Discipline Based Versus Integrated Curricula: A Comparative Study between Clinical II Medical Students of Adama Hospital Medical College and Adigrat University, Ethiopia With Regards to Retaining Knowledge of Basic Sciences and Ability to Use Their Concepts and Principles to Solve Clinical Problems

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Abstract

Background: In Ethiopia, the discipline based curriculum, has been implemented since medicine program started in the country. This curriculum model is still in use by 20 of the 35 medical schools in the country. However, the curriculum has been criticized for not helping students retain the knowledge they acquired in pre-clinical years and apply it in their clinical practice.

Objective: To compare the performance of those students who pass through integrated curriculum with those who pass through discipline based curriculum in terms of retention of basic science knowledge and application of principles and concepts

Method: A comparative cross-sectional study was conducted between medical students of Adama hospital medical college (AHMC) and Adigrat University (AU), school of medicine in August 2016. A standardized MCQ exam that tested students' ability of recall and application of knowledge was administered to clinical II students of the two medical schools. Test mean scores were compared.

Results: A total of 99 examinees participated of which 65 of them were from AHMC and 34 from AU. The mean score of the exam is 53.7 (SD=10.051) where the mean for part II (Application questions) is higher which is 58.1 where as for part I (recall questions), it is 49.4. The higher score was on pharmacology with mean value of 61.3 followed by biochemistry, 59.4. The mean scores of the exam in both schools are almost similar which are 54 in AHMC and 53 in AU. The percentage of students who scored more than 60% (The pass mark) is higher in AU accounting for 41.2% and 33.8% in AHMC. Higher number of students in AU scored above 60% on part I accounting for 20.5% where as it is 13.8% in AHMC. However, the percentage of students who scored above 60% on part II is similar in both AHMC and AU accounting for 50.8% and 50% respectively.

Final score hasn't shown statistically significant difference in sex ($p=0.063$, $x^2= 3.454$).Similar finding was found while separately performing the test for each school ($p=0.116$, $x^2=2.474$ for AHMC, $p=0.288$, $x^2=1.13$ for AU).Similarly, it hasn't shown statistically significant difference in age group ($p=0.472$, $x^2= 0.518$).

The binary logistic regression showed that the final score of the exam is not significantly associated with the type of curriculum (p=0.472).

Conclusion and Recommendation: The mean test score in both medical schools is not satisfactory showing performance in high stake context dependent application exam is challenging. This can be attributed to either limited experience of the students to this type of examination or drawback in content delivery which has focused in teaching recall of isolated facts than application of knowledge to solve clinical problems. The result of this study didn't show significant difference between medical students from the discipline based and integrated curriculum in terms of retaining basic science knowledge and using concepts and principles to solve clinical problems. Hence, since there are many confounding factors which could affect students' performance; it's difficult to generalize the findings. It's therefore important to further investigate the effects including the implementation of integrated curriculum.

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Acronyms

AAMC: Association of American medical college

AHMC: Adama hospital medical college

AU: Adigrat University

CI: Confidence interval

CII: Clinical II

MCQ: Multiple choice questions

MoE: Ministry of Education

MoH: Ministry of Health

PLAB: Professional linguistic assessment board

SPSS: Statistical packages for social sciences

TSoM: Tasmanian school of Medicine

USMLE: united States medical licensing examination

UK: united Kingdom

Chapter One

Introduction

1.1 Background

Medical education in the 19th and early 20th century had a traditional discipline-based curriculum model with didactic courses in the initial years focused on the basic sciences and clinical rotations in later years organized by specialties. (6)In this model, individualized structure of lectures and topic areas including anatomy, biochemistry, physiology, microbiology, and pharmacology where courses stood more alone as separate entities, rather than cooperative courses which were given to medical students.(4)

Despite a century of evolution of the fund of knowledge in basic and clinical sciences as well as advancements in teaching strategies, this curriculum format still persists in many medical schools around the world, yet is viewed as an inadequate system to prepare future physicians for twenty-first Century medicine (11).

The curriculum, with each science discipline offering its content from within a departmental silo, frequently fail learners as they advance to the clinical years. Information presented without robust cross-links and ties to clinical applications, and tested in isolation from related subject matter, has proven difficult for students to recall after the transition to clinical clerkships (14).

In response, innovative curricula were constructed built from educational units focusing on organ systems or clinical problem areas like pain or blood loss. For such ‘integrated curricula’ both integration of basic sciences (‘horizontal integration’) and of basic sciences with clinical sciences (‘vertical integration’) were advocated (4). Integrated curricula have been implemented by a growing number of medical schools all over the world, including schools based in industrialized and in developing countries. (5)

Beane (1977) first reviewed integrated curricula in the general education literature and the term soon thereafter appeared in medical education (Harden et al. 1984). (2)

Designed to be repetitive yet progressive, the ‘‘integrated curriculum’’ has rapidly risen to popularity with the belief that breaking down the barrier between the basic and clinical sciences improves connections between these disciplines and enhances graduates’ retention of knowledge and development of clinical skills. (2)

Until 2012, the discipline based was the only curriculum which has been implemented in medical system of Ethiopia. In the year 2012, the integrated curriculum has been introduced in 14 newly established medical schools.

1.2 Statement of the problem

In Ethiopia, the discipline based curriculum, has been implemented since medicine program started in the country. However, this curriculum has been criticized for not helping students retain the knowledge they acquired in pre-clinical years and use it in their clinical practice.

Despite its limitation, this curriculum model is still being used by 20 of the 35 medical schools in the country.

With all the time and money spent teaching medical students one must wonder how well that investment is paying off. What proportion are they retaining in their memory? What are they learning? – This seems to be the central question for medical education.(1) Surely if students are not remembering what they have been taught then the effort was wasted; if students cannot make use of the knowledge they have been taught, if that knowledge becomes inert and inaccessible, then why teach it in the first place. This question is important for both pre-clinical and clinical courses. (7)

1.3 Significance of the study

In the perspective of the above two different curricula, the research I carried out bestowed an insight on the comparison of knowledge loss during undergraduate medical

study in the discipline based and Integrated curriculum. Considering the different aspects including availability of human and financial resources, the finding will inform in taking a step towards making important decisions in adopting one curriculum model instead of the other.

Chapter Two

Literature Review

Since the time of Flexner, the basic science medical school curriculum has largely consisted of discrete courses controlled by individual departments. Such curricula have largely included an initial phase focused on normal structure and function followed by a pathophysiology phase, sometimes organized around organ systems or taught during core clinical rotations (7).

Medical education in the 19th and early 20th century was comprised of many reports detailing the individualized structure of lectures and topic areas including anatomy, biochemistry, physiology, microbiology, and pharmacology where courses stood more alone as separate entities, rather than cooperative courses which were given to medical students. These lectures consisted largely of didactic format, in which students at various medical schools were given basic information in a lecture format, without emphasis on interactive learning or clinically based instruction (1).

As of the middle of the previous century medical curricula based on mono disciplinary Courses in basic (pre-clinical) sciences have been challenged. One of the major disadvantages identified for this discipline-based curriculum model was the haphazard sequence of presentation of basic sciences courses frustrating integration in a knowledge-base relevant for clinical Contexts (8).

In traditional schools students are given a set of facts, asked to memorize them, but then are not given the opportunity to apply them in a way that is applicable to life outside of the school. Disconnection breeds apathy while integration thrives on connections (1). Dissatisfaction with this curricular model has included students' complaints about lack of relevance and faculty members' concerns about students' failure to recall relevant basic science knowledge during their clinical education. Medical students have viewed the basic science curriculum as a hurdle to overcome in order to earn the right to step onto the hospital wards. In a mean time, clinical teachers complain that when students arrive on the clinical rotations, they have no intellectual curiosity, despite spending the first

phase of medical school memorizing unrelated facts rather than learning to think like a clinician (7).

Many researchers have proven that information presented without robust cross-links and ties to clinical applications, which is tested in isolation from related subject matter, has proven difficult for students to recall after the transition to clinical clerkships (2). For medical students to make competent clinical decisions based on sound scientific principles, they must be able to retain knowledge from the preclinical phase of their medical course (3).

Knowledge of basic science has been of interest to medical educators since Miller, in his study on an inquiry into medical teaching, found disappointingly low scores on a delayed test in anatomy, biochemistry and physiology among senior medical students, regardless of the students' initial scores (4).

Evidence from published literature indicates that failure rates on certifying examinations and board certification status were significantly associated with the assessment of retained basic sciences knowledge from medical school education. D'Eon found a considerable knowledge loss among medical students in immunology (13%), neuro-anatomy (46.5%) and physiology (16%) on retest ten months later. He concluded that knowledge loss did not seem to be related to the marks on the final examination or the assessment of course quality by the students. Similarly, Ling et al. revealed dramatic decline in examinee performance in biochemistry, followed by microbiology and pharmacology during the Step 1 United States Medical Licensing Examination (USMLE) in comparison to the Step 2 USMLE (3).

A similar study was done on Knowledge loss of medical students on first year basic science courses in University of Saskatchewan, Canada where students take a variety of pre-medical basic science courses for a minimum of two years. In the study, 29 second year students were examined on Physiology, neuroanatomy and Immunology courses. The result showed that, in each of the three individual courses studied, there was a statistically significant difference between the test and the re-test results in which there

was a relative knowledge decrement of 17.6%, 52% and 19.4% on Immunology, neuroanatomy and physiology respectively (5).

Another study was done on 29 randomly selected medical students in Karolinska Institute, Sweden where the participants were re-examined with the original physiology examination which they had completed 36 months earlier. The result showed that, scores on the re-examination depict a substantial knowledge decline over a period of three years. Of the 19 students that participated, only one would have passed the re-examination. It is especially noteworthy that all three top students, that performed the highest results in the original examination, lost more examination scores in the re-examination, compared to the other 16 students (4).

Harris et al. concluded that when knowledge gained is not directly relevant or applicable to clinical contexts, it is lost rather quickly. They recommended that in order to prevent extensive loss of knowledge, the information given must be relevant. Perceived relevance of a subject matter facilitates knowledge retention and application, while a lack of relevance is associated with the converse of this (3).

In a study done in Tasmanian School of Medicine (TSoM), Australia on 232 years 2-5 medical students, participants were asked to complete an 80-minute paper-based examination consisting of fifty (50) A-type (single best response of five) multiple-choice questions (MCQs) from past second year written examinations which tested their knowledge on five basic science disciplines. The result showed that, there were increasingly positive correlations between the items that were answered correctly and their perceived relevance (clinical practicability) from Years 2 to 5, implying that items that were rated as clinically relevant were more likely to be answered correctly by the senior students than by the junior students (3).

A study was done in Liverpool, UK on Graduates from a traditional medical curriculum where 46 doctors were interviewed 6 years after their graduation to evaluate the effectiveness of their medical curriculum. In the result there were complaints that they had learned too much irrelevant knowledge in those areas. For many of the interviewees,

though knowing the science for postgraduate exams was more useful than knowing it for diagnosing patients (6).

The current paradigm of medical education has been called into question as the demands for the quality and quantity of medical graduates increases (3). The prevailing trend in basic science curriculum changes around the world is now towards integration (1). Shoemaker et al. defined an integrated curriculum as "education that is organized in such a way that it cuts across subject-matter lines, bringing together various aspects of the curriculum into meaningful association to focus upon broad areas of study". It views learning and teaching in a holistic way and reflects the real world, which is interactive (9).

Curriculum integration can also be described as an approach to teaching and learning that is based on both philosophy and practicality. It can generally be defined as a curriculum approach that purposefully draws together knowledge, skills, attitudes and values from within or across subject areas to develop a more powerful understanding of key ideas. Curriculum integration occurs when components of the curriculum are connected and related in meaningful ways by both the students and teachers (10).

The integration is both horizontally among the disciplines which provides learning within the structure where individual departments/subject areas contribute to the development and delivery of learning a meaningful, holistic manner. and vertically between basic and clinical sciences in such a way that the traditional divide between preclinical and clinical studies is broken down, therefore basic science is represented explicitly in the curriculum within the clinical environments during all the years of undergraduate education and beyond into postgraduate training and continuing professional development. This means that the learning of basic science is placed in the context of clinical and professional practice and seen to be more meaningful and relevant to students. Curriculum integration usually involves both horizontal and vertical integration and is the pattern that is becoming widespread throughout the world (10).

Integrated curricula have been widely adopted, fuelled by dissatisfaction with the way basic sciences have been taught as individual disciplines with no clinical application and by growing recognition that the traditional instructional modes no longer meet current demands for interdisciplinary inquiry and practice in medicine (11,12). At the same time, cognitive theories of learning suggest that an integrated approach to education may have important benefits for learning and retention because it facilitates contextual and applied learning, and can promote development of the well-organized knowledge structures that underlie effective clinical reasoning (13, 14). Relationships between drugs, specific diseases and their pathologies, affords students a broader knowledge with which they can more accurately diagnose and treat patients. The integration of anatomical skills with physiological understanding helps provide the student with a better understanding and insight into the biochemical basis of disease and clinical treatment (1).

The International Association of Medical Science Educators' review of 100 years of Flexner's influence proposed that modern curriculum alternatives exist, particularly the ''integrated curriculum'' model, which could better promote the retention of knowledge across the basic and applied sciences (Finnerty et al. 2010).(2)

Recommendations for integrated curriculum have also been published by the Association of American Medical Colleges (AAMC; Corbett & Whitcomb 2004), the General Medical Council in the United Kingdom (2010), the Association of Faculties of Medicine of Canada (2009), the Australian Medical Council (2012), and the Inquiry on Medical Education in Sweden (Lindgren 2013) (2)

Key words

1. **Discipline based curriculum:** Is a model where individualized structure of lectures and topic areas including anatomy, biochemistry, physiology, microbiology, and pharmacology where courses stood alone as separate entities
2. **Integrated curriculum:** Is a model that is organized in such a way that it cuts across subject-matter lines, bringing together various aspects of the curriculum into meaningful association to focus upon broad areas of study"
3. **Horizontal integration:** Integration across basic sciences
4. **Vertical integration:** Integration between basic and clinical sciences
5. **Basic science:** biomedical courses which are given during preclinical years: Anatomy, Physiology, Biochemistry, Microbiology, pathology, Pharmacology

Chapter Three

Objective

3.1 General Objective:

- To compare the performance of students who pass through integrated curriculum with those who pass though discipline based curriculum in terms of retention of basic science knowledge and application of principles and concepts to solve clinical problems.

3.2 Specific Objective

- To compare the performance between CII students of AHMC and AU in terms of retention of basic science knowledge and application of principles and concepts.
- To assess performance of clinical II medical students at AHMC in terms of retention of basic science knowledge.
- To assess performance of clinical II medical students at AHMC in terms of ability to use basic science concepts and principles to solve clinical problems.
- To assess performance of clinical II medical students at AU in terms of retention of basic science knowledge.
- To assess performance of clinical II medical students at AU in terms of ability to use basic science concepts and principles to solve clinical problems.
- To show the students' performance on each basic science course in terms of knowledge retention and application of principles and concept.

Chapter Four

Research hypothesis

1. Medical students who are trained with integrated curriculum better retain knowledge of basic science than those who are trained with discipline based curriculum

2. Medical students who are trained with integrated curriculum can better apply basic science concepts and principles to solve clinical problems

Chapter Five

Methods and Materials

5.1 Description of study area and study period:

The study was conducted from July 11- November 30, 2016 in AHMC and AU. The former is located in Adama town, central Ethiopia which is 99 km southeast of Addis Ababa, the capital where as the latter is located in Adigrat town, northern Ethiopia which is 894 km from the capital.

Both are among the newly established universities which started medicine program by the year 2012. Being new, both institutions have got similarity in that they have severe shortage of infrastructure and resources. According to the supportive supervision reports of each year compiled by ministry of health (MoH), both institution faced shortage of classrooms, reference books, lab materials, internet access e.t.c. In addition to this, the gaps in teaching staff both in number and experience affected the curriculum implementation.

The AHMC has a four and half-year undergraduate entry integrated modular curriculum which includes vertical and horizontal integration of basic sciences and clinical teaching. The first two years of the course provide a systems-based introduction to the foundations of medicine, with an early opportunity to develop communication and clinical skills. In the third and fourth years of the program, students commence clinical rotations in Medicine, Surgery, Obstetrics & Gynaecology, Paediatrics and Primary Care and specialty areas; whilst the final clinical year is dedicated for Internship rotations where learning is consolidated in the context of clinical and community placements.

AU, school of Medicine on the other hand has a six year discipline based curriculum. The basic sciences are given as a separate entity in the first three years. Students start clinical year when they reach fourth year then they rotate in major and minor clinical departments for two years, the final year is for internship rotation.

5.2 Study Design

A cross-sectional comparative study was conducted between CII medical students of AHMC and AU. The reason for the two institutions to be selected as representatives was that they both have similar features: They both are new with similar years of experience; they share similar gaps which can affect curricular implementation. E.g. shortage of infrastructure, teaching materials, teaching staffs, e.t.c. The above factors were taken into consideration as to narrow the effect of confounding factors on the result of this study.

A standardized MCQ exam, which was taken from sample USMLE and Professional linguistic assessment board (PLAB), was administered to both groups.

5.3 Source population

All CII medical students of both AHMC and AU participated with a total number of 65 and 34 respectively at the time of the study. CII were preferred than CI in that it was relatively longer period since they finished the basic science courses. Therefore, they were found to be better group to assess knowledge retention.

5.4 Study population

It is the same with source population

5.5 Study variables

5.5.1 Dependent variables

- Retention of knowledge of basic sciences
- Ability of using concepts and principles of basic sciences to solve clinical problems

5.5.2 Independent variables

- Sex
- Age
- Medical school
- The type the curriculum

5.6 Sampling and sample size determination

The study and source population are the same

5.7 Data collection:

Exam questions were selected from sample USMLE and PLAB which contains both recall (part one) and application questions (part two). Both parts include the basic sciences; Anatomy, Physiology, Pathology, Biochemistry, Microbiology and Pharmacology. It contains a total of 60 questions; 10 questions from each discipline (5 questions in each part). Simple random sampling was used to select the questions.

It was then administered at both schools. Exam papers were marked out of hundred (each part out of 50%) and results were recorded. 60% was taken as pass mark based on the grading and promotion criteria of medical curriculum of the country. (Please see Annex II).

5.8 Data Quality Assurance:

The questions are reliable and valid since they were taken from sample USMLE and PLAB.

5.9 Statistical Analysis:

Data was entered after checking for completeness, and coding into computer Statistical packages for social sciences (SPSS) software. Analysis was made and results were presented in the form of tables, graphs, percentage and mean. Statistical analysis was made for selected variables. P value of <0.05 and 95% CI was taken as significant. SPSS for Windows (version 20.0) was used.

To test the statistical significance of exam score among the different students' characters Pearson chi square tests were employed.

Binary logistic regression tests were used for multivariate statistical analyses of dichotomous outcome/dependent variables to identify variables that are predictors of retention of basic science knowledge and ability to use their concepts and principles to solve clinical problems.

5.10 Operational definition

Recall questions: Exam questions which focus on memorizing facts

Application questions: Exam questions which focus on clinical application of the basic sciences

Ethical Considerations

Ethical clearance to conduct the study was obtained from both institutions. Study participants were informed about the purpose of the study, anticipated benefits and how they are chosen to participate. Individual results are kept confidential.

5.11 Limitation of the study

As the study was quantitative only, it doesn't have the information that would have been obtained with a qualitative study.

The comparison groups have different background – those with integrated curriculum had first degree in health or natural science unlike the other group who came directly from high school. Hence, experience may have interfered with the finding.

Another limitation could be the difference in number of students. The number of CII students in AHMC is twice that of AU which may affect the result.

More schools should have been included in the study for better conclusion.

5.12 Dissemination of results

The result of the exam was provided to both institutions which may help them to use it as one reference to see gaps of their students. The final results will be shared with all stakeholders: MoH, MoE, Universities since it can be used for important curricular decisions.

Chapter Six

Result

Among the total of 99 students who took the exam, 78 (78.8 %) of them are male and 21 (21.2%) females. The students are in the age group between 21 and 35 with mean age of 28.

Table 1: Distribution of CII students of AHMC and AU by their sex and age group, August, 2016

Sex	Count	Percent	Total
Male	77.7	78.8%	65 (65.7%)
Female	21.3	21.2%	99 (100%)

65 (65.7%) of the students are from Adama hospital medical college and the rest 34 (34.3%) are from Adigrat University, school of medicine.

Table 2: Distribution of CII students of AHMC and AU by their school, August, 2016

School	sex		
	Male	Female	Total
Adama hospital medical college	52 (80%)	13 (20%)	65 (100%)
Adigrat University	26 (76.5%)	8 (23.5%)	34 (100%)
Total	78 (78.8%)	21 (21.2%	99 (100%)

Taking the total students of both schools, the mean score of the exam is 53.7 (SD=10.051) where the mean for part I I (Application questions) is higher which is 58.1 where as for part I (recall questions), it is 49.4.

Considering each subject, the higher score is that of pharmacology with mean value of 61.3 followed by biochemistry, 59.4.

Table 3: Mean score of each discipline in the exam for total students of both schools, August, 2016

	Exam Score								
	Total score	Recall questions	Application questions	Anatomy	Physiology	Pathology	Biochemistry	Microbiology	Pharmacology
Mean	53.7	49.4	58.1	47.4	55.1	55.1	59.4	51.2	61.3
Std deviation	10.051	9.492	12.505	15.484	14.477	13.704	14.902	14.865	18.089
Minimum	25	24	26	0	24	22	30	20	5
Maximum	72	70	80	86	88	83	90	80	100

Comparing between the two schools, the mean scores of the exam are almost similar which are 54 in AHMC and 53 in AU.

Most students, 36.4% scored less than 50% followed by those who scored between 60 and 69 accounting for 30.3%.

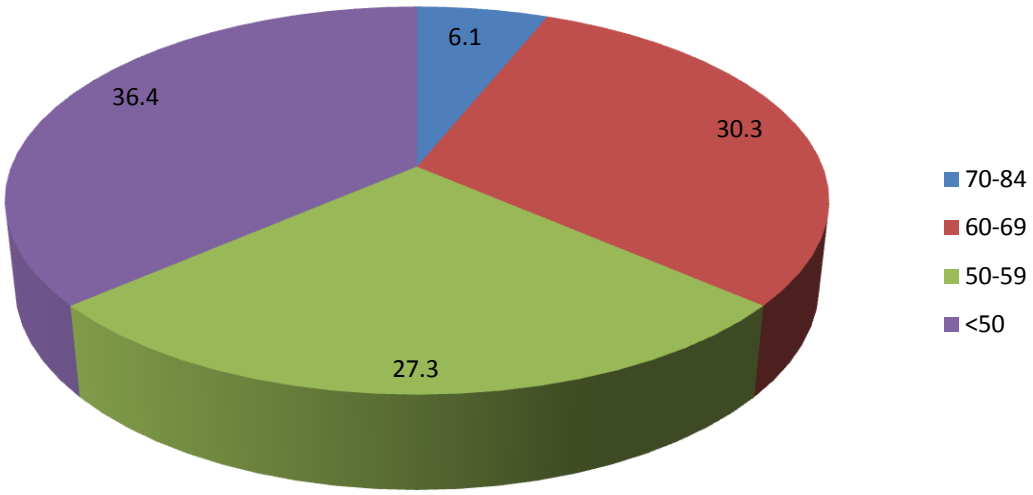

Figure 1: Distribution of CII students of AHMC and AU by their exam score, July 2016

However, comparing between the two schools, the percentage of students who scored more than 60% is higher in AU accounting for 41.2%. It is 33.8% in AHMC.

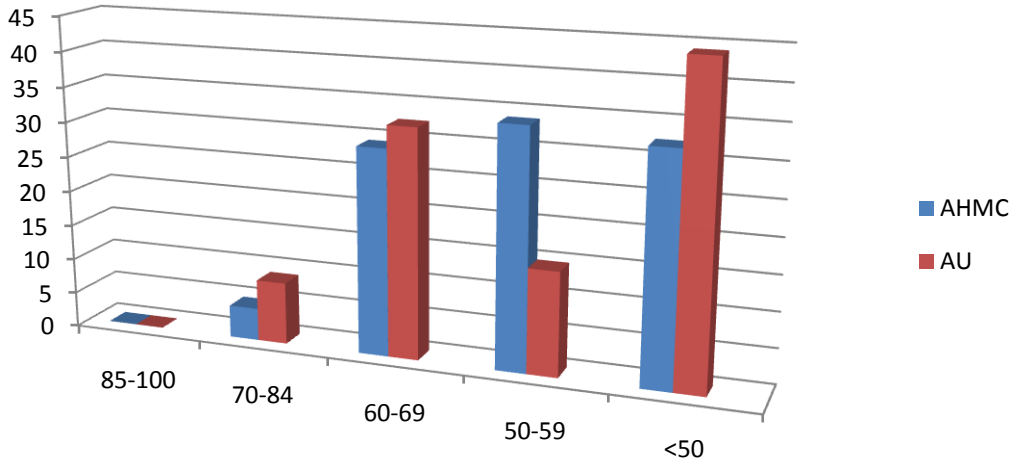

Figure 2: Distribution of CII students of AHMC and AU by their exam score, July 2016

Comparing between the two exam parts, only 16.1% of the total students scored above 60% on part I (recall questions) where as 50.5% of them on part II (Application questions).

When this result is compared between the two schools, higher number of students in AU scored above 60% on part I accounting for 20.5% where as it is 13.8% in AHMC. However, the percentage of students who scored above 60% on part II is similar in both AHMC and AU accounting for 50.8% and 50% respectively.

Table 4: Distribution of students of AHMC and AU by their exam score for each of the two exam parts, August, 2016

Score	School		
		AHMC	AU
Part I (Recall questions)	<50	52.3%	55.9%
	50-59	33.8%	23.5%
	60-69	12.3%	17.6%
	70-84	1.5%	2.9%
Part II (Application questions)	<50	20%	32.4%
	50-59	29.2%	17.6%
	60-69	27.7%	23.5%
	70-84	23.1%	26.5%

Taking mean scores, Anatomy, Physiology, Pathology and Microbiology are better scored in AU where as Biochemistry and Pharmacology are better scored in AHMC.

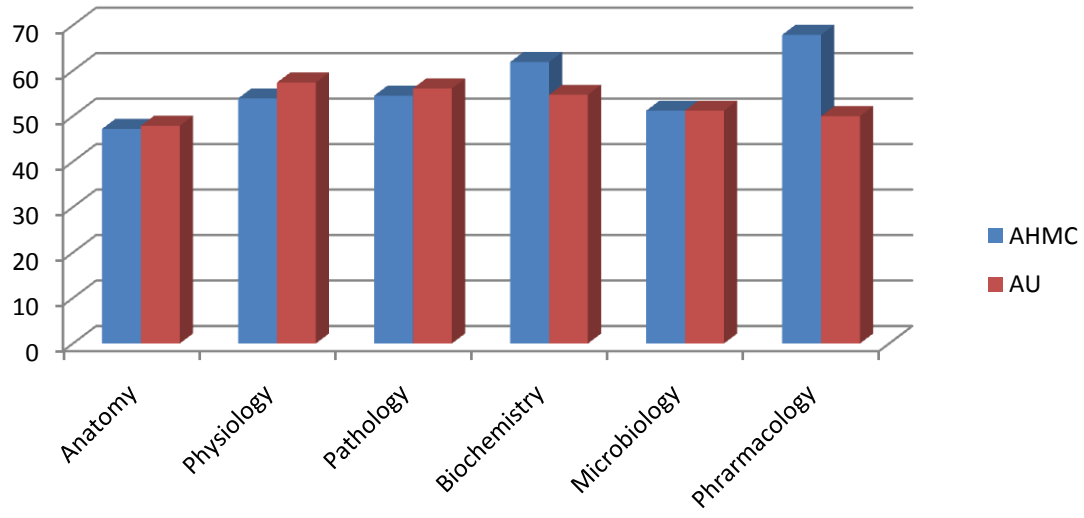

Figure 3: Distribution of CII students of AHMC and AU by their exam score for each discipline, July 2016

Taking the whole students, Chi-square test performed on the final score hasn't shown statistically significant difference in sex (p=0.063, x^2= 3.454).Similar finding was found while separately performing the test for each school (p=0.116, x^2=2.474 for AHMC, p=0.288, x^2=1.13 for AU).

The binary logistic regression showed that the final score of the exam is not significantly associated with school where students belong (p=0.472). Similarly, neither the score of part I (recall questions), nor part II (application questions) are significantly associated with the school type (p=0.39 and 0.942 respectively).

Taking each discipline separately, the binary regression showed that, scores in physiology, pathology, biochemistry and microbiology hasn't shown statistically significant difference with the schools. However, students of AU outperformed that of AHMC with significantly higher score in Anatomy (p=0.041, x^2= 2.969). On the other hand AHMC students outperformed with significantly higher score in pharmacology (p-0.000, x2=0.123).

Chapter Seven

Discussion

The hypothesis anticipated that students from integrated curriculum would better retain basic science knowledge than those from discipline based. It was therefore surprising that in this study, greater percentage of students who scored above the pass mark (60%) were from the discipline based curriculum. This may be attributed by gaps in curriculum implementation. According to the supportive supervision reports compiled by ministry of health (2012-15), there is critical shortage of both preclinical and clinical instructors teaching at new medical schools implementing integrated curriculum one of which being AHMC. On top of this, the existing instructors don't have experience of teaching with integrated curriculum. All in all AHMC is new with limited resource and experience in implementing the newly introduced integrated curriculum. The above mentioned factors affect the integration system which may be the reason for the above finding.

The other factor that interfered with the finding might be the difference in admission criteria of the two schools. AU enroll students who graduated from high school where as AHMC admits those with first degree with a minimum of 2 upto 10 years of experience. Hence, most students at AHMC came to this program leaving their job and majority of them are married with kids. Therefore, they have familial and social responsibility which can't be ignored to be a confounder.

Another finding in this study showed that the mean for part II (Application questions) is higher which is 58.1 where as for part I (recall questions), it is 49.4. This finding is consistent with the finding of a study done in Tasmanian School of Medicine (TSoM), Australia on 232 years 2-5 medical students. The students were given 50 MCQ questions which tested their knowledge on five basic science disciplines. The result showed that, there were increasingly positive correlations between the items that were answered correctly and their perceived relevance (clinical practicability).

The low performance in anatomy is similar with the finding of a study done in university of Tasmania, Australia and university of Saskatchewan, Canada ( ) which reported that

students performed poorly in anatomy. The widely-held perception that anatomy is regarded by educationalists as a difficult subject may have been the reason for this. Another reason may be that in learning anatomy, the students might have focused on memorization at the expense of understanding.

The result of this study showed that exam score is not significantly associated with the type of the curriculum through which students were trained. As only two schools were taken in this study, the sample may be too small to make an inference. The finding might be different if more schools were involved.

Generally, this study showed low performance of both groups of students. This may be because medical students in the country are not familiar with such kind of exam with questions of clinical application since most medical schools focus on recall of facts. The national licensing exam report compiled by MoH (2016) supports this finding. Additionally, the existing gap in infrastructure and resource might affect the teaching learning, which may in turn affected students' performance

Chapter Eight

Conclusion and Recommendation

The mean test score in both medical schools is not satisfactory showing performance in high stake context dependent application exam is challenging. This can be attributed to either limited experience of the students to this type of examination or drawback in content delivery which has focused in teaching recall of isolated facts than application of knowledge to solve clinical problems.

The result of this study didn't show significant difference between medical students from the discipline based and integrated curriculum in terms of retaining basic science knowledge and using concepts and principles to solve clinical problems. .

Students from the discipline based curriculum were found to have better performance in Biochemistry and Pharmacology than those from the integrated one. On the other hand, the latter performed better in Anatomy, Physiology, Pathology and Microbiology.

However, since there are many confounding factors like availability of human and financial resources, bottlenecks in implementation including management and operation which could affect students' performance; it's difficult to generalize the findings. It's therefore important to further investigate the effects.

Generally, Except in Biochemistry and Pharmacology, both groups of students scored low in the other disciplines with mean score less than 60% (the pass mark). Therefore both schools have to assess their teaching learning system. In addition to the schools, all concerned stakeholders including MoH and MoE should give attention for the low performance of the students.

Since integrated curriculum has recently been introduced in medical education system of Ethiopia, MoH and MoE should do detail assessment as to have strong evidence for future curricular decision.

Chapter Nine

References

1. Myers. The changing face of Medical education. Journal of Medical Education and Curricular Development.2014; 1:1–3 doi:10.4137/JMECD.S17270.

2. Nasra N Ayuob1, Basem S Eldeek, Lana A Alshawa1, Abdulrahman F ALsaba. Interdisciplinary Integration of the CVS Module and Its Effect on Faculty and Student Satisfaction as Well as Student Performance. BMC Medical Education 2012, **12**:50 doi:10.1186/1472-6920-12-50

3. Bunmi S Malau-Aduli, Adrian YS Lee, Nick Cooling, Marianne Catchpole, Matthew Jose, Richard Turner. Retention of knowledge and perceived relevance of basic sciences in an integrated case-based learning (CBL) curriculum. BMC Medical Education.2013;13:139 .doi:10.1186/1472-6920-13-13

4. Niklas Wilhelmsson, Klara Bolander-Laksov, Lars O. Dahlgren, Håkan Hult, Gunnar Nilsson, Sari Ponzer, Lars Smedman, Anna Josephson. Long-term understanding of basic science knowledge in senior medical students. International Journal of Medical Education. 2013; 4:193-197. DOI: 10.5116/ijme.5232.2de4

5. Marcel F D'Eon. Knowledge loss of medical students on first year basic science courses at the University of Saskatchewan. BMC Medical Education. 2006; 6:5. doi:10.1186/1472-6920-6-5

6. Simon Watmough, Helen O'Sullivan, David Taylor**.** Graduates from a traditional medical curriculum evaluate the effectiveness of their medical

curriculum through interviews. BMC Medical Education 2009, 9:64 doi:10.1186/1472-6920-9-64

7. **Hani S Atwa , Enas M Gouda.** Curriculum Integration in Medical Education: A Theoretical Review. Intel Prop Rights.2014; 2:113. doi: 10.4172/ipr.1000113 Education.2012;12:50.doi:10.1186/1472-6920-12-50

8. Papa, F J; Harasym, P H. Medical curriculum reform in North America, 1765 to the present: a cognitive science perspective.Journal of the Association of American Medical College 1999,74:2

9. Shoemaker BJE (1989) Integrative Education: A Curriculum for theTwenty-First Century. Oregon School Study Council 33: 1-46.

10. Alberta Education Guide (2007) Primary Programs Framework-Curriculum Integration: Making Connections. Alberta Education, Alberta, Canada.

11. Cooke M, Irby DM, Sullivan W, Ludmerer KM (2006) American medical education: 100 years after the Flexner report. N Engl J Med 355:1339-1344.

12. Custers E, Cate OT (2002) Medical students' attitude towards and perception of the basic sciences: a comparison between students in the old and new curriculum at the University Medical Centre Utrecht, the Netherlands. Med Educ 36: 1142-1150.

13. Mann KV (2002) Thinking about learning: implications for principlebased professional education. J Contin Educ Health Prof 22: 19-26.

14. Vidic B, Weitlauf HM (2002) Horizontal and vertical integration of academic disciplines in the medical school curriculum. Clin Anat 15:233-235.