

The Language of Mathematics versus English Grammar Rules: the case of questions in Mathematics examination question papers at the University of Limpopo

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Article Info

Page Number: 6230-6245

Publication Issue:

Vol. 71 No. 4 (2022)

Article History

Article Received: 25 March 2022

Revised: 30 April 2022

Accepted: 15 June 2022

Publication: 19 August 2022

Abstract

"The language of mathematics" has not only been a concern of the mathematics education community alone but also for linguists alike. Several substantial efforts having been made to describe its characteristics and, in particular, the ways in which it may support or cause difficulties for learners to learn mathematics. However the argument in this study is that the 'language of mathematics' can cause a huge obstacle if not given careful consideration. This study investigated how the type of language used in mathematics disciplines have a potential to stifle language learning. The importance of language in education cannot be over emphasized. In order to fill this gap and expand previous work on this subject matter, this study explored and identified the English grammar rules that are flouted when questions are asked in the mathematics examination question papers. We make a case that this practice impact negatively on the English writing competency of students which is very crucial for their academic performance. This article reports on the findings from the data collected in this investigation. The data for this study were collected from various selected examination papers in Mathematics and Applied Mathematics department at the University of Limpopo. Twenty (20) questions were selected from various examination question papers from 2019 to 2021 and analysed for English grammar conformity. Prescriptive Grammar theory undergird this study. The objective of this study is to present analysis of data to illustrate how English grammar rules are flouted in mathematics question papers. Analysis of the data reveals that a significant number of English grammar rules are flouted when questions are developed. The study found that examiners exhibit comma splice challenge (i.e. punctuation issue), lack of knowledge in question structure in English (i.e. word order). The problem of concord is also found. Furthermore, it is also found that the supposedly questions are predominately instruction and request statements that are riddled with grammatical errors. This findings reported in this article have implications for English writing pedagogy. It is hoped that these findings will help even in a small to lecturers in phrasing question in mathematics.

Keywords: English Second Language; Prescriptive grammar; English first language; discipline-based expressions; Vocabulary, English speakers; Syntax; meta-linguistics; lexical knowledge; Grammar rules.

Introduction

English language, like any other languages of the world is rule governed. Among those rules, there are rules that govern or dictates how sentences should be constructed and this encapsulates how questions should be phrased in English (i.e. in the written form). However, when questions (i.e Examination papers) are constructed or phrased in mathematics disciplines, the rules seem to be flouted willy-nilly without any consideration of the existing English grammar rules. A rule in this context refers to ‘any statement expressing a linguistically significant generalisation about the grammatical facts of a particular language, especially when formulated within the formalism of some particular formal description’ (Trask, 1993: 245). Furthermore, it has been observed that "the language of mathematics" has been a concern of the mathematics education community for some time, several substantial efforts having been made to describe its characteristics and, in particular, the ways in which it may support or cause difficulties for learner (Morgan,1996:02). In addition, Morgan (ibid) argue that little attention has been paid to the grammatical structure of mathematical texts. This among other things, is the reason why this study was undertaken. Most research on ‘language in mathematics’ focused on issues such as vocabulary (e.g Riccomini, Fries and Hughes, 2015). One of the reasons that prompted thus study is because language development is often overlooked by math teachers (Riccomini & Witzel, 2010). Morgan (1996:02) corroborate this by saying that ‘little attention has been paid to the grammatical structure of mathematical texts’.

In addition, purists, as Mojela (2010) calls them would find the flouting of grammar rules to be a serious concern. One of the reasons is because according to Jamison (2000:45) language can be a pedagogical tool. This study therefore aimed to explore and identify the English grammar rules that are flouted when questions are developed for examination question papers at the University of Limpopo. This leaves a serious gap in the area of language in mathematics. Thus, the present study aims to contribute to the literature by addressing this gap.

In an attempt to achieve this aim, the study formulated three research objectives, namely:

- To find out if English grammar rules are flouted when examination questions are developed for mathematics examination question papers.
- To identify the English grammar rules that are flouted when examination questions are developed
- To suggest ways in which mathematics lecturers can be helped to improve the English language used in examination question papers.
- To explore the likely repercussions as a result of such flouted grammar rules on students’ academic performance.

Thus, the following research questions were set to guide the enquiry:

- Are English grammar rules flouted when questions are developed for mathematics examination question papers?
- Which grammatical rules are mostly flouted when questions are developed for mathematics examination question papers?
- What intervention measures can be applied to help mathematics lecturers when they develop examination questions?
- What are the likely repercussions on students' academic performance if indeed grammar rules are flouted in the mathematics examination question papers?

The Value of Language in Mathematics Teaching and Learning

Linguistic proficiency is a vital component for aide performance in academia, which includes mathematics (Chow & Wehby, 2018; Kleemans, Segers, & Verhoeven, 2011; LeFevre et al., 2010). In emphasising the above assertion, Peng et al. (2020:19) maintain that 'different types of language skills might be differentially related to different types of mathematics skills'. It is important that when teachers and lecturers assess students who do mathematics, take into the kind of language they use for assessment. It has to be remembered that one of the principles of 'good assessment' is that assessment has to be fair, understandable and valid. According to Peng, Lin, Ünal, Lee, Namkung, Chow, & Sales (2020:03) many mathematics tasks comprise word problems, which also require general knowledge. This makes linguistic proficiency very critical in accessing mathematics knowledge.

Jamison (2000:46) is of the view that 'most mathematics students have little practice in forming clear, precise sentences and often lack the patience to do so they seem to feel that mathematicians spend too much time distinguishing upon trifles to the disruption of all true conversation'. Thus, it is very crucial to always remind mathematics teachers and lecturers about the importance of language in their teaching and assessment of mathematics activities. Peng et al. (2020:02) maintain that it is necessary to gain better insight into the relation between language and mathematics because such knowledge is important not only for theorists of language and mathematical cognition, but also for educators so that they can make informed decisions about how to use language and to what degrees language should be emphasized in mathematics instruction. This is so because, the ability to write well is crucial in mathematical development (Vukovic & Lesaux, 2013:229). Furthermore, some studies such as Merz, Zucker, Landry, Williams, Assel and Taylor (2015) reported strong correlations between language and mathematics. The study by Peng, Lin, Ünal, Lee, Namkung, Chow, & Sales (2020) found that the relation between language and mathematics was stronger among native language speakers (See, also, LeFevre et al., 2010). Peng et al (2020:22) concludes that inadequate proficiency in the second language among second-language learners may create a bottleneck in their use of the second language to think in mathematics tasks. Majority of students in this study (i.e at UL) speak English as a Second Language (L2) and they are not that proficient in the language. It is necessary for the communication of higher order mathematics reasoning (Sloyer, 2003) but the researchers in this study argue that condition should not be abused to an extent that rules of the language are flouted will-nilly in the name of creating 'confusion'.

Communicating mathematically is a complex task for even the most mathematically advanced student, the ability to effectively communicate (expressively and receptively) through the language of mathematics requires mathematical understanding; a robust vocabulary knowledge base; flexibility; fluency and proficiency with numbers, symbols, words, and diagrams; and comprehension skills (Riccomini, Smith,Hughes & Fries (2015:237).

According to Jamison (2000:46) the use of language in mathematics differs from the language of ordinary speech in many important ways, for example it is nontemporal, there is no past, present, or future in mathematics everything just 'is'. He further argue that making the syntactical and rhetorical structure of mathematical language clear and explicit to students can increase their understanding of fundamental mathematical concepts. The above assertion puts the issue of language particularly the grammar aspect at the centre. Therefore, providing appropriate academic language support is important for all learners, especially in the mathematics classroom (Bay-Williams & Livers, 2009). The researchers in this study also argue that providing language support should not only be restricted to students alone but also to lectures so that they are able to carry their tasks efficiently and effectively. Particularly in institutions where the adage 'language across the curriculum' is at the centre of pedagogy like at UL. This is corroborated by Craig (2012) calls for us (academics) to expand 'writing-across-the-curriculum'.

In addition to the above assertion, Jamison (2000:46) writes that 'conceptual mathematics courses focus on proof and argument with an emphasis on correct, clear, and concise expression of ideas and this is a difficult but crucial leap for students to make in transitioning from rudimentary to advanced mathematical thinking, at this stage, the classical trivium of grammar, logic, and rhetoric becomes an essential ally'. What comes very clear in the above assertion is that the author acknowledges the importance of concise expression which reside in good grammar and this makes grammar very important in the 'language of mathematics'.

According to Jamison (ibid) the other challenge in mathematics language is that 'systematic thought also requires precise verbal expression' (Jamison,2000: 48). Thus, it is important for lecturers who set examination and Test questions in mathematics question papers to have a very good knowledge of how to construct the questions in such a manner that they subscribe to the idea of 'precision' as Jamison (ibid) mentioned.

In addition to what has been discussed above, according to Morgan (1996:02) one grammatical structure that has received some attention, because of its relevance to the formation of new mathematical objects and concepts, is the extensive use of nominalisation (forming a noun from a verb and hence an object from a process, e.g. permutation, relation, rotation). This is one important element of grammar which should not be taken for granted because of its importance in aiding comprehensibility. For example, if a particular mathematics student does not know whether a word in a certain question is used either as a verb or noun, that particular student is likely to get that question wrong and not because he or she did not know the answer but because she mis-understood the question to grammatical issues.

There are various ‘mathematics language’ challenges identified by various scholars. For example, Riccomini *et al*, (2015) identified the categories that might pose problems as far as comprehensibility is concerned and they are discussed below:

- meanings are context dependent (e.g., foot as in 12 inches vs. the foot of the bed)
- Mathematical meanings are more precise (e.g., product as the solution to a multiplication problem vs. the product of a company)
- Terms specific to mathematical contexts (e.g., polygon, parallelogram, imaginary number)
- Multiple meanings (e.g., side of a triangle vs. side of a cube)
- Related but different words (e.g., circumference vs. perimeter)
- Concepts may be verbalized in more than one way (e.g., 15 minutes past vs. quarter after),

Theoretical Framework

Prescriptive Grammar (PG) theory was adopted as the underpinning framework to this study. PG is one of the approaches to the study of language through the lens of critical linguistics, it focuses on how relations among words in a sentence are established and constructed (i.e both in written texts and spoken texts language). The rules of the language are very central in this theory. It prescribes how words should be arranged. The PG grammar was referred to as “text-book grammar” because of its strict adherence to rules. The grammar books then contained almost all the rules and were therefore rule-centered. Unegbu (2014:991). Whether you are making declarative statements or asking questions, rules have to be followed. This theory was relevant to this study simply because of its focus and strictness on rules regarding language. Willig (2015:146) posits that ‘what people say tell us something about what they are doing with their words (disclaiming, excusing, justifying, persuading, pleading etc) rather than about the cognitive structures these words represent’. Mavunga and Kaguda (2016:176) assert that the above mentioned knowledge can be utilised to answer a variety of questions related to language questions such as:

1. What meaning is created by the arrangement of words in a particular way?
2. How are hearers likely to interpret what they hear?

The researchers in this study used PG theory to zoom into how various questions were constructed in various mathematics examination question papers with the intention of among other things finding out if they articulate what they were meant to articulate and in a succinct manner with no nuances that can be deciphered. Thus, this framework was relevant and pivotal in providing a solid grounding to this study.

Context of the Study

The choice of the site of a study resulted from combination of criteria including availability, accessibility and theoretical interest (Schwedt, 1997:140). This study was conducted at the University of Limpopo (UL), Limpopo province in South Africa. The researchers, in this study are employees of the UL. Therefore, the sources were data was harvest accessible to them.

Research Design

The researchers have employed the qualitative approach as a research design to this investigation and this was mainly because the type of data collected. This was a desktop based study where literature texts (i.e. the various selected mathematics examination question papers) were analysed. The study focused on the whether English grammar rules were flouted in the questions contained in the mathematics examination question papers at the UL. This makes this study a case study.

Data Collection and Analysis

A total of thirty (30) mathematics question papers were randomly selected from the UL Library online database of examination question papers. The question papers were all from the Department of Mathematics and Applied Mathematics. Random sampling was therefore the preferred method of sampling so that bias of focusing only on one mathematics module or course or focusing on question papers from one specific year could be avoided. This also helped the researchers because modules/courses from various levels were selected. The sample of some of the selected and analysed mathematics question papers are indicated in Table 1.1 below:

TABLE 1.1 Number of Research subjects interviewed and their gender

Name of course / module	Code	Level	Examination year
Mathematics for Health Sciences	MOPM011	1	May/June 2019
Fluid Mechanics	SAPA031	3	May/June 2019
Numerical Analysis	SAPA022	2	Jan/Feb 2021
Theory of Electromagnetism & Relativity	SAPA032	3	Jan/Feb 2021
Computational Mathematics & Mathematical Modelling	SAPM012	1	Jan/Feb2021
Mathematical Analysis I	SMTA031	3	May/June 2019
Complex Analysis	SMTA032	3	Jan/Feb 2021
Abstract Algebra	SMTB031	3	May/June 2020
Mathematical Analysis II	SMTB032	3	Jan/Feb 2021
Differential & Integral Calculus	SMTH011	1	May/June 2019
Applied Linear Regression	SSTB031	3	May/June 2019
Computational Mathematics & Mathematical Modelling	SAPM012	1	Jan/Feb2020

Due to COVID-19 protocols at the time of data collection no hard copy question papers were analysed. The researchers harvested the question papers through the help of a librarian. In other words, data analysis helps one figure out what the data reveals. Data in this study was of qualitative nature and it was analysed using principles from both interpretational analysis (c.f. Winegardener, 2001) and ‘method of agreement’ (c.f. Neuman 2000:428). According to

Newman (ibid) the 'the method of agreement' focuses a researcher's attention on what is common across cases. In other words the person who conducts the investigation tries to locate a common cause among cases. In this study, various examination questions in various examination papers were analysed for ungrammatical questions. The identified question were then extracted, put in a folder and then analysed using commonly known Prescriptive Grammar (PG) rules approach. A search for similar grammatical errors in various questions was also done and this was done to try and figure out what the cause could be for such an error to occur. Once all the grammatical errors were identified they were grouped into different categories of grammatical errors.

Data

The below data indicates ungrammatical statements 'taken to be questions' in the examination question papers. The supposedly questions are extracted raw as they appear in the question papers (in other words they are not edited).

Specifically extracted questions from the previous examination question papers (2019-2021)	
1	2.1. Approximate the integral $\int_0^{\frac{1}{2}} \sin\left(e^{\frac{t}{2}}\right) dt$ correct to 4 decimal places with $n = 4$ by using 2.1.1. Trapezoidal rule. [6 marks] 2.1.2. Simpson's rule. [7 marks]
2	2.2. For the integral in 2.1., how many subintervals are needed to estimate it with error not exceeding 0.5×10^{-12} by using 2.2.1. Trapezoidal rule. [6 marks] 2.2.2. Simpson's rule. [6 marks]
3	5.1 Use Newton's method , to solve $f(x) = x - \tan x$, with initial guess $x_0 = 4.6$ to 5 decimal places. (7)
4	The pressure at A is $20Pa$ and at B is $30Pa$. In which direction is the flow, and what is the friction loss of the fluid if the fluid has secific weight of $100kg/m^3$?
5	Simplify the continuity and Navier – Stokes equations to model this flow assuming the fluid is Newtonian. Obtain expressions for the velocity profile in the fluid, shear stress distribution, and volume flow rate.
6	(iii) At the 5% level of significance, use the partial F-test to determine whether each independent variable makes a significant contribution to the regression model. (11) (iv) On the basis of the results indicating ...

7	Given $\epsilon > 0$, there is a $\delta > 0$ such that $\left \frac{4-3i}{1-2i}z - L \right < \epsilon$ whenever $0 < z + 2i < \delta$. Then $L =$ A. $-2 - 4i$. B. $2 + 4i$. C. $-2 + 4i$. D. $2 - 4i$. E. None of the above. [2]
8	2.4 Determine $\frac{d^2y}{dx^2}$ given that : $y^2 + xy - x^2 = 9.$ and simplify completely. (7)
9	1.1 Show that $\{f_n(x)\}$ converges uniformly on $[a, b]$ if and only if given any $\epsilon > 0$ there is a natural number N such that $f_n(x) - f_m(x) < \epsilon$ for all $x \in [a, b]$ whenever $m, n > N$. 1.2 Find the pointwise limit of the sequence $\{f_n(x)\}$. [6]
10	If f is an entire function and suppose $f'(z) < \infty$ in the whole complex plane. Then which of the following statements is true? A. f is also bounded entire function. B. f is a constant. C. f is a polynomial with maximum degree of 1. D. f' is a non-constant entire function. E. None of the above. [2]
11	2.5 Show that any interval (a, b) with the discrete metric is locally compact but not compact. [5]
12	2.3 Define an isomorphism between two groups. [2]
13	1.1.2. The 5th decimal place in 0.01235 as an approximation for 0.0123482 is significant. [2 marks]
14	1.3) Let $A = \{2, 4, 6, 8\}$ and define the relation R on A by $(x, y) \in R \text{ iff } x \text{ divides } y.$ Then: A. R is an equivalence relation. B. R is only reflexive. C. R is only symmetric. D. R is only reflexive and transitive. E. None of the above.

Results

The problem in the below question is that of punctuation.

5.1 Use Newton's method , to solve $f(x) = x - \tan x$, with initial guess $x_0 = 4.6$ to 5 decimal places. (7)

In the above question, the comma used just after the word '*method*' should have not been there. Again this is a problem of incorrect punctuation and this is the problem also in the below question.

The pressure at A is 20Pa and at B is 30Pa. In which direction is the flow, and what is the friction loss of the fluid if the fluid has secific weight of 100kg/m³?

In the above question, the comma (,) after the word 'flow' is not necessary because there is a conjunction 'and' that join the two clauses together.

The below question has a very surprising and unimaginable grammatical issue.

2.1. Approximate the integral $\int_0^{\frac{1}{2}} \sin\left(e^{\frac{t}{2}}\right) dt$ correct to 4 decimal places with $n = 4$ by using

2.1.1. Trapezoidal rule. [6 marks]

2.1.2. Simpson's rule. [7 marks]

The challenge with the above question is that there is an unnecessary omission of the word 'that is' to make the question read '*... that is correct to 4 decimal places with...*' When the complementizer '*that is*' is omitted in the above sentence, the remainder of the sentence assumes other semantic inferences which might lead the students astray.

2.2. For the integral in 2.1., how many subintervals are needed to estimate it with error not exceeding 0.5×10^{-12} by using

2.2.1. Trapezoidal rule. [6 marks]

2.2.2. Simpson's rule. [6 marks]

The challenge with the above question is that the word '*it*' creates a lot of confusion and perhaps even ambiguity. There is a problem in identifying what the word '*it*' in that question refers. The other problem with this kind of question is that of concord.

Simplify the continuity and Navier – Stokes equations to model this flow assuming the fluid is Newtonian. Obtain expressions for the velocity profile in the fluid, shear stress distribution, and volume flow rate.

The challenge in the above question is that the words ‘simplify’ and ‘stokes’ are used as verbs in one sentence and the area in the sentence where they are placed creates a lot of confusion as far as the instruction is concerned. The other issue that complicates matters is the use of the hyphen. In other words, the students are expected to carry out the following two actions:

1. To ‘simplify the continuity and Navier’
2. To ‘stoke the equations...’

The question could have been better phrased as follows:

‘Simplify the continuity and Navier and after that stoke equations to model...’

Lastly, in that sentence, ‘continuity’ is not capitalised whereas ‘Navier’ is capitalised. It looks like ‘continuity and ‘navier’ are nouns. The question is why capitalise ‘navier’ and leave ‘continuity’?

- (iii) At the 5% level of significance, use the partial F-test to determine whether each independent variable makes a significant contribution to the regression model. (11)
- (iv) On the basis of the results, indicate...

The problem with the above question is that the sentence starts with ‘At’ which is a wrong way of starting a sentence as far as Prescriptive Grammar (PG) is concerned.

2.4 Determine $\frac{d^2y}{dx^2}$ given that :

$$y^2 + xy - x^2 = 9.$$

and simplify completely.

(7)

In the above question the challenge is that a colon (:) is used. The function of a colon (:) is to separate items or when items are listed. The sentence would have been correct if

$$y^2 + xy - x^2 = 9.$$

was added without the colon.

- 1.1 Show that $\{f_n(x)\}$ converges uniformly on $[a, b]$ if and only if given any $\epsilon > 0$ there is a natural number N such that $|f_n(x) - f_m(x)| < \epsilon$ for all $x \in [a, b]$ whenever $m, n > N$.

- 1.2 Find the pointwise limit of the sequence $\{f_n(x)\}$. [6]

The challenge with the above sentence is that it does not flow. The problem start where immediately after $\epsilon > 0$ is used. This sentence is just ungrammatical.

If f is an entire function and suppose $|f'(z)| < \infty$ in the whole complex plane. Then which of the following statements is true?

- A. f is also bounded entire function.
- B. f is a constant.
- C. f is a polynomial with maximum degree of 1.
- D. f' is a non-constant entire function.
- E. None of the above.

[2]

The above question is punctuated incorrectly because it is a 'conditional sentence'. In other words, it joins two thoughts. In that sentence we have the 'if' clause and the 'result clause'. A comma (,) should have joined the two clauses. The full-stop after the word '*plane*' is not needed.

- (iii) At the 5% level of significance, use the partial F-test to determine whether each independent variable makes a significant contribution to the regression model. (11)
- (iv) On the basis of the results, test the hypothesis...

The problem with the above question is the use of the clause '*At the 5% level of significance, ...*' at the beginning of a sentence. The sentence would have flowed nicely if it was started with the second clause '*use the partial F-test...*'

Given $\epsilon > 0$, there is a $\delta > 0$ such that $\left| \frac{4-3i}{1-2i}z - L \right| < \epsilon$ whenever $0 < |z + 2i| < \delta$. Then $L =$

- A. $-2 - 4i$.
- B. $2 + 4i$.
- C. $-2 + 4i$.
- D. $2 - 4i$.
- E. None of the above.

[2]

The full-stop is used wrongly in the above question. The two clauses should have been joined by a comma (,).

- 1.1 Show that $\{f_n(x)\}$ converges uniformly on $[a, b]$ if and only if given any $\epsilon > 0$ there is a natural number N such that $|f_n(x) - f_m(x)| < \epsilon$ for all $x \in [a, b]$ whenever $m, n > N$. (15 marks)
- 1.2 Find the pointwise limit of the sequence $\{f_n(x)\}$. [6]

The above question has a problem of concord

2.3 Define an isomorphism between two groups. [2]

The article 'an' in the above question is used incorrectly. An incorrect article is used.

If f is an entire function and suppose $|f'(z)| < \infty$ in the whole complex plane. Then which of the following statements is true?

- A. f is also bounded entire function.
- B. f is a constant.
- C. f is a polynomial with maximum degree of 1.
- D. f' is a non-constant entire function.
- E. None of the above.

[2]

The above question is punctuated incorrectly and the second problem is that the first clause is an incomplete thought. The full-stop after the word '*plane*' should have been replaced by a comma (,).

1.1.2. The 5th decimal place in 0.01235 as an approximation for 0.0123482 is significant.
[2 marks]

The problem with the above question is that it conveys an incomplete thought.

1.3) Let $A = \{2, 4, 6, 8\}$ and define the relation R on A by
 $(x, y) \in R$ iff x divides y .

Then:

- A. R is an equivalence relation.
- B. R is only reflexive.
- C. R is only symmetric.
- D. R is only reflexive and transitive.
- E. None of the above.

The problem in the above question is like with some of the questions analysed in this data is concord and punctuation. This is a multiple choice question but a colon is used together with the word 'then' and this is clumsy and incorrect.

Discussion

The findings of this study on the 'flouting of English grammar rules' in these supposedly questions in mathematics questions papers highlight the prevalence and continuous incorrect grammar rules utilisation by examiners. Morgan (1996:07) puts it that 'the way in which a mathematical text is constructed as a coherent whole and the type of "message" it attempts to convey may, in summary, be investigated by considering thematic progression, the cohesiveness of the text'. It is indeed true that cohesiveness enhance comprehensibility.

However, in this study, it is found that most questions lack in that regard. For example, in these findings, we observe that there is a pervasive use of colon (i.e. punctuation) that deviate from standard English conventions. The issue of punctuation is a problem because punctuation can change meaning, particularly if a question is not phrased correctly. The two example sentences example below highlight the issue raised above very well.

1. Would you like a woman pastor?

2 Would you like a woman, pastor?

The above two questions expresses two different thoughts and that is why punctuation should always be correct so that the question expresses the exact idea the examiner wants to ask. Furthermore, it is evident from the data analysed in this study that there is lack of knowledge regarding comma splice challenge among examiners. Furthermore, a sentence just like a question, should express a complete thought. The relationship between a subject and a verb in a sentence is very important. Therefore, concord (what is commonly known as subject-verb agreement) should always be checked whenever a sentence or a question is developed.

Another issue related to the above that is revealed by this study is the incorrect use of hyphen (-). Hyphen like comma if used incorrectly, can also significantly change meaning. Again, the two example sentences below highlight the above raised issue.

1. The University of Limpopo offer three-year degrees

2. The University of Limpopo offer three year-degrees

The above two sentences expresses two different thoughts and that is why the use of hyphen should always be correct so that the question expresses the exact idea the examiner wants to ask. A significant number of mathematics questions utilise hyphen and unfortunately most of the time it is utilised incorrectly. This problem should not be left to perpetuate.

The other issue that came out quite clearly in this study is the confusion or lack of knowledge regarding various sentence categories. For example, there seems to be a confusion on the part of the examiners in understanding a command (imperative), request and a question. Most of the supposedly questions in this study straddle between being a 'request' and a 'command'.

Furthermore, one of the distinguishing finding in this study was the general use of spoken English discourse which is so unfortunate. We contend that questions in written examination question papers should also adhere to conventions of correct academic writing and this will help in fulfilling the objective espoused in the adage 'language across the curriculum'. This principle of 'language across the curriculum is still very much prevalent in various universities across the globe. In SA, most if not all universities use English as a LOLT and therefore this language of instruction is very vital for the academic success of students.

The other challenge observed in the data in this study relates to syntax. The use of tense in these supposedly questions is very much different from the grammatical norms in standard English and lecturers should be encouraged to avoid it. In addition, when other language aspects such as complementizers are omitted in questions, the remainder of the sentence/question assumes other semantic inferences and thus, students can assume that they understand the question and only to find that they are actually wrong. Phrase structure rules account for much of our syntactic knowledge and when this is compromised in the mathematics question papers, the potential of dismal academic performance in this discipline is high.

Morgan (1996: 09) argue about this issue in his study and note that students find it challenging to draft written texts that were acceptable'. The findings in this study also vindicated the above supposition. Now, this study is also an attempt in trying to fill this void and we as researchers think we have played our part in doing so even if it in a small way.

Lastly, data analysed in this study indicated lack of knowledge on the use of articles by examiners. Articles are lexis that define a noun as specific or unspecific. Some questions in the mathematics questions use articles wrongly as it has been seen in the data. Article 'a' for a general statement and 'the' for specificity. In other words is a definite article.

Conclusion

The main goal of the study was to investigate if English grammar rules are flouted when examination questions are developed for mathematics examination question papers. The study found that (i) there is evidence that English grammar rules are flouted when questions are developed for mathematics examination question papers and some of those relate to (a) the issue of punctuation, (b) omission of complementizers in the phrasing of questions, (c) incorrect use of articles, (d) word-order and (d) Concord problem. Given these findings, the researchers argue that I argued that while mathematics content is important in the pedagogy of mathematics, equally important is the use of proper usage of the language of instruction. The frequency of occurrence of these grammar mistakes in the question papers, additionally, suggests a serious English language gap on the part of examiners and this should not be left to perpetuate.

The findings in this study will help students to be enable to conform to the conventional expectations of the mathematics genre while learning acceptable English grammar rules so that when they break these conventions they should be able to know and self-correct. To sum up, the data extracted from these question papers has provided further evidence that further research in this area is needed to fully understand the phenomenon. The researchers argue that the side of the lecturers should be heard regarding this problem.

Recommendations

The following recommendations are made based on the findings in this study:

- Lecturers should from time to time attend workshops on English language usage

- Mathematics question papers should be submitted for editing and proof reading by a linguist before final submission can be made
- English for mathematics course should be developed at the UL
- Interdisciplinary relations should be encouraged
- Language across the curriculum should be encouraged and form part of the pedagogy in mathematics lecture halls.

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