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There is Nothing “BASIC” about Numeracy in Higher Education - A Case Study from an Accounting Programme

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***Abstract*—**Numeracy, like Literacy is considered to be a core value of modern societies. Most higher education institutions in South Africa include being numerate as an important graduate attribute. It is argued that a suitability numerate society contributes to social justice, empowerment, financial and environmental sustainability and a lack of numeracy practices can contribute to disempowerment.

Numeracy is commonly misconstrued as a basic and simple practice, similar in nature to basic arithmetic. This study highlights the complexities of higher education numeracy practices by analyzing a programme in a higher education institution in South Africa using the New Literacies Studies perspective.

***Keywords*—**Higher Education, New Literacy Studies, Numeracy Practices.

I. Introduction

In today’s society being literate and numerate is considered basic competencies. The term numeracy is sometimes used interchangeably with Mathematical literacy or quantitative literacy. Recent international tests suggest that South African learners (schools) students are experiencing difficulties with literacy and numeracy. It is argued that a numerate society contributes to social justice, economic empowerment, environmental sustainability and critical citizenship. Both basic and higher education in South Africa has placed importance on the development of these literacies. The introduction of the school subject Mathematical Literacy together with Mathematics ensures that all students engage with mathematical or numerical content from grade 1 to grade 12.

The National Benchmark Tests (NBTs) and the Standardized Assessment tests for Access and Placement (SATAPs) are entrance and/or placement tests that have sections designed to assess competencies of students in terms of the quantitative demands of higher education broadly. The lack of correlation between the school leaving examination at the end of grade 12 and NBT and SATAP results could suggest that the numeracy practices developed through the studies of the school subjects Mathematics or Mathematical literacy are different to higher education numeracy practices.

It therefore becomes incumbent for higher education to develop these practices.

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An understanding of the implicit numerical demands of a curriculum can contribute to the appropriate design and development of numeracy within higher education. This paper explores the complexities of higher education numeracy practices through an examination of the numeracy demands in an Accounting diploma at a higher education institution. This involved examining the numeracy practices either explicitly stated or implied within the programme by analyzing the course material which included the departmental handbook, tests, exam papers, tutorial materials and lecturers’ perception of the numeracy demands of the programme.

The data was analyzed using a framework informed by the New Literacy Studies perspective. Within this framework, it was possible to identify and unpack the complexity of numeracy events in different contexts and thereby highlight that the numeracy demands of the programme were not limited to mathematical computations. It demanded an integration of various numeracy practices specific to the discipline. It was also evident from the study that the academic numeracy practices expected in the course materials and exam papers were consistent. However, there were discrepancies between what the lecturers explicit expectations and the implicit expectations evident in the course material.

Although the study focused on a particular case; and is not readily generalizable, it does highlight the complexities of the numerical demands of higher education curricula and the “specificness” of these practices to the disciplines or professions. Examining the numerical demands of a programme and becoming explicitly aware of these demands may contribute to facilitating the design and implementation of curriculum and appropriate teaching strategies for the development of higher education numeracy.

II. Background and Related Literature

A. What Are Numeracy Practices

The terms numeracy, quantitative literacy, mathematical literacy and quantitative reasoning have been used synonymously. Reference [1] attempts to make a distinction between numeracy and mathematical literacy. However, there are many commonalities in the skills and concepts identified in both categories. The only distinction is the implication that numeracy deals with simple single contexts.

In arriving at a definition of numeracy practices for this study various terminology and definitions were reviewed. Reference [2] highlight the use of mathematics in the workplace and define mathematics literacy as “the application of a range of mathematical concepts integrated with a detailed understanding of the particular workplace context”. However this definition was limiting as it just focused on students becoming employees. Reference [3] draws attention to another crucial skill in the definition of mathematical literacy as being the ability to correctly communicate quantitative information in different forms and to think critically and logically. However, he does not engage the practice perspective of literacies [4], [5].

Within the New Literacy Studies perspective Numeracy practices is viewed as more than an acquisition of skills but rather a social practice [4], [5]. Therefore being literate and in this case numerate implies having “mastered a set of social practices related to a set of signs which are inevitably plural and diverse” [6]. This implies that numeracy practices are influenced by and constructed within the norms and values of communities or society. Thus students are numerate in different context and never really innumerate. This forces us to acknowledge that there are multiple literacies and that interpretation of texts is never “autonomous” [7]. Therefore even mathematical equations especially in the context of numeracy practices can be understood as a socially constructed practice, ideological in nature, dependent on a range of shared understandings and not as a neutral activity (autonomous or ‘out there’).

Reference [8] defines Quantitative Reasoning “as the predilection and ability to make use of various modes of mathematical thought and knowledge to make sense of situations we encounter as we make our way through the world’’. This definition resonates with the interpretations of numeracy in higher education within this study. Similarly [9] define “quantitative literacy as an inclination and ability to make reasoned decisions using general world knowledge and fundamental mathematics in authentic, everyday circumstances.” Both these definitions suggest that being numerate is a “habit of mind”. The knowledge drawn on is based on re-contextualized mathematical knowledge from the discipline of Mathematics, but is not focused on the knowledge in terms of conceptual abstraction rather in terms of particular ways of applying the knowledge to everyday contexts.

Reference [6] uses the phrase “academic numeracy practices”. The addition of “academic” in the terminology positions the literacies as those that are experienced or expected within the academic context. For instance, the numeracy practices expected of a street vendor would not necessarily be the same as those being discussed within the higher education context.

The practices referred to in this study are particular to higher education but will also be different within the context of specific programmes and professions.

B. Importance of Being Appropriately Numerate

Numeracy practices, quantitative reasoning or mathematical reasoning is seen as a “basic competency” necessary for survival. Numeracy practices draws on the knowledge content of the discipline of Mathematics. Mathematics is more than an abstract or applied discipline; it is also an everyday practice. The involvement of mathematics in modern life and modern society has grown exponentially. According to [10], “Society today is increasingly mathematized”. This is in agreement with [11] view that modern (Western) society functions within a highly quantified framework. Mathematical knowledge and reasoning is now part of a variety of different activities of the lives of all citizens in a society.

Reference [9] argues that sound numeracy practices can “enhance individual and collective living in areas such as health, education, finances/economics, politics and social action” The said authors also state that these practices are “closely linked to the quality of personal, vocational and civic life”.

Reference [12] claims that “many decisions that are socially relevant may be strongly influenced by mathematical models and applications”. Therefore mathematical knowledge and reasoning is an integral component of society. Appropriate numeracy practices make it possible for citizens to critically analyze reports and statements issue by politicians that govern them. Without this kind of citizenry democracy can be undermined.

The importance of numeracy practices to decision making is also referred to by [13] in the context of sustainability. In order to make informed decisions about everyday use of energy or wider policy decisions about public transport or housing infrastructure critical engagement with numerical data is required. This implies that individuals must be equipped with the fundamental mathematical knowledge demanded in numeracy and the mathematical reasoning.

With respect to the study of Accounting based programmes, [14] highlights the competence in numeracy as a “generic attribute” of the profession but qualifies that these must be contextualized and understood “as part of the professional scholarly practice of accounting and so taught as integral to discipline practices”. For the programme in this study and many other higher education programmes, academic numeracy plays an important role in students’ formal access (which is based on competence in Numeracy, measured through the grade 12 results or entrance tests) to programs as well as their epistemological access to disciplinary discourses.

It is the authors’ contention that the academic numeracy levels of students within these programmes will influence their adaption to the practices valued in the programme and therefore in the discipline they will eventually participate in.

C. An Assessment of Numeracy Competencies in South Africa

South African students performed poorly in both the TIMMS and the ANA. TIMMS is an international instrument and focusses on Mathematics and Science. Therefore it’s not directly related to numeracy practices. However numeracy practices requires knowledge of fundamental mathematical concepts. This is the indirect relationship of the TIMMS as an indicator of the levels of numeracy in South Africa.

The ANAs is a national instrument that provides information on achievement levels at various stages of schooling in respect of Literacy and numeracy. Students in the different grades have performed below the expectation.

The current education context in South Africa implies that a majority of the students entering higher education have either completed Mathematics or Mathematical Literacy at grade 12 (which is the grade students write the school exiting examination). Higher Education programmes assume (or would like to assume) that the successful completion of these subjects suitably prepares students with the mathematical literacies necessary to build on for success in their new disciplines in Higher Education. However recent results of the pilot National Benchmark tests, a project intended to assess students' entry level literacies against criteria set by higher education academics as the expected entry literacies have revealed that only 25% are proficient in quantitative literacy [15]. The National Benchmark Test project team has defined students in the proficient categories in the QL test as those that are likely to deal with the quantitative demands of higher education programmes with very little change in higher education curricula. Results on SATAPs as well do not correlate well with grade 12 performance in Mathematics or Mathematical Literacy.

III. Method

This study was conducted at a Higher Education Institution in South Africa within the Faculty of Accounting and Informatics. The faculty of Accounting and Informatics consists of two streams viz. Accounting and Information Technology. Within the Accounting stream there are three year diplomas in Financial Accounting, Cost and Management Accounting, Auditing and Taxation. All of the four programmes within this strand have the first two years common. The first year includes courses such as Accounting1, Taxation1, Auditing1, Costing1; Communications. The minimum requirement for access into these programmes is grade 12 mathematics or mathematical literacy.

For the purpose of this research purposive sampling was used to select the department. The department was chosen because they offered a programme selected that did not have Mathematics as a separate course in the curriculum.

The research used a case study approach. As such, the emphasis was on what can be learned from a particular case for its own sake. Therefore what may be possible from the study is comparability and transferability to other cases. Furthermore, the study contributes to an understanding of higher education numeracy practices through a New Literacies perspective.

IV. Data Collection

The course materials collected and analyzed included:

- Departmental Handbook;
- Study guides of courses,
- Examination papers. This was mainly of first semester courses. There were a total of 5 courses in the first semester. One course does not have an exam. One of the papers analyzed was from a second semester course.
- Handouts and tutorial exercises from lecturers. Handouts were primarily tutorials and solutions which were based on past examination papers.

Lecturer perceptions of the numeracy practices expected in the programme were gathered through semi structured interviews. Lecturers were asked about what numeracy practices they expected of their students for them (the students) to engage academically with their courses, what numeracy practices were important for success in their programs, their view on the role of numeracy in their programs, and their perception of the level of numeracy practices of their students. All five lecturers in the department were interviewed. The two new staff members were ex-students in the programme and they provided their understandings from the perspective of those who had completed the entire programme. The lecturers had experience at lecturing at different levels, but had all lectured the major subject.

V. Framework for Analysis

As indicated the author subscribes to a practice approach as inform by the New Literacy Studies perspective. Within this theory [16] provide a useful framework for understanding the complexity of the demands of numeracy related activity. The authors describe the framework as having been designed to assist in analyzing the quantitative demands of a quantitative literacy event. The numeracy practices that can be expected of students span one or more of the following six categories:

- Students knowing the language of mathematics in terms of vocabulary and symbols (Knowing)
- Students recognizing what to pay attention to in the information provided (Identifying and Distinguishing)
- Students making meaning of information that may be presented in different ways (Deriving Meaning)
- Students performing the necessary calculations/operations (Application of Mathematical Techniques)
- Students thinking logically and reasoning appropriately (Higher Order Thinking)
- Students describing the quantitative information in an appropriate manner (Communication)

Within such an inclusive framework, some categories may lead to subjective categorization. For example, the category dealing with higher order thinking can be ill defined. This notion of "higher order thinking" in this case draws on Blooms taxonomy of learning as described by [17] which provides a hierarchy of learning from "recall" at the most basic level through to "Analysis, Evaluation and Synthesis" which are commonly referred to as "Higher Order Thinking".

A. Units of Analysis

The unit of analysis in an exam paper was a question or sub-question, anything with a specific mark allocation. The unit of analysis in a hand-out was any identifiable chunk of text which referred to one particular aspect, topic, etc. The unit of analysis in the handbook was an outcome or an individual entry requirement, typically appearing in a clause. The unit of analysis in lecturer interviews was a statement or collection of statements with the same or very similar content. Only statements which refer to the content of the course have been analyzed for this purpose. The results presented in this article are based on the units of analysis described, so for example when the results are presented in Table I, the percentages refer to the proportion of each category in the total number of units of analysis.

B. Analysis of Handbooks

The handbook included a description of the courses that constitute the programme. Brief outcomes of each of these courses were described. Each of the outcomes of the courses were considered in terms of whether a mathematics discourse was evoked by using words like calculate etc., and whether there were mathematical demands implied. For instance, the stated outcome "Administer remuneration systems" implies performing calculations according to the pay structure of the person, calculating and including bonuses or overtime, or calculating deductions. Both the handbook and study guide proved useful in establishing a broad perspective on the numeracy practices of the programme, but did not have sufficient detail for these to be analyzed using the [16] Framework.

C. Analysis of Interviews

Interview statements were analyzed according to the framework by [16]. Examples of statements representing each of the six categories are presented below.

Knowing

Phrases such as "students are expected to know terminology like sum", or "understanding vocabulary like largest, smallest or sum etc. are expected" were coded here.

Identifying and Distinguishing

A phrase like "to calculate breakeven, students may be expected to identify relevant information and identify what the problem wants" was coded in this category

Deriving Meaning

Lecturers' statements about questions in the tests or exam being based on Accounting scenarios or within the Accounting context which requires that the students make sense of the problem was coded in this category

Applying Mathematical Techniques

A phrase like "80% of the course is numerically based, focus on calculation, computing +, -, x or division" or "students are expected to perform basic calculations" were coded in this category.

Higher Order Thinking

The phrases coded in this category mainly dealt with the expectations of "logical thinking" as a result of the study of mathematics and a practice needed for success within the programme was coded in this category.

Communication

Phrases similar to "students need to be able to correctly structure their answers" or "represent numbers correctly in financial statements or financial reports" were placed in this category.

Certain phrases that were not overtly about mathematics such as "we expect that they understand English, and are able to understand problems in the context (figure out the problem, understand narratives)", was coded as knowing (knowing terminology), deriving meaning (understanding…..) and identifying and distinguishing the mathematics that needs to be done and strategies to do this. When probed about the "lack of English or perceived lack of the understanding of English" and asked for examples, lack of understanding of phrases like "time and half" was given as examples. Although this may appear to be lack of understanding of English, this lack was identified by the students' lack of understanding that this implied 1 ½ of a quantity. This strengthened the belief that interviews were more productive since the initial responses had to be probed for further clarity.

D. Analysis of Exam Papers, Handouts and Tutorial Exercises

Tutorial exercises and handouts were very similar to previous examination questions. All these sources of data were coded in a similar manner. Below is an example an exam question and the coding of this data within the framework.

In order to engage with the text and answer the questions in Fig. 1, the students would need to engage in one or more or a combination of the different practices within the framework. Examples of statements or mathematical processes representing each of the six categories from the framework are presented below.

Knowing

In order to solve the question students would be expected to know the meanings of quantitative terms and phrases such as "cost plus approach"; "reducing the mark up"; "one half", "one third minus". They would also be expected to know the conventions of representing quantitative information, include symbolic representations such as whole numbers with a space between the 3 digits or representations of a million as indicated in the profit and loss statements

Identifying and Distinguishing:

Aspects of the question that expected students to identify quantitative connections and distinctions or to identify the mathematical process that needed to be done and strategies to do it were coded in this category. Examples in the question was that students needed to identify the relationships between information under the additional information and the profit and loss statement or identify the relevant items to be apportioned such as distribution of rent costs which needs to considered in proportion of factory space occupied.

Deriving Meaning:

An example of such practice expected in the question could be trying to make meaning of the statement: "prices are rough estimates of costs of direct material and direct labour inputs plus a 50% mark-up". Again this extraction of meaning is easier if students know certain terms and concepts. To solve the question students are expected to understand the description of a quantitative concept/situation/process

QUESTION 5 **[20 MARKS: 36 MINUTES]**

Central Trap Company (CTC) is a manufacturer of taps and fittings for the plumbing trade located in Durban. The company was established by Ken Hall in 1951, with a workforce of 10, to meet the needs of the postwar housing boom. Its product range was fairly limited but the company had an excellent reputation for quality.

Nowadays, CTC manufactures an extensive range of high-quality brass and chrome taps. The company is managed by Ken's sons, Michael, and employs 20 people. It has annual sales averaging approximately R10 million. Although, it has been consistently profitable, CTC has experienced increasing pressure from competitors since the early 1990's. The company uses a cost-plus approach to pricing but is having to reduce its mark-up constantly in order to maintain market share.

Both Ken and Michael are qualified engineers. The business is small and has never been able to employ an accountant. Instead, a bookkeeper calculates monthly profit as sales revenue minus expenses. Prices are based on rough estimates of cost of direct material and direct labour inputs plus a 50 % mark up.

With the decline in profit and constant pressure on prices, Michael began to feel uneasy about the way costs and profits were calculated. The results for the month just ended were:

Sales	**980 000**
Less: Expenses	**925 000**
Materials Purchases	**300 000**
Factory Wages – production line	**250 000**
Production supervisor 's salary	**35 000**
Rent	**80 000**
Council Rates	**5 000**
Sales staff	**110 000**
Advertising	**18 000**
Equipment Depreciation	**25 000**
Electricity	**12 000**
Manager's Salary	**80 000**
Truck Lease	**10 000**
Net Profit	**55 000**

Additional information:

- There was no beginning inventory of raw material, work in process and finished
- At the end of the month 10 % of the materials purchased remained on hand, work in process amounted to 20 % of the manufacturing costs incurred during the month, and with no stock of finished goods.
- The factory occupies 80 % of the premises, the sales are 15 % and administration 5 %.
- Most of the equipment is used for manufacturing, with only 5 % of the book value being used for sales and administrative functions.
- Almost all of the electricity is consumed in the factory.
- The truck is used to deliver finished goods to customers.
- Michael Hall spends about one-half of his time on factory management, one-third in the sales area and the rest on administration.

Required:

Michael Hall asks you to review the results for the month and evaluate the company's approach to estimating product costs. In doing so, you should:

5.1 Calculate the cost of goods manufactured and sold. (15)

5.2 Explain the differences between your income statement as prepared in 5.1 and the one above. (3)

5.3 Comment of the cost classification used in the income statement above. (2)

Fig. 1 Example of Exam Question

Applying Mathematical Techniques:

Aspects of the problem solving of the question that expected students to perform certain mathematical techniques such as calculating percentages of whole numbers, performing operations involving mixed fractions, addition and subtraction of appropriate costs and revenues or calculating mark-ups were included in this category.

Higher Order Thinking:

Aspects of the question that expected students to reflect on and compare the two different financial statements (one given and one produced) or establish differences and evaluate why the differences exist were included in this category. This category also included the practices that required students to think logically and identify the information that is needed to solve the problem, establish ways/mathematical processes of gaining that information and then solving problem.

VI. Findings

The analysis of the programme indicated that there were multiple numeracy practices expected that were additional to the ability to perform calculations. This was consistent across the analysis of the handbook, examination papers, handouts and tutorial exercises as well as from the interviews with the lecturers. However initially in the interviews all lectures started by stating that all that was expected of students was BASIC numeracy.

Analysis of the handbook indicated that students could not access the programme without certain levels of achievement in mathematics or mathematical literacy in grade 12, since the entrance requirements of the programme include a pass in Mathematics or Mathematical Literacy as a pre-requisite.

The programme consists of 30 courses. For 23 of these courses, the stated outcomes require students to be able to engage in numerical practices at some point during the course. In the first semester, the students undertake five courses, two of which are the majors for this programme. The outcomes of three of these courses have inherent numerical practice demands for example as expressed in outcomes such as "Determine the cost of manufactured goods".

Analysis of the lecturers' expectations indicated that four of the five lecturers estimated that over 70% of their courses were mathematically or numerically based. However, in terms of the content of mathematics, the lecturers initially stated that the students only needed to "do number crunching", or perform the four basic operations viz, addition, subtraction, multiplication and division. This was their responses in terms of earlier questions in the interview which was actually contradictory to their responses later on in the interview in terms of their perceptions of the mathematical literacies needed after they reviewed an entrance test or when they were asked to provide examples in their courses that required the mathematical literacies.

All lecturers were adamant that the mathematical literacy required in the program was "basic mathematics" that was covered during the early years of the school curriculum. However, they strongly believed that students were unable to perform these basic operations of mathematics. Lecturers identified competence in the following content areas, concepts or processes as crucial for success in the programme:

- Numerical Application including percentages, ratios, decimal numbers, fractions, whole numbers
- Graphs
- Probabilities

- Working with mathematical equations
- Knowledge of mathematical language or terminology
- Application of Linear Programming
- Basic Arithmetic
- Problem solving
- Following prescribed procedures.

The analysis of the numeracy expectations as assessed in the exam papers, handouts, tutorials, and lecturer statement is summarized in Table I.

TABLE I
PREVALENCE OF EXPECTATIONS OF NUMERACY PRACTICES IN THE DIFFERENT COURSES

	Exam Papers (n = 4)	Handout (n = 2)	Tutorial Exercise (n = 3)	Lecturer Statements (n = 5)
Knowing	72.50%	100.00%	66.29%	40.00%
Identifying and Distinguishing	47.25%	0%	41.57%	40.00%
Deriving Meaning	49.75%	50.00%	42.13%	40.00%
Applying Mathematical Techniques	77.13%	100.00%	82.02%	100.00%
Higher Order Thinking	27.25%	0%	8.43%	80.00%
Communication	8.25%	0%	0%	40.00%

Using the [16] framework to analyze the interviews showed that lecturers believed that the academic numeracy practice required in this program is mainly performing calculations followed by the ability to think logically (see the last column in Table I).

Analysis of handouts, tutorial exercises and exam papers showed that the greatest percentage of questions required practices that involved applying mathematical techniques. In fact, all four papers reviewed showed that a majority of questions required an application of mathematical techniques. The practices described in the knowing category were also required in the majority of the questions.

Only 27.25% of the numerical practices in the examination papers expected Higher Order thinking such as logical thinking, complex problem solving or interpreting. This was very different from the lecturers' views which ranked the practice of Higher Order thinking as very high. There were very few questions (only 4 questions across the four papers or 8.25% of the numerical practices in the examination papers reviewed) which demanded that students communicate or represent quantitative information in an appropriate manner. Most of the exam questions requiring academic numeracy practices expected an integration of most of these practices.

In summary, the most frequently demanded practice was that of "applying mathematical techniques". This was ranked most highly from all sources of data analyzed. "Communicating quantitative information" arose infrequently in the data which is surprising given that within the profession students will be expected to write reports and present interpretations of financial statements etc. Reference [18] draws attention to the importance of communication both oral and written in the practicing of Management Accounting. Perhaps this would gain more importance later on in the programme (second and third year).

The "knowing" category which dealt with knowing the mathematical conventions or understanding the mathematical language was highly prevalent in the data. Lecturers indicated that "Higher order thinking" was crucial for success and in the analysis of interviews this appeared to ranked as the second most important category; however this was not consistent with the analysis of the other materials where "Higher Order Thinking" was an infrequent coding.

Upon reflection on the data it appears that the academic numeracy practices that are implicit within the materials (handouts, tutorial exercises and examination papers) are similar. The academic numeracy practices expected as assessed from the lecturer statements were somewhat different to the other sources of data.

The high percentage of questions requiring mathematical calculations could be the reason that academics believe that students only need to "number crunch". What they are perhaps not consciously aware of are the other academic numeracy practices that are implied in the examinations since these are almost "second nature" to people in the discipline and have therefore become "common sense" practices. Reference [19] tells us that experts can sometimes be so adept at particular literacy practices that these take on the power of common sense.

The "doing" of calculations are easier to identify as the numeracy practices and could be why academics understand this to be the primary academic numeracy practice required. This could lead to the development of numeracy modules that are skills based and taught as separate entities as interventions to address gaps in mathematical literacy. Such an approach is problematic seen from a New Literacies Studies perspective. This may lead to the mastering of skills but not the development of practice which is important for the individual, vocation and civic

VII. CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the study has highlighted the various numeracy practices required in the Management Accounting programme, which is more than performing calculations. It has highlighted that the numeracy expectations of the programme are not as simple as lecturers may assume, and that in order to improve students' opportunities to succeed in the programme, the practices of the programme need to be understood and made overt to students. To describe the expectations of students solely in terms of their knowledge of mathematical conventions or terminology and their ability to perform standard algorithmic calculations belies the complexity of the numeracy practices students must be able to engage.

However at a broader level the research also reaffirms the New Literacy Studies perspective that the numeracy practices of a programme are more than a set of skills. Therefore assuming that these practices can be developed through the teaching of particular skills in a separate numeracy course may be problematic. The adopting or developing of mathematical practices is influenced by context within which it is developed. Given that the study of Management Accounting at tertiary level is a new context for these students, it is unlikely that they have been prepared for this.

The complexity of the numeracy practices expected in a higher education programme and the "specificness" of these practices to a discipline and programme impacts on what is taught, when it is taught, how it is taught and by whom it is taught.

A. Learning, Teaching and Assessment Suggestions

Numeracy interventions need to be integrated into the substantive subject curriculum. If a generic numeracy course is added to the programme, the benefits to the students will be limited. Such interventions should focus on numeracy practices and not a set of skills that can be learned independently and transferred. It is these ways of "doing mathematics" in an Accounting course (in this case) that needs to be made explicit to the students since they may not have experienced these practices before. The danger of attempting to have a course that is designed to "bridge the numeracy gap" is that the students may improve their abilities to calculate but may not be able to transfer this to the Accounting courses, as transfer is in itself a problematic assumption [20].

This implies making the numeracy based expectations of the programme explicit by including and highlighting these practices through the facilitation of the discipline courses. Therefore the improvement of numeracy of students needs to be undertaken by all staff and needs to be appropriate for the level of study. This is in line with the [21] notions of 'rules of recognition' and 'rules of realisation': students from disadvantaged backgrounds are less likely to assimilate recognition and realization rules which are not made explicit.

This study has attempted to identify the numeracy practices beyond generic notions but rather within the specifics of the programme. Studies such as this cannot hope to solve the multiple issues academics contend with in their professional capacities in dealing with numeracy demands of their programmes. The demands on educators in our context of transformation are enormous. However, hopefully this study contributes to academic debates around curriculum issues dealing with higher education numeracy by clearly indicating the need to identify programme specific academic numeracy demands if they are to be addressed in a meaningful way.

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