Addressing student diversity and integrative learning in an undergraduate medical curriculum

Dr Shalote Chipamaunga, SRN, SCM, DNE, BAdEd, MAdEd, PhD (Medical Education), Senior Lecturer, Department of Health Professions Education, College of Health Sciences, University of Zimbabwe.

Dr Detlef Prozesky, BSc MBChB, MCommH, PhD, Head, Department of Medical Education, Faculty of Medicine, University of Botswana, Gaborone.

Abstract

Introduction

South African universities are increasingly enrolling students from a variety of educational backgrounds. This brings in diversity in levels of language and learning ability and universities face the challenge of adjusting their curricula to meet the academic needs of the different learners. The objective of this paper is to document the experiences of students and teachers on a course that was introduced to address student diversity and integrative learning in a higher institution of learning.

Methods

The course was evaluated through two ways. Firstly, a student feedback questionnaire was administered to 250 students at the end of the first and second semesters during the first two years

of introduction of the course. Secondly, students' reflections were extracted from in-depth interviews and focus group discussions during the 4th and 5th years of implementation of the course.

Results

Due to the diversity in entry level learning and language skills, some units of the course were not rated favourably by about 50% of the students who struggled to see the relevance. However, many students' experiences with the value of the course in enabling integrative learning were positive. Some students reported that they acquired lifelong skills in critical thinking and problem solving.

Conclusion

This paper demonstrates that a course that focusses on helping students to integrate learning is invaluable. Further research is required on the types of strategies and how to implement them to meet the varied needs of students from diverse backgrounds.

Introduction

In undergraduate medical programmes there is a clear logic in seeing horizontal and vertical integration of content as a good in itself. Students learn information from many different disciplines which they have to be able to bring together as they start carrying out the principal activity of their professional lives, the consultation. To some degree the ability to integrate knowledge is likely to be intuitive in all humans, as a survival strategy for life. However students from diverse educational backgrounds will not have developed this ability to the same degree by the time they enter medical programmes – those in whom it is less developed are likely to struggle academically.

In the context of this paper, student diversity refers to the differences in educational background, culture and language with which students come to university. Such diversity was experienced in South Africa in the years immediately following the 1994 transition from the apartheid era. Universities which had previously catered largely for students from advantaged backgrounds, mostly whites, were mandated to open their doors to those from previously disadvantaged backgrounds, mostly black [1]. As a result South African universities experienced an increasing number of students who arrived without the requisite study skills and strategies required for succeeding in higher education[2,3]. Student diversity may impact on different aspects such as variations in academic and English language skills; study skills; confidence to participate; numeracy; and motivation to study[4–6]. The resulting alienation that black students experience in historically white universities is mentioned by Adam Habib[7]. So, for example, adjusting to a medical school environment has been reported as a potential cause of distress [8]; this distress would be particularly acute for students from remote rural backgrounds who are not familiar with the urban setting in which most universities are located. However the transformation of South African universities to accommodate diverse groups of students has been slow [9]. It seems that universities have maintained an implicit assumption that the diverse groups of students are homogenous in terms of levels of preparedness and ability to handle university studies [10].

With reference to current studies in higher education institutions, Kelly observes that student-oriented support services and academic interventions are now receiving attention [11]. There is a clear need to creating a nurturing learning environment [8]. Some form of support is needed to enable students cope with the language of instruction while developing skills to identify links

between subjects is necessary at the beginning of a demanding programme like medicine. According to Sfard, participation describes collaborative knowledge production where learning is reconfigured and knowledge is reconceptualised [12,13]. This emphasis on social interactions necessitate the teaching of language to enable communication amongst students from different backgrounds. Students report that the ability to integrate learning develops over time and it is heavily influenced by factors in the environment [14]. Students play a role in making integration happen but this needs the support of a curriculum that is committed to assisting them to integrate learning. Authorities in educational psychology support the idea of scaffolding to guide students through periods that are perceived problematic until they can learn independently[15–17].

Examples of and suggestions for integrated curricula have been presented, starting with encouraging dialogue between and amongst disciplines and culminating in fully integrated teaching[18–21]. However the nature of support to enable students to integrate is still an open question – what it looks like and how it might be shaped by emerging cultural realities and new thinking about learning and teaching [22]. One example concerns reading with comprehension and critical thinking, which are key skills that determine success at university level. There is evidence that most first year university students lack academic reading skills and employ reading strategies that result in surface learning[23,24]. Studies on reading abilities found that second language readers struggle with unknown words and phrases resulting in poor understanding; on the other hand first language readers were successful in reading with understanding while integrating new information with old [25]. Since there is a close link between unfamiliar vocabulary and slow reading, students who were taught reading strategies understood passages better [26]. Integrative learning could also promote structures, strategies, and activities that

bridge the divide between learning experiences inside and outside the classroom, theory and practice, and disciplines and fields [27].

While it must to some degree be intuitive, the ability to integrate knowledge needs to be explicitly developed to reach its full potential. This is particularly true of students from relatively disadvantaged educational backgrounds, for example those for whom the main study strategy has been rote learning resulting in superficial retention of information. At university level, learning through participation becomes imperative. There is a dearth of information in the literature about interventions in medical programmes explicitly designed to promote integrative learning, while also meeting the needs of a diverse spectrum of students.

This paper therefore introduces an early intervention in a medical school to support and develop the ability to integrate, which in addition takes student diversity into account. Each component of the resulting two year programme is described and the logic behind its inception and implementation is explained. The paper also reports students' response to the intervention. It is hoped that sharing such innovations will influence learning that is designed intentionally to help students cope better with integrative learning.

Background

In 2004 the undergraduate medical programme of the University of the Witwatersrand in Johannesburg, South Africa moved from a traditional six year programme (pre-clinical courses followed by clinical ones). The new programme allowed graduate entry with problem-based

learning as its main educational strategy (therefore well integrated). However the first two years of the programme were still subject-based, with Year 1 consisting of separate physical, biological and behavioural science courses and Year 2 consisting of separate courses in Anatomy, Physiology and Molecular Medicine. Recommendations from "Tomorrow's Doctors" in 1993 call for integration of basic physical, biological and behavioural sciences with early clinical exposure [28]. Years 1 and 2 of the programme were therefore revised to improve vertical and horizontal integration. An output of this revision was an integrating course entitled "Medical Thought and Practice", commonly referred to as MTP. It was introduced in Year 1 of the medical undergraduate programme in 2010 and in Year 2 in 2011. The course was designed to be a spiral one over two years, with the more advanced second year course building on the more basic first year course.

Components of the "Medical Thought and Practice" course

In each of its two years the new course had two modules: 'Health System Dynamics' and 'Integrating Skills'. These are shown in Figure 1.

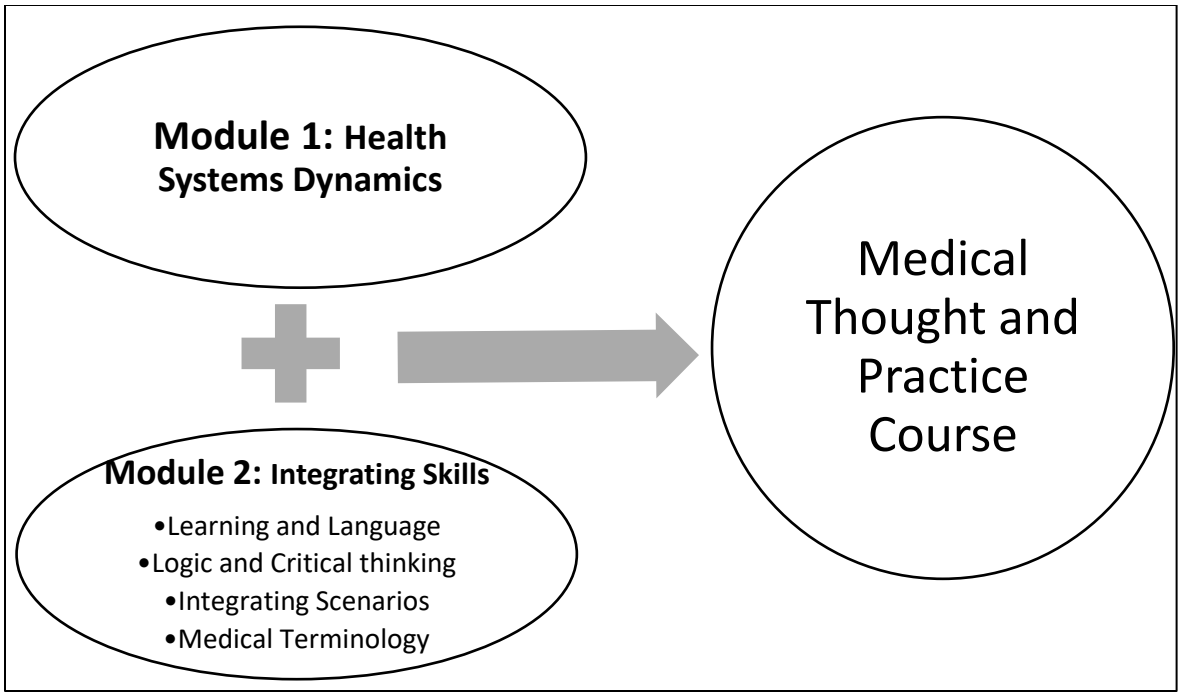

Figure 1: Components of the Medical Thought and Practice Course (adapted from Chipamaunga, 2015)

programmes – e.g. 'Learning and Language' and 'Medical Terminology'[10,15,16] . What is unique about the Medical Thought and Practice course is its five-pronged approach to teaching integrative skills to a highly diverse group of medical students, as a formal examinable course.

Module 1

Health System Dynamics made up 50% of the Medical Thought and Practice course. As its name implies Health System Dynamics focuses on systems and how they function; it incorporates thinking, modelling, computer-based simulation and more thinking. The module was introduced to enable students to understand the ubiquitous systems in the medical field and how they function and interact. Experience has shown that some students struggle with grasping the ability to conceptualise systems fully and this is linked to their educational background [29]. Health

System Dynamics has the potential to teach students a lifelong way of thinking and problem solving while promoting horizontal and vertical integration of learning [30]. This course was assessed by means of practical examinations in the computer laboratory as well as a theory paper.

Module 2

Integrating Skills made up the other half of the course. This module had four 'units':

Learning and Language

The rationale for introducing this unit was the observation that many students failed to progress in their studies effectively simply because they did not possess the skills and language to learn and study effectively[3]. Psychology has linked performance of some medical errors to shame and guilt which may be a result of failure to communicate effectively [31]. In this unit, students were introduced to strategies for reading at the correct speed and with understanding in order to cope with academic work at university level. The Learning and Language component was particularly relevant to students whose comprehension of the English language was not strong enough to enable deep understanding of school content and also to hold academic conversations with their contemporaries. This unit helped students acquire skills they needed to be successful in all their subjects in the early and later years of their studies. This unit was assessed by means of practical assignments.

Logic and Critical Thinking

The aim of this unit was to help students learn to draw correct conclusions from facts. The unit was introduced because all science is constructed empirically; scientists observe events in the natural world and draw the correct conclusions from them [32]. Experience has shown that teachers regularly encounter the failure of students to reason logically from facts, and to identify flaws in their own thinking (which also raises the question why formal teaching of logic for medical students was largely abandoned at Oxford University in the middle of the 19th Century)[33]. There is documentation linking this 'failure of logic' to medical errors related to diagnosing and treatment of patients [34]. Taught by teachers from the Philosophy Department, the unit took a philosophical perspective to scrutinizing some scenarios students encounter in medicine. Similar to the Learning and Language, this unit was also particularly relevant to students with a weak academic background. The unit was assessed by means of a written examination.

Medical Terminology

This unit aimed to help students master scientific and biological/ medical jargon more effectively. Since formal teaching of classical languages for medical students was abandoned years ago many students struggle to learn long words derived from Latin and Greek [35]. If students know the component words (prefixes, suffixes and combining forms) on which these terms are based it is easier to work out what the terms mean and to learn them. This also facilitates integration with other subjects since the Latin and Greek core words are found in different physical, biological and medical science disciplines. Students with a weak academic background would find this unit helpful as the integration of core word components facilitates learning. The unit was also assessed by means of a written examination.

Integrating Problems and Exercises

The aim of this unit was to show students that everything they learn in the Year 1 and Year 2 relates to the practice of medicine and therefore to what they will be learning in later years in their programme ('vertical integration'). There is abundant evidence that students learn 'within boxes' and are subsequently unable to bring knowledge from different subjects together, so they need knowledge of several disciplines to deal with one case or problem ('horizontal integration') [36]. In this unit, students were presented with regular examples showing how the basic physical, biological and behavioural sciences all contribute to understanding medical cases. This was followed by practical assignments for each student based on mini-case scenarios, in which they were expected to link their basic science learning to the medical scenario. This not only promoted horizontal and vertical integration but introduced students to basic aspects of clinical medicine. The practical assignments constituted the assessment of the unit.

Evaluating the course

The Medical Thought and Practice course was evaluated in two ways – ongoing student feedback and reflections of students from a phenomenographic study.

Student feedback (mid-term and end-of-year)

At the end of the first semester of the first year, Module 1 and two units in Module 2 had been presented and students were asked to evaluate these using the following rubric:

Evaluation statement

1. I have learnt some new things that I did not know before.
2. I will use what I learnt in my day to day life.
3. I will use what I learnt in other modules and courses of this year.
4. I will use what I learnt in my further studies next year
5. What I have learnt from this module will help me draw conclusions from facts
6. What I have learnt in this module will help me understand all the other subjects in this year and later years.

The results are given in Figure 2:

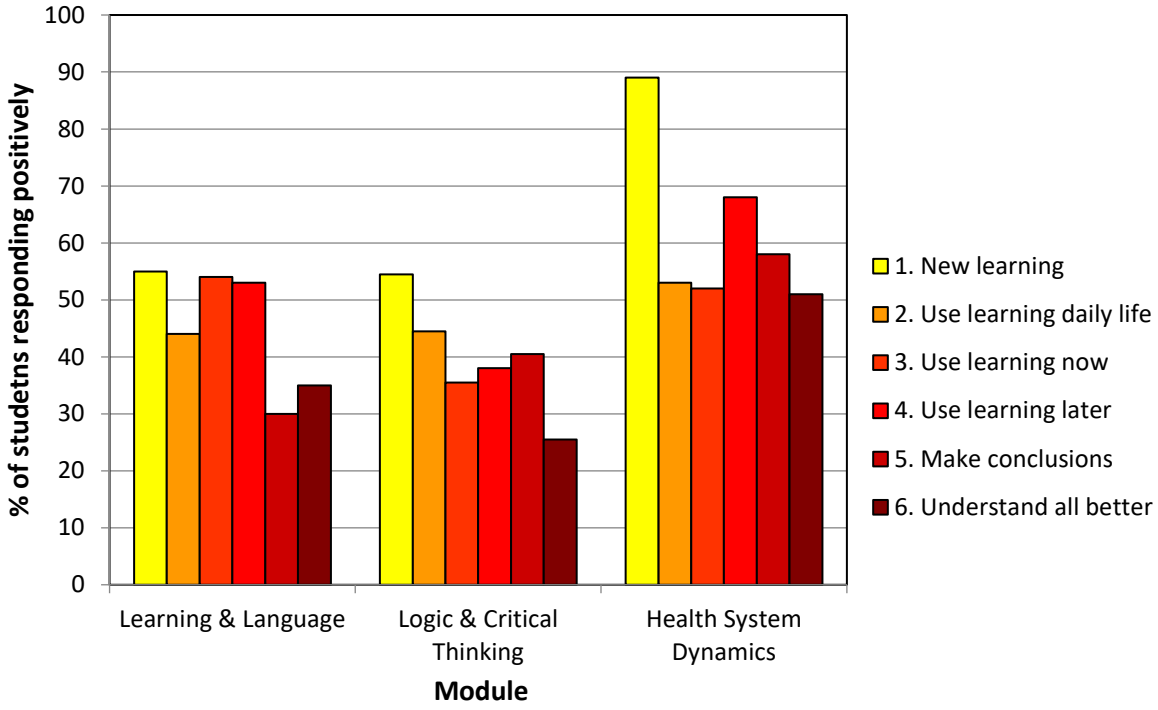

Figure 2: Student evaluation of modules: mid-term

With reference to Figure 2, students encountered new learning in all the three sections of the course. However, they rated 'Health System Dynamics more positively in all aspects of the evaluation. Almost 90% found 'Health System Dynamics' to be new learning and about 68% felt they would use the learning later on in their studies. This was a higher rating compared to about 50% who found 'Learning and Language' and 'Logic and Critical Thinking' useful.

By the end of Semester 2 all the modules and units of the course had been presented and students were asked to evaluate these using the following modified rubric:

Evaluation statement

1. I have learnt some new things that I did not know before.
2. I will use what I learnt in other modules and courses of this year.
3. I will use what I learnt in my further studies next year.
4. What I have learnt from this module will help me draw conclusions.
5. What I have learnt in this module will help me understand all the other subjects in this year and later years.
6. My way of thinking and approaching problems has changed this year.

The results are as follows (Figure 3):

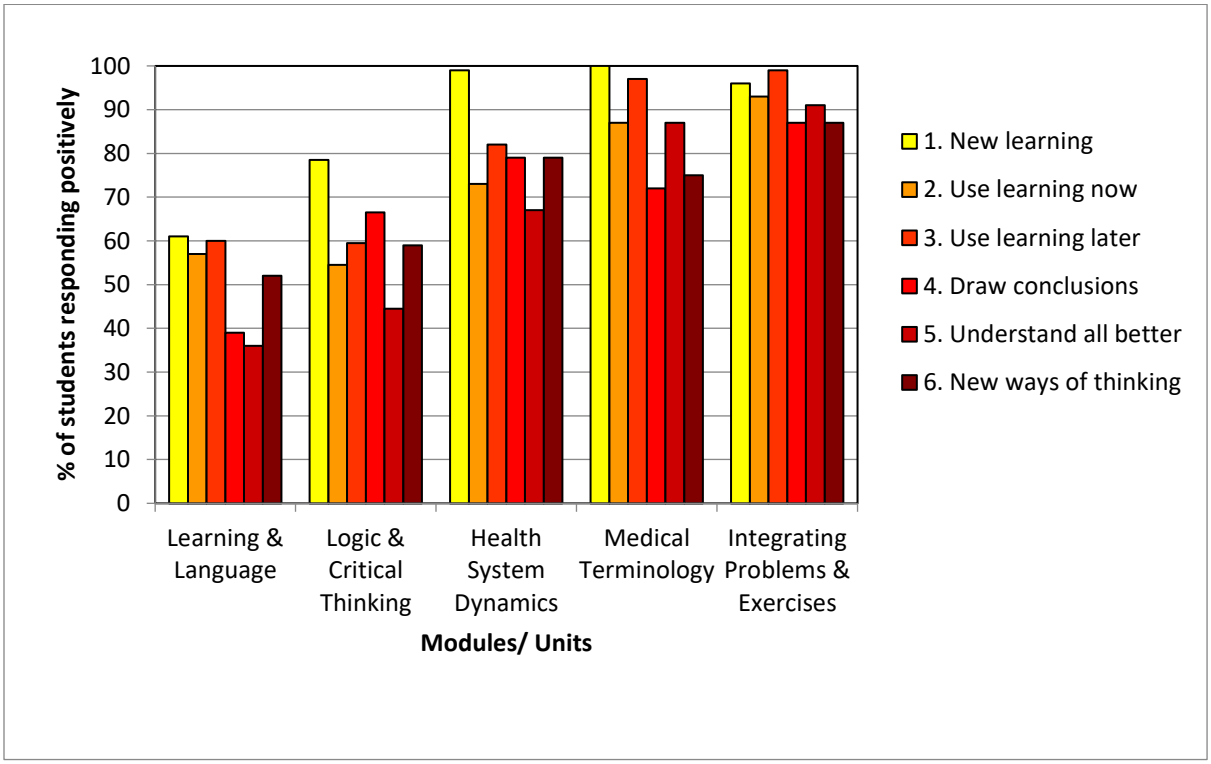

Figure 3: Student evaluation of modules: year-end

Figure 3 shows that Health Systems Dynamics still received high ratings and two units from Module 2, Medical Terminology and Integrating Problems were also highly rated. Almost all students encountered new learning in these modules. While 'Learning and Language' and 'Logic and Critical Thinking still received lower ratings compared to the other units, the scores for equivalent questions improved from those at mid-term – especially for 'Logic and Critical Thinking'. Appreciation of new learning rose to 78% in 'Logic and Critical Thinking' and 61% in 'Learning and Language'. Lots of change in appreciation of the courses were observed in Health Systems Dynamics and Logic and Critical Thinking while little change was observed in Learning and Language (Table 1).

Table 1: Analysis of student MTP evaluation

		Health Systems Dynamics		**Learning and Language**		**Logic and Critical Thinking**	
Statement mid-term	**Statement year-end**	**Score mid-term**	**Score year-end**	**Score mid-term**	**Score year-end**	**Score mid-term**	**Score year-end**
1	1	89	98	55	61	55	78
3	2	51	73	54	57	35	55
4	3	68	82	53	60	38	60
5	4	58	79	30	38	41	67
6	5	51	67	36	36	26	59
		LOTS OF CHANGE		**LITTLE CHANGE**		**LOTS OF CHANGE**	

Students' experiences 4 and 5 years after course introduction

In a qualitative study on students' experiences of integrative learning, 25 students and 10 teachers shared their perceptions on the course Medical Thought and Practice. The experiences were summed up in four main themes: lifelong skills, promotion of vertical and horizontal integration, integration as deliberate activity and role of the teacher in integration. A student who

experienced the course in the first year of study was still applying the skills gained in the fourth year courses, suggesting retention of learning. Other students experienced a different perception and approach to problem solving as they developed an enquiring mind. Representative quotes follow:

> *So, as I was saying that with Health Systems Dynamics with Medical Thought and Practice the basis of how I was taught to approach questions and stuff; those things still haven't left me...* [**4th year student**]

> *...the skills that we have developed through those subjects have I think made us into people who think differently about problems and approach problems differently ... we now question more and when we get just given a problem or a lecturer says something, we will say "But why" ...* **[2nd year student]**

> *... it was very helpful and ... even now the Logic & Critical Thinking lectures because even now when we're chilling with guys someone will say something that's not making sense ....we say "there is no logic in it"* **...[5th year student].**

Other students felt that the course promoted vertical and horizontal integration. An example given was Medical Terminology, which made it easier to understand the meaning of words in other subjects like Anatomy and Physiology.

… I know last year, what did help was if you did Medical Terminology …there is a lot of anatomy that has Latin names and stuff, that was interesting because you could work out what something did… it helps a lot...**[2nd year student].**

…. I have to commend the MTP as far as that is concerned because all… Medical Terminology, Integrating exercises, HSD and Logic & Critical Thinking, all of them work to integrate all our subjects together….. When we get things like graphs, especially it was very helpful in physics and chemistry, a lot of those concepts, integrated so perfectly with HSD **[3rd year student].**

I find the integrating lectures very useful to integrating information … they give you almost a new perspective sometimes on looking at it and two things that you thought might be totally unrelated, they can put them together in such a way that you are able to say… "I understand this now and how it works" **[3rd year student].**

From the experience of a **Teacher,** students who come from disadvantaged backgrounds will struggle with integration of learning.

…the learning background of the learner Uhm will make a significant contribution to their ability to integrate effectively…I think that students who come from a disadvantaged background Uhm have got Uhm a severe disadvantage in terms of integration… [**Teacher**]

Some students acknowledged that Medical Thought and Practice was the only course that made a

deliberate focus on integration of learning. The course presented an opportunity to focus on teaching students how to integrate. It seems that the teachers also appreciated this opportunity, which assisted students to develop the ability to integrate learning.

> *.....there was a project we did in MTP last year that was really helpful. That was the time we actually started talking about the integration with my friends…. where we like have a session where we just talk about integration* **[2nd year student].**

> *....I think that having these opportunities to integrate… at an earlier level in the university system…it would play out in them being able to do it effectively…* [**Teacher**]

There were experiences relating to an appreciation of the role of the teacher in teaching students to integrate learning.

> *… honestly for me the best way for me to learn sometimes is not just hearing about the concept but to see it put into action. So, when I see how the integration is actually done, it opens my eyes to the possibilities ….. to links that may exist to other subjects*. **[2nd year student]**

Some students expressed negativity towards the course MTP as it encouraged integration which was perceived to be increasing the workload while others did not appreciate the relevance of it.

> *…integration would be extra studying…* **[5th year student]**

...sometimes you will be studying something and you think 'I am never going to use this as a doctor', so you struggle to see the importance of it so it makes you not to take it as seriously... **[1st year student]**

DISCUSSION AND LESSONS LEARNT

This paper presented a five-pronged, spiralling, examinable course that was explicitly designed to address integrative learning for a diverse student body in medical education. Each of the five components of the course was designed to address specific approaches to integrative learning. Reading with comprehension enhances critical thinking skills, problem solving skills and the ability to identify links between subjects; systems thinking enhances an understanding of how related events interact; mastering concepts of formal logic guards against false associations; learning Latin and Greek roots of scientific terminology enhances learning with understanding and uncovering links between disciplines; and practical integration exercises increase the ability to integrate. Together these strands of the Medical Thought and Practice course focused on teaching students to understand concepts and link content from different subjects horizontally and vertically.

Students rated the Medical Thought and Practice course more highly at the end of the year than at mid-term. The value of the modules and units in the course seems to have become clearer to students as time went by. Health Systems Dynamics, Medical Terminology and Integrating Exercises received the highest ratings and the rationale could be attributed to the nature of the module and units. There was a clear link to the practice of medicine hence students identified the relevance to their studies. While initially less valued, the ratings for the Logic and Critical

Thinking unit increased dramatically – a very interesting finding that may have its roots in students' initial belief that they knew how to 'do' logic anyway and subsequently learnt that they actually don't. The Learning and Language unit was the least liked by the students. In implementing this course which was designed to address student diversity, it became clear that some students had greater need of this unit than others, depending on their background relating to their mother tongue and the quality of their secondary schooling. Our experiences and observations were that this course benefitted primarily those students who were from a disadvantaged socio-economic background; hence with a weaker educational background.

The data from the phenomenographic study help to clarify the ways in which the units of the course benefited students – sometimes in ways which seem surprising, relating to life outside the medical school. In a following publication these data will be presented and analysed in more detail.

Although the teachers perceived the need for students to take the course, it seems the low ratings for the Learning and Language unit were due to 'unconscious incompetence' that led to the perception that some modules were not useful. There is a need to institute interventions that overcome the perceived stigmatisation of students who need components that are not universally needed. Another observation was that students perceived the course as introducing extra work rather than assisting with learning. This could be a result of the novel content and structure of the course and the fact that it was formally assessed. Integration of learning is a student activity that requires students to reflect on their learning and identify links, and students whose main

experience of learning was through lectures perceived this as extra work. The new course also required securing the support of teachers and this took time.

LIMITATIONS

The students' feedback on the integrative course reports on single cohorts in the first and second years of the programme. Feedback from cohorts in subsequent years would have been useful to establish whether experiences would have been different.

CONCLUSION

This paper demonstrated a unique initiative that addresses fundamental issues that have received little attention in undergraduate medical programmes – despite compelling evidence of the heterogeneity of students' entry levels in the language of instruction, critical thinking and problem-solving skills. Assisting students to cope better with their studies and bringing integration of learning to the focus of their learning is a necessary and logical project.

References

1. Mayet R. Supporting at-risk learners at a comprehensive university in South Africa. Journal of Student Affairs in Africa. 2016;4:1–12.

2. Luescher T. JC van der Merwe & D. van Reenen (2016). Transformation and Legitimation in Post-apartheid Universities: Reading Discourses from 'Reitz'. Bloemfontein: Sun Press. Journal of Student Affairs in Africa. 2017;4.

3. Ngcobo S, Ndaba N, Nyangiwe B, Mpungose N, Jamal R. Translanguaging as an approach to address language inequality in South African higher education: summary writing skills development. Critical Studies in Teaching and Learning (CriSTaL). 2016;4:10–27.

4. Chipamaunga SR. How students develop the ability to integrate learning-a phenomenographic study [PhD Thesis]. 2015.

5. Kelly S. Classroom discourse and the distribution of student engagement. Social Psychology of Education. 2007;10:331–352.

6. Singaram VS, Dolmans D, Lachman N, Van der Vleuten CPM. Perceptions of problem-based learning (PBL) group effectiveness in a socially-culturally diverse medical student population. Education for Health. 2008;21:116.

7. Makoni M. Global summit on student affairs and services: Prof. Adam Habib's keynote. Journal of Student Affairs in Africa. 2016;4:61–64.

8. Dyrbye LN, Thomas MR, Shanafelt TD. Medical student distress: causes, consequences, and proposed solutions. Mayo Clinic Proceedings. Elsevier; 2005. p. 1613–1622.

9. Badat S. The challenges of transformation in higher education and training institutions in South Africa. Development Bank of Southern Africa. 2010;8.

10. Lawrence J. Addressing diversity in higher education: Two models for facilitating student engagement and mastery. Proceedings of the 28th HERDSA Annual Conference: Higher Eduation in a Changing World (HERDSA 2005). Higher Education Research and Development Society of Australasia (HERDSA); 2005. p. 243–252.

11. Kelly WE. No time to worry: the relationship between worry, time structure, and time management. Personality and Individual Differences. 2003;35:1119–1126.

12. Bleakley A. Broadening conceptions of learning in medical education: the message from teamworking. Medical education. 2006;40:150–157.

13. Sfard A. On two metaphors for learning and the dangers of choosing just one. Educational researcher. 1998;27:4–13.

14. Chipamaunga S, Prozesky D. How students experience integration and perceive development of the ability to integrate learning. Advances in Health Sciences Education. 2018;1–20.

15. Sehoole MT. Democratizing higher education policy: Constraints of reform in post-apartheid South Africa. Routledge; 2013.

16. Sleeter C, Torres MN, Laughlin P. Scaffolding conscientization through inquiry in teacher education. Teacher Education Quarterly. 2004;31:81–96.

17. Van de Pol J, Volman M, Beishuizen J. Scaffolding in teacher–student interaction: A decade of research. Educational psychology review. 2010;22:271–296.

18. Brauer DG, Ferguson KJ. The integrated curriculum in medical education: AMEE Guide No. 96. Medical teacher. 2015;37:312–322.

19. Harden RM. The integration ladder: a tool for curriculum planning and evaluation. MEDICAL EDUCATION-OXFORD-. 2000;34:551–557.

20. Malik AS, Malik RH. Twelve tips for developing an integrated curriculum. Medical Teacher. 2011;33:99–104.

21. Muller JH, Jain S, Loeser H, Irby DM. Lessons learned about integrating a medical school curriculum: perceptions of students, faculty and curriculum leaders. Medical education. 2008;42:778–785.

22. Huber MT, Hutchings P. Integrative Learning: Mapping the Terrain. The Academy in Transition. Association of American Colleges and Universities. 2004;

23. Bharuthram S. Making a case for the teaching of reading across the curriculum in higher education. South African Journal of Education. 2012;32:205–214.

24. Hermida D. The importance of teaching academic reading skills in first-year university courses. 2009;

25. Brantmeier C. Second language reading strategy research at the secondary and university levels: Variations, disparities, and generalizability. The Reading Matrix. 2002;2.

26. Hellekj\a er GO. Academic English Reading Proficiency at the University Level: A Norwegian Case Study. Reading in a foreign Language. 2009;21:198–222.

27. Klein JT. Integrative Learning and Interdisciplinary Studies. 2005;3.

28. Rubin P, Franchi-Christopher D. New edition of Tomorrow's Doctors. Medical Teacher. 2002;24:368–369.

29. Jama MP. Academic guidance for undergraduate students in a South African medical school: can we guide them all? Journal of Student Affairs in Africa. 2016;4:13–24.

30. Rubin DM, Richards CL, Keene PA, Paiker JE, Gray ART, Herron RF, et al. System dynamics in medical education: a tool for life. Advances in health sciences education. 2012;17:203–210.

31. Bynum WE, Goodie JL. Shame, guilt, and the medical learner: ignored connections and why we should care. Medical education. 2014;48:1045–1054.

32. Lederman NG. Teachers' understanding of the nature of science and classroom practice: Factors that facilitate or impede the relationship. Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching. 1999;36:916–929.

33. Anderson RD. The History of the University of Oxford. Vol. VII: Nineteenth-Century Oxford, Part 2. JSTOR; 2002.

34. Facione NC, Facione PA. Critical thinking and clinical judgment. Critical thinking and clinical reasoning in the health sciences: A teaching anthology. 2008;1–13.

35. Bosman JP, Kritzinger JPK, Meiring JH, Schumann CJ, Abrahams PH, Greyling LM. Medical Terminology for students of the health professions. Pretoria: Van Schaik; 2006.

36. Hmelo-Silver CE. Problem-based learning: What and how do students learn? Educational psychology review. 2004;16:235–266.