropriate plan. Some teachers expressed their opinion as it is very difficult to work on the complete coverage of the current syllabi at preparatory level and fill the gap at university level due to congested

curriculum. It needs proper arrangement at preparatory as well in university level.

Regarding the old freshmen program closure was raised and all Universities recommend for at least one semester of freshman program in the university. They have commented as different universities have different system for example Gonder University gives general health courses for all health departments for 1st semester of year one and then make field choice according to their performance, thus best students will go to medicine and Pharmacy and the remaining weak students all going to other departments in the same faculty. They pressed that language should be improved through advanced methods. All faculties of Jimma University also expressed that freshmen program was helpful to almost all students in so many ways. It brings the students to one level before joining year-I.

According to Bahardar University, the beauty of old freshman program was to bring all differences in one equal level and give equal opportunity and put their in one line. Now students have missed that opportunity. So this is a big difference among students in one class. Urban students are dominating over rural students. The curriculum is there but there is problem of implementation. Freshman course is an advantage to rural area students and which is choice to weak/untrained students to cope-up with university atmosphere and different social/psychological problems.

The hypothesis

Important information regarding the hypothesis was collected from the staff too. According to Jimma Univrsity staff, similar opinions with other university teachers were expressed through separating field streams at preparatory level seem convincing theoretically, but to implement may be very difficulty and hence care must be taken. At current situation, some teachers from computer science have asked to include more basic computer related subjects at preparatory; because these are useful to each and every faculty. Teachers at different FGD's expressed that if the splitting of fields at preparatory level is to be implemented students must be given sufficient orientation before they go into it to avoid wrong field choices. It was observed from university teachers of all faculties needed contents different field areas shall be included right at university level either part of curriculum or tutorial if credit hours not adjusted.

It was noted from the Baherdar university teachers of chemistry department opposing the hypothesis completely. They felt that hypothesis may not solve the problems since the problem is different as they said. They proposed proper implementation of teaching method and appointment of qualified teachers and subjects are to be given properly at preparatory level. According to them, existing problem is at the levels of 9th and 10th grades, not only 11th and 12th grades questioning the whole school curriculum from lower level. But other teachers in the same faculty accepted the hypothesis in-principle but orientation must be given starting from 9th grade about field choice and its application in the future.

Even though technology Faculty teaching staff found the hypothesis is reasonable and they have accepted with some modification. It was noted from teachers of Civil Engineering that they opposed this hypothesis because frequent changes in educational system is not good. But remaining teachers strongly accepted as it is good opportunity to students. They suggested to include basic computer

science and Engineering but had fear that students may not have capacity to determine their interest correctly, which was argued by some others this could be compensated through different orientations of 1)family 2) friends and community 3) Mass media 4) senior universality students like it was argued by students.

Both Health and Applied Science faculties of Gonder University teaching staff have expressed similar concern like other teachers. They expressed specially as it is difficult to rural students who have no exposure at all even if they have been oriented and very difficult to convince them. But mathematics staff supported the hypothesis because if not all, at least some problems of present complexity may be solved in due course when senior students being role model as with brief orientation. Other teachers also argued that job opportunity may have conflict with their choice of interest and hence exposure may be against the hypothesis.

Along with specific questions at each FGD, general suggestions from university teachers regarding the present problems in the new education policy and other concerned academic activities have been discussed. Almost all university teachers have accepted the present new generation students were academically weak. According to them, it might be either with course structure or with closure of freshman program. Generally almost all university teachers from different universities uniformly accepted educational standards are going decreasing every day. They suggested suitable set-up/mechanism need urgently to correct the system. As general comment from Jimma University teachers what ever the case may be, any curriculum revision must be according to various departments needs. Similarly others concerned department consultation in designing the curriculum is essential. Applicable areas/topics that are being given at freshman level must be given attention when revising the preparatory curriculum.

Another general issues raised were that texts translated to different local languages found giving different meanings from language to language; so, care must be taken when texts are translated specially sciences. According to experience of some teachers, social science graduate teachers are teaching science subjects in some high schools. Mathematics contents should be arranged at preparatory level as application to other science fields like Physics, Biology, Chemistry etc. Almost all teachers felt that concerned higher authority people did not taking care while preparing the national curriculum. As Gonder University teachers generalized, at the present situation at least sequential and proper arrangement at preparatory is essential; so steps should be taken in this direction as early as possible.

From different universities 90% of the teachers suggested that first English Language should be given priority as communication language from high school. It solves 50% problems in the Teaching – Learning program with quality development. General suggestions have been recorded from Bahardar University teachers as the whole curriculum starting from elementary level must be revised in depth and in sequence, and quality of teaching must be maintained. For example students of chemistry diploma students are teaching at high schools. The language problem should be rectified urgently. Now-a-days teachers are not able to translate even in vernacular and every student does not know Amharic properly at university level, this is the new phenomenon to give attention during curriculum design. To our wonder, some suggested that the lecture

method teaching could take more time to cover all topics so teaching methods must be changed at high school to cover all topics properly.

DISCUSSION

It has been some years since Ethiopian educational system ventured a paradigm shift changing the curriculum of the nation right from elementary up to tertiary levels. Traditionally, students at end of high school (12^{th} grade) used to take ESLCE (national exam) to enter tertiary education where by the first year in all universities was meant to review selected high school subject areas assumed prerequisites for advanced learning; the program called freshman program. The main objective of this program was to bring together fresh university students originated from different high schools with different level of facilities that made the quality of education varied from school to school, particularly those coming from rural or remote areas with very low standard. But this system was criticized in many forums unsatisfactory for the development of the country not able to solve the societal problems; the bases for a change of the whole system.

The Ethiopian government specially the MOE initiated the change in educational system and made a paradigm shift, one of which changing the university level training duration reduced by one year, taking freshman program down to high schools in 11^{th} and 12^{th} grades calling it preparatory program. Selected students join these preparatory program after passing national examination given in 10^{th} grade.

School education in general high school level education in particular is very important to every student since it provides basic education at pre-university level assisting higher level knowledge and skills, developing independent thinking which leads to a necessity of conducting investigation on the existing curricula [7]. In India for example, the universities concerned shall frame the curriculum for their respective inter disciplinary courses through Board of Studies and also can introduce syllabus suitable to present trends. The committee felt for practical oriented mathematics. The committee of opinion that syllabus should be changed as per existing conditions and developments [1].

Consequently, several comments dissatisfactions and criticism following this change. Some saying that high schools are not yet at equal status specially teaching and learning facilities and environment, some saying students are young to choose their best interest at preparatory level, others saying narrow possibilities of field choices at this level, and some other supporting the system and suggesting to wait and see give it enough time for implantation. This study tried then to investigate the situations at preparatory and tertiary level interrelation and coherence for a better educational standard, specifically in mathematics which is fundamental tool for all sciences and progress of technology. Second year students at university level which of the new generation, called preparatory program complete (PPC) were assumed appropriate sources for the feedback of the preparatory level, the tertiary and their coexistence; of course their instructors could also play the some role.

According to the study based on the questionnaire then, students at PPC level originated from the big city like Addis Abeba city to the remote areas from the boarders of Ethiopia from 20-30% percent

in each case. But majority (77%) of urban students got the opportunity to join technology and health areas which are the most demanded field of studies in view of students and the community now a days. On the contrary the study showed that majority of students from rural (73%) got the chance to join the least wanted field of studies; natural science (teaching in most cases) and agriculture. Hence the question of being able to correctly identify their interest, and the level of academic performance at the iterance examination to be able to compete to join the "best" areas like technology and health was against the opportunity of those students coming from remote areas. This was true even if their preparatory level (11^{th} and 12^{th} grades) mathematics were 60% and above for most of them, more than 90% of them. Here the male dominance in mathematics performance was significantly ($p = 0.02$) observed at preparatory level; showing the need of empowering females through affirmative actives and assertiveness, to bring them up.

This big sum of students scoring reasonably good in mathematics at preparatory level was reflected in first university level where by very few students (5%) scoring below average (F and D) with no significant difference in sex ($p>0.05$) in the same subject. Even the cumulative grade point average (CGPA) at the end of first year in all subjects confirmed that 95% of them were successful scoring 2 and above. This implied that background is essential for tertiary level success; the origin from which they came did not even show significance difference in this regard.

According to the result, 74% of the students confirmed that their level of understanding mathematics good and excellent, only 2.2% poor supported the above argument that the subject is the main background to most of the field areas. Those who needed the applicability of mathematics reflected that 25% of them had encountered difficulty in learning it; in particular, 28% of them had difficulty in learning mathematics at tertiary level than the preparatory level; implying the question of adequate background at lower level. The students, 72% of them supported that their PPC level mathematics was mainly affected by lack of basic knowledge at high school level and then next (62%) the gap created between preparatory and PPC curricula. The third factor affecting mathematics learning at university level; teachers ability to teach and evaluate, mentioned by the students was the basis for the first and hence need to be improved by the government nationally. As to the second, to improve the coherence of the two curricula, students identified mathematical areas they missed at preparatory level but essential and must have been given deep to support university levels; these were: algebra, calculus, geometry, statistics. Students were divided almost into two equal parts to support modification of the curricula (49%) and to leave it as it was for the time being (51%). This may imply that it was two early to raise this question at the level of students and periodically. Similar rate views against restructuring 55% strengthening this idea.

The curriculum structure of Department of Mathematics of Jimma University indicated that applied mathematics and mathematics courses are being taught to various faculties/departments in the University by Mathematics Department are under new educational system changed by Ministry of Education. The syllabus in the above courses has been revised to meet the academic requirements [10, 11, 12, 13].

Correspondingly, as we can see it in the curriculum structure for preparatory level in Ethiopia, mathematics is being taught at preparatory level through out the country in two streams. 1. Natural Sciences 2. Social sciences where by natural science stream have more Mathematical Areas than social science stream. Both streams have common chapters like Polynomials-Rational functions – Logarithms, Geometry – Elementary Calculus [2].

From the complaints that students could not be capable of identifying their choice of interest, at preparatory and possible categories/streams at this level did not correspond the variety of field choices at university level which was the basic factor of lack of essential background areas; a hypothesis to divide the streams at preparatory into three rather than two which was suggested for respondents was adopted from other advanced countries like Idea. This hypothesis changed the current natural and social science streams into natural sciences, mathematical sciences and social sciences for fields listed in the result section above. As a result, 88.5% of the students agreed for this hypothesis of which 42% agreed with modification suggested; leading the study to accept the hypothesis and suggest a change.

Teachers at university level also appropriated resources of information for this study; where by more than 80% of the respondents were lecturer and above, of which 81% of them had experiences in teaching the new generation PPC showing the relevance of their judgment. Many of them involved in teaching sciences like chemistry, physics, biology, mathematics, health sciences, technology and computer sciences. Majority of these instructors (65%) confirmed that they faced difficulties in teaching the new generation PPC, which corresponded with the response of students in this regard. These teachers complained that the difficulty of teaching raised due to; lack of background and understanding of and full of slow learners from the new generation, with little motivation to learn and do things by themselves; indicating the level of understanding of theses students very low (61%). Like that of the students, teachers also confirmed that there is gap between the two curriculums, preparatory and PPC (65%) one of the factors of difficulty in teaching. The teachers view showed us that teaching difficulties arose due to: lack of depth of education a thigh school level to cope up the university level, no confidence of students build at high school level.

The university may change or amend the curriculum at any time and changes or amendments made shall be applicable to all the students and respective courses. Applied mathematics plays very important role in Engineering courses and Computer Sciences courses [8]. Looking in to the document of curriculum for computer Science at AAU, Ethiopia, the present curriculum for Computer Science courses for all university in Ethiopia has been drafted as per world standards. In which, Application of Mathematics in Computer Science courses stressed in more specific way. According the above curriculum Applied Mathematics contributes more and more in the development of computer science field [9].

Teachers suggested that preparatory mathematics not sufficient for the support of university level courses implying the need for considering modification; suggesting the modification in line with the need of selected applicable mathematical topics towards problem solving, up grading the quality of high school teachers in which case most of them were at diploma level; time to cover the designed course in time

was not sufficient. The teachers at university level commented that students were weak almost in all subject areas, lack of mathematical background like calculus, algebra, geometry, numerical methods etc, lack of systematic approach in teaching, students with no active participation in learning, all must be worked out for improvement. Contrary to students response, 60% of the teachers suggested for modification of the new preparatory curriculum to make students background strong in such way that; depth of mathematical knowledge, quality of professional teachers, stream restricting and strong entrance examination to join university, all to be considered for revision seriously. Topics like calculus, algebra, geometry, statistics, applied mathematics and the like were suggested for consideration during modification.

In general majority of these university instructors supported restructuring the existing field stream designed in the hypothesis 77% of them agreed where 25% with modification to change it in to three streams; similar to students view in this issue. The university teachers general comments and suggestions shown in the result sections, like; for appropriate duration of training at least a semester at freshman level to strengthen the background, working to up grade the level of students understanding and background at high school level, adjusting mathematical courses according to the needed topics mentioned above, designing a system compromising quality and quantity both in content and quality of professionals (teachers at high schools) both in teaching delivery and evaluation system, were some of the justification for modifying the curriculum and restructuring the streams.

The above arguments were also supported by the focus group discussions made during the study. It is well known fact that every person associated with education fields should support proper curriculum set-up from lower level which is very essential to accommodate most advanced things with respect to ever changing scenario of any discipline. At the same time, suitable infrastructure, skilled/qualified man power are complementary to make teaching–learning program most effective. In this connection, University or concerned academic body have right to change the existing educational programs as per existing conditions. In the other way, it was observed that competition among the students of academic/education field is increasing day by day in this country because of educated unemployment has been increased proportionately. To withstand and cope-up this situation, it recommended that students are to be prepared well targeted way with well talented skills from lower level in the one particular field. It was suggested that this targeted achievement is possible if there is suitable infrastructure and peaceful atmosphere in the educational institutes. From our experience, it was stated that targeted path way of sequential curriculum are necessary to succeed in the any particular field. Now-a-days in Ethiopia, it was observed that narrow platform (Natural Science stream) at preparatory with different vast courses is the only base for different diversified various numerous departments of different faculties like Technology, Computer Science, Applied Science, Medicine, Public Health, Agriculture and Education.

It was learnt that Students were not competent in any department of university. It was noted from the Focus Group Discussion of University Teachers all over the country that the present new generation

students are not well qualified to take university courses. It was specifically viewed as they are poor in the communicative English language generally and particularly the rural area students. Almost all teachers recommended that steps should be taken to prepare the students well from preparatory. They commented at each FGD of teachers, students are coming to university with out sufficient preparation in their specific field.

According to our ref [1], it was known that concerned academic bodies of any country has been monitoring the constant changes in the education field, introduction of new advanced fields, maintaining the educational standards, review the existing curriculum so as to include advanced topics and changes could be made according to existing conditions. Concerned Academic bodies like Ministry of Education and other Universities in Ethiopia University Grant Commission for general university education and all India council for Technical Education for Technology Education in *India* are concerned bodies. It is remembered that the roles of all these academic bodies are (i) monitoring the educational standards in the country (ii) taking steps to review/restructure the existing curriculum (iii) it can suggests/directs to introduce new advanced topics in any fields according world level system. (iv) implementing the all new education policies in the country.

According to ref[4], it is learnt that Ministry of Education of Ethiopia has changed the whole educational system (it is compared as more or less equal with Indian Educational system) from the lower level from the year 1996 E.C. According the new education policy, the major changes are

(i) Closure of freshmen programmed at the University and all courses were adjusted at 11^{th} and 12^{th} grade called *PREPARATORY.*
(ii) Opening of more number of universities and plan to admit more number of graduate students.
(iii) Opening of new departments in the all universities to admit maximum number of students. Duration of degree programmed is reduced by one year.
(iv) Course structure was changed from School level as to adjust/maintain world level standard curriculum at Universities.

From our research result/analysis, it was learnt from both students and teachers of Focus Groups Discussions of various faculties of all over universities that courses at preparatory are vast and not possible to complete in the time as scheduled. It was observed from teachers comment that topics were not adjusted sequential almost all in the every field. Regarding mathematics, it was studied that mathematical areas found at preparatory are supportive for some faculties like Technology, Computer science and Applied Science but for rest of faculties, the present mathematics is sufficient.

It was noted that there are some unnecessary courses like: drawing and more load of Physical Education. Though it was true for technology drawing was not much supportive to some faculties like medicine, public health. From the students points of view, they can get some more useful basic courses to support their areas like microbiology, biochemistry and some information technology. It was understood, from all over discussions, communicative language (English) was not being given properly. Strictly speaking, it is the major problem currently, it does effect largely in so many ways at university level. Students and teachers have requested for practical training programs from preparatory level. It

was viewed as important because students can easily follow university courses and it does improve the real learning.

Regarding the freshmen program closure, it was attempted to get the information from students and teachers all the way, and students could not identify differences between freshmen program and the new one, without freshmen program because they had no experience in this regard. On the other hand according to teachers, it was learnt more and more as it was big mistake since it had been helping students as a bridge between the two programs, bringing the rural and urban together. They recommended for at least one semester freshmen program at university level and suggested that all excess topics to be truncated and adjusted at preparatory level. It was observed from their comments, it would bring all students to one level and there would be chance to improve communication language for students generally and particularly for rural area students. Thus concluding its closure brought big effect on the students performance.

An attempt was made by researchers by putting a hypothesis to stream out all affected academic things in the new education policy as pre supposed adjustment with the aim of rectifying most of things of new education policy activities from lower level to university level by comparing with other countries like India and other advanced countries. It was put forward in both FGD's of students and teachers to decide on the hypothesis to include more applied mathematics areas in the divided new particular stream for supporting the Technology and Applied Science faculties at the University level on one hand, because these needed more applied mathematical areas necessary and useful in advanced studies, while biology, natural science topics in the another stream to cover all required topics/areas for the faculties like Medicine, Agriculture, Public Health and common general basic mathematics, basic computer science along with general courses to all streams uniformly to strengthen the students all the way at preparatory level before joining at the university.

From both students and teachers with Focus Group Discussions at various universities of different faculties, most of the students have accepted our hypothesis with out hesitation but some teachers were not at that much level. It was viewed that this was because they have fears of implementation. Some students have expressed their concern over the field selection after the 10^{th} grade. And it was noted that the new hypothesis may affect the rural area students. It was recommended to compensate through the orientation about the fields of university faculties available and their applications from early stages with the help of different means like: educated parents and friends, mass media and school environment with help of university senior students. As to why students have accepted strongly with modification flowed by orientation all the way than university teachers, it was viewed that students were real affected people than others.

General comments both from the students and teachers were discussed as final aspect of research discussions at all places. Most of students commented largely about the present selection of field allotment by Ministry of Education through the central admission process. Besides, it was noted during the group discussions as education faculty students are been ashamed of being teachers. Because of mass admissions with out proper screening even at universities in recent times, all students are not getting

sufficient facilities proportionately according to their interest in so many respects. Due to this standard, the education goes on decreasing every day. This was accepted by almost all university teachers that the coming batches standard is questionable.

CONCLUSIONS AND RECOMMENDATIONS:

As confirmed from the questionnaire and the FGD majority of students coming from the city and main towns have the opportunity to join the field areas at tertiary level with fierce competition anticipated with better future for employment like technology and health sciences where by unfair distribution between urban and rural students the later usually joining agriculture and natural sciences (mostly in teaching). So well designed system for selecting fields at early stages awareness given to students before hand discouraging parents' influence imposed on students interest must be planned.

The study showed that many of the students (more than 90%) had good performance in mathematics in preparatory level scoring at least 60% in their yearly average both in 11 and 12 grades. This good performance at preparatory was also reflected in the university at PPCI only 5% in semester one and 3% in second semester failed to score C and above in mathematics. And this mathematics performance was not reflected a significant difference in their origin where they came from. Majority of students (more than 90%) performing a general success at the end of first year university level (CGPA at least 2.00) was indication that mathematics is one of the bases of the courses at tertiary education. Thus, basic and applied mathematics topics must be given starting at lower levels deep at preparatory level supported by tutorial sessions.

Most students (74% and above) had confidence in their level of understanding mathematics at university level based on their background knowledge at preparatory rating good and excellent, but learning mathematics found difficult at PPCI relatively than in preparatory. Some factors like lack of background knowledge, gap between the curriculums of universities and preparatory levels, high standard subjects at PPC and teaching quality were identified affecting the learning of mathematics in tertiary education; specifically for technology, computer sciences and applied sciences found in need of mathematics highly. Therefore, revision of curriculum and the system as a whole need to be done in appropriate period of time.

It was stated based on this research result, the narrow platform i.e, Natural Science stream at the preparatory with different courses/vast contends has not been supporting much to Technology and Applied Science faculties. It was learnt that Technology and Applied science faculties need much Applied Mathematical areas at preparatory level. So it is recommended that suitable set-up with more Applied Mathematics and Computer Sciences courses should be included.

It was concluded that there were some problems in the sequence of concepts, gap between preparatory and university courses, missing topics, repeated topics, shortage of necessary basic courses in the almost all areas from preparatory level to university level. It was also observed that there was no smooth connection between present revised preparatory and new education policy first degree courses. Some topics of mathematics like calculus, statistics, geometry etc were known to be

the short comings at preparatory level education to learn mathematics and applied courses since some of them missing, some not given deep when there is a need, some given at early stage difficult to recall when the need arises. It is recommended that committee of experts should be appointed for both mentioned levels to make proper order in every field, it is more important to make students more effective in learning.

Many of the students (68%) found the preparatory mathematics sufficient to support PPC level courses but the rest 32% to the contrary could not be neglected based on their reasons given; lack of, sufficient knowledge at preparatory, teaching quality, deep treatment of selected topics, compromised system of quality and quantity of education. It was also noted that the time not sufficient as scheduled to complete all topics and teachers at preparatory are rushing all important topics for the sake of examination and completion mainly due to traditional methods of teaching. So, steps should be taken to bring awareness and/or training among teaching community by any suitable standard refresher courses.

It could be concluded that major barrier to university students is the problem of communicative English language. It is studied both from the students and teachers, however, students are facing problem while following the lessons of teachers because of no commend on the English language generally and particularly on the rural area students. It is recommended that whatever the way possible i.e convenient and available to provide commend on the English language, it is better to follow from lower levels.

In most preparatory schools it was learned that teachers were not qualified, many of them at diploma level, some social science teachers even teaching natural science subjects. More than that many of them did not show interest, commitment and motivation in teaching and helping students, which was also reflected to student teachers at training institutions majority of them not interested in teaching profession where by MOE and the society itself assumed the main source of the problem by neglecting to respect the teaching profession. Thus the government and the society must work hard to convince itself for the respect of this profession besides providing quality of professional training for the appropriate candidates.

Besides, it was learnt in this study from the discussions of teachers and students, most of the schools, largely from rural area have no basic infrastructure facilities like Library, Laboratories, teaching materials and qualified teachers. Even if some schools have this facilities, it is noted that skilled human resource not sufficiently available. It is recommended that steps should be taken in this direction to fulfill all requirements to enhance the quality of education from lower level.

From about 80% of the university teaching staff with qualification at least lecturer and above and having teaching experience in these classes of the new generation (PPC), many of them (65%) had difficulty when teaching them mainly due to lack of background and language barrier, origin differences from where they came, the gap between the curriculums of the two programs, depth of some mathematical contents essential to support PPC courses. Most of these teachers agreed by the weakness of the new generation in many academic aspects the rural students to the disadvantage at large. So, the modification of the system to alleviate these problems is inevitable.

Quit a reasonable sum of university teachers (54%) concluded that preparatory level mathematics was not sufficient to support the PPC level and hence applied mathematical areas, quality of teaching, sufficient material supply, remedial classes at university level, time adjustment to offer sufficient knowledge are badly needed. According to the 60% of these staff, the system must be changed or modified in adjusting towards supporting tertiary education emphasis given to deep treatment of selected topics. It was further recommended that the system and the curriculum must be revised in depth in many aspects right from lower grades targeting to provide sufficient mathematical background to cope up the advanced study. Besides changes in methodology, sequential arrangement, selection of appropriate topics at appropriate levels, to satisfy the need at the course of university level. The gap between the two levels (preparatory and tertiary) needs very serious maintenance; different facilities including libraries and laboratories, appropriate class size with respect to normal size of student population must be designed cautiously. More than these, the evaluation system in screening preparatory students to come to university education must be given due attention targeting the aim to select able students for this level.

Actually, the one year freshmen program, that was before 1996 E.C in almost all universities was good for bringing all students coming from various levels, standards, regions and communities, at equal level. Now, it was closed by Ministry of Education in the New Education Policy from the 1996 E.C. It was concluded that generally all students facing problems and particularly rural area students are under big trouble. Due to this, it was observed that standards in the education are decreasing. It is recommended that bridge courses between preparatory and university is quite essential and the bridge/transitional program should have been continued temporarily for at least a semester till the high schools come up to the same level of standard.

It was concluded that the proposed hypothesis, splitting the current natural sciences stream in to two, was highly accepted by the students (88%) and the University teachers (77%) all the way; some of them recommending the change with some modification emphasis given to creating awareness for both students and the family before any decision is made on the field choices; special focus directed towards those students coming from rural areas. It is recommended that steps should be taken to wards the implementation of hypothesis, making three streams instead of two, but serious detailed work plan must be done, coming to common understanding with appropriate stakeholders.

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