Towards an Analysis of Poor Learner Performance in a Theoretical Computer Literacy Course

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Abstract

An alarming number of learners in Accounting at a large distance teaching university fail an introductory course in computer literacy. The lecturers proposed over a period of three years various methods of studying and preparing for the examination in the subject, but with limited success. The problem seems to start at school level even as early on as primary school education. Distance-teaching institutions are furthermore faced with the absence of a classroom environment, a facility which many learners, fresh from school, still have a need for. However, having marked a few thousand scripts twice a year over the past three years, the lecturers identified a number of subproblems all part of the larger problem of learners having to use English as their second or third language to master a content subject. Other problems include an inability to determine the relevance of a formulated answer to a question.

Keywords: Computer literacy, Content literacy, Second language, Problem frames, Patterns

Introduction

When studying a subject which is content related, in a different language than their mother tongue, learners (i.e. students) are faced with the problem of content literacy. Content literacy is defined by Hurley & Tinajero (2001, p. 87) as: "the ability to use reading and writing to learn subject matter in a given discipline and how a learner uses literacy to learn". It is well known that learners who have to use a language in which they are not proficient in (typically their second or third language) to master course content, for example a theoretical module dealing with computer literacy, experience grave problems in mastering the material (August, 1994; Collier, 1995; Tinajero & Schifini, 1997). This problem is aggravated if the course in question is not part of the core subjects for the particular qualification, but very much a background module needed as part of the makeup of a successful graduate in the qualification.

Learners studying course content using a 2nd or 3rd language first need to become proficient in the particular language before they can sensibly utilise this knowledge to comprehend the content of the subject. Language plays a vital role in the understanding of technical terms and in turn seriously affects the learner's success in a content-related subject (Vacca & Vacca, 1993). This dilemma is also highlighted by Hurley & Tinajero (2001, p. 87) when they claim that "non-

English speaking learners are expected to adapt to two or more languages and still make sense of content reading". In the same vein Wang (1996, p. 8) reports about a course conducted in English that "the higher the proficiency in English, the better the academic achievement (in that course)". Naturally it is the object of a language to help a learner to comprehend what is happening, to understand and to be understood. Language and semantics are, therefore, closely intertwined and cannot sensibly be separated.

Computer literacy courses of a theoretical nature normally contain vast amounts of technical terminology and many learners attempt to master such terminology using their second or third language. Learners need to develop the cognitive and academic skills required at school level to succeed in learning academic subject matter (Collins, 1995). The way to achieve this is for teachers to integrate language learning with content learning, making use of the learners' experiences and to focus on higher-level cognitive skills (Hurley & Tinajero, 2001). If the problem is not addressed adequately at both primary and secondary school level, the learner has a disadvantage when studying at a Tertiary Education Institution (e.g. university or college). The problem is compounded when the medium of tuition is primarily through distance education.

In this paper we analyse a number of examination scripts of learners, a large number whose first language is not English and show how the problem of content literacy manifests in a number of subproblems. The course is a first-year background computing module for learners in Accounting.

We begin the paper with an analysis of a number of cases of a real examination. For each case we categorise the various ways in which the lack of good language skills contribute to a learner obtaining a low mark and illustrate a very important subproblem, namely, an inability to match a correct answer with a given question. Some relationships among these subproblems are identified and collated in a diagram. Towards the end a number of steps are presented to solve some of these problems. The paper concludes with an analysis and some pointers for future work.

The May 2005 Examination

During the past three years the lead author has been involved in the offering of a theoretical computer literacy course for first-year accounting learners at a large distance teaching institution. It is a semester course and examinations are written during May and October every year. The material for the course consists of a prescribed book (which the learners have to buy from an official bookseller) and a study guide which is included in the learner's study package upon enrolment for the course. The learner enrolment comprises an average of 7000 learners during the first semester and 4000 for the second semester. The pass rate for this particular course has always been low, despite the fact that the lecturers embarked on a number of measures in an attempt to improve the pass rate. These measures include the following:

- As a first measure we introduced by means of a tutorial letter a number of generic guidelines for studying the particular subject. These guidelines were simultaneously published on the web page for the module and also included as a hard copy document returned with the marked assignment of each learner. This measure appeared to have had some effect, since our pass rate increased with about 3% during the following exam period.
- With the second round of learners we embarked on a further two measures: (1) we rewrote the study guide, incorporating a step-by-step study method, aimed particularly at explaining the character of the course and (2) learning outcomes previously presented as pure statements were rewritten as questions, known in Outcomes Based

Education (OBE) terminology as *knowledge tests*. Note, however, that these were just the questions and the learners still had to determine the answers themselves. After these additional two measures our pass rate decreased by an alarming 5%. This was rather disturbing, especially given the fact that the new study guide was written according to the guidelines proposed by experts in tuition, internal to our institution.

After another round of examinations, again having had to face a rather low pass rate, we decided to analyse a number of the typical low-mark learner scripts. The aim was to identify typical incorrect responses to questions as well as problematic type of examination questions. The results are categorised and presented below.

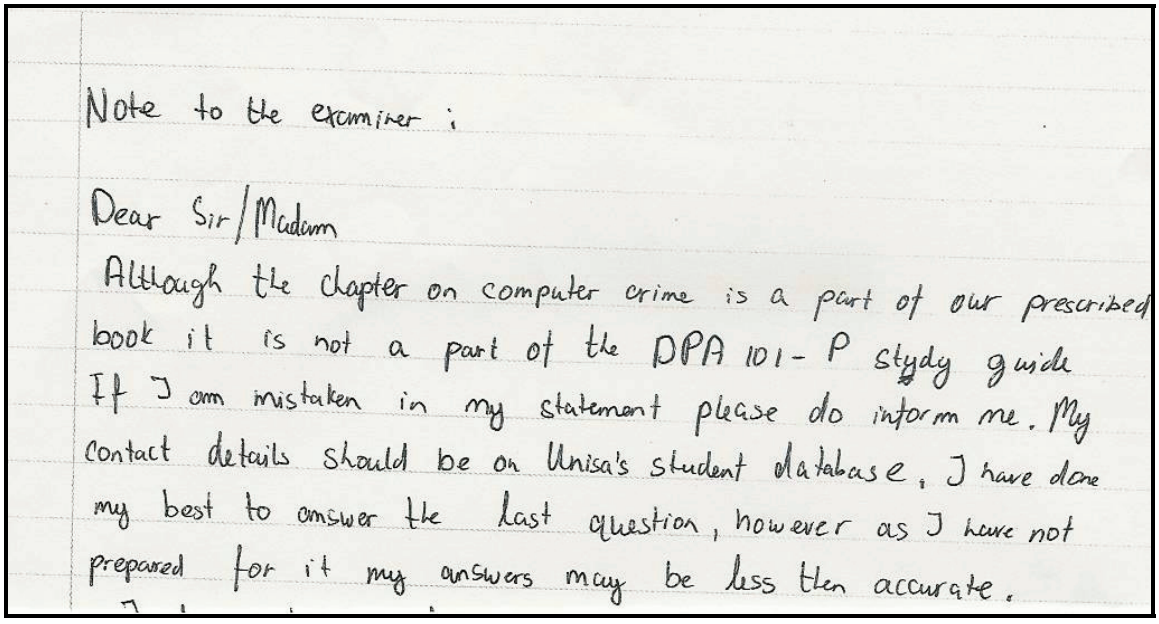
The pass rate of the May examination was 12.84% with the majority of the students obtaining an average between 20% and 40% for the examination. The exam consisted of 10 questions. Question 1 was a multiple choice in which 95% of students passed and in question 2 students had to match 2 columns, 92% passed. Further through the question paper the pass rate per question mostly decreased (the course consists of 8 modules):

- Question 3: 55% (1st module to be studied)
- Question 4: 56% (2nd module to be studied)
- Question 5: 13% (3rd module to be studied)
- Question 6: 41% (4th module to be studied)
- Question 7: 6% (5th module to be studied)
- Question 8: 6% (6th module to be studied)
- Question 9: 8% (7th module to be studied)
- Question 10: 23% (8th module to be studied)

Relative Ignorance of the Prescribed Material

The first problem which was identified is that learners are relatively unfamiliar with the prescribed study material. Of course, this phenomenon is nothing new, but if a learner claims (incorrectly) that the answer to a content question is not to be found in the prescribed material then some analysis is called for. A generic example is given in Figure 1. The learner claims that although the prescribed text book contains a section on computer crime, the study guide is silent about this topic.

The above claim by the learner is, however, incorrect. Section 8.1 of study unit 8 in the study guide for this module does indeed cover computer crime. The statement made by the learner may be as a result of not following the guidelines that we propose in the study material or because of complete ignorance of selected parts of the study guide, as can be seen in Figure 2 which is an extract from the study guide in question.


Note to the examiner :

Dear Sir/Madam

Although the chapter on computer crime is a part of our prescribed book it is not a part of the DPA 101-P stydy guide If I am mistaken in my statement please do inform me. My contact details should be on Unisa's student database, I have done my best to answer the last question, however as I have not prepared for it my answers may be less then accurate.

Figure 1 Learner's note in examination script

8.1 Computer Crime

Computer crime includes a wide variety of criminal activities of a traditional nature, for example, theft, fraud, forgery and mischief. The abovementioned has spread to the computer environment. The use of computers has lead to a large number of new forms of misuse of technology.

Activity 8.1

Read the text book, chapter 9 (page 193 – 197) carefully.

Pay particular attention to:

the origin of computer crime

the definition of computer crime

the different types of computer crime

Figure 2 Extract from the 2005 study guide for the subject

In the next section we identify a number of subproblems of the larger language problem discussed before.

Limited Comprehension of English as Second Language

In Figures 3 and 4 below two different learners reveal anything from a minor to a complete lack of understanding of their second or third language. Naturally, if a learner does not comprehend the language used to communicate in, it is difficult, if not impossible, to understand the subject content. The answer in Figure 3 was given by a learner in answer to the question: *Define computer crime*.

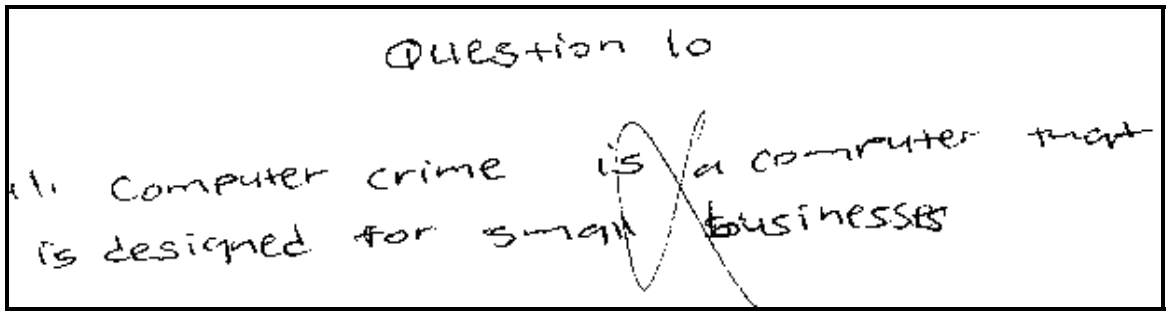


Figure 3 Answer from a learner to a straightforward content question

Figure 4 is an answer given by a learner to the question: *Briefly discuss fraud by means of computer manipulation with specific reference to data diddling*. Incorrect word sequences and grammar mistakes make it virtually impossible to understand what the learner was attempting to articulate. This may be because of a serious inability on the learner's side to efficiently use his or her second or third language.

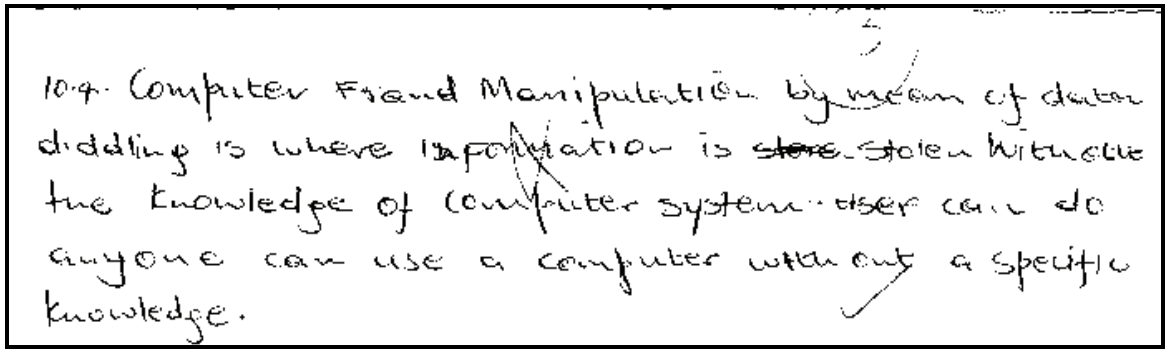


Figure 4 Quote from learner's examination script: 1st articulation problem

In the next case learners were asked to *name five (5) types of computer crime*. From the partial answer given by the learner in section (iv) in Figure 5, namely, *unauthorised protective the computer system develop*, it becomes clear that this learner is also battling to express him- or herself in a second or third language.

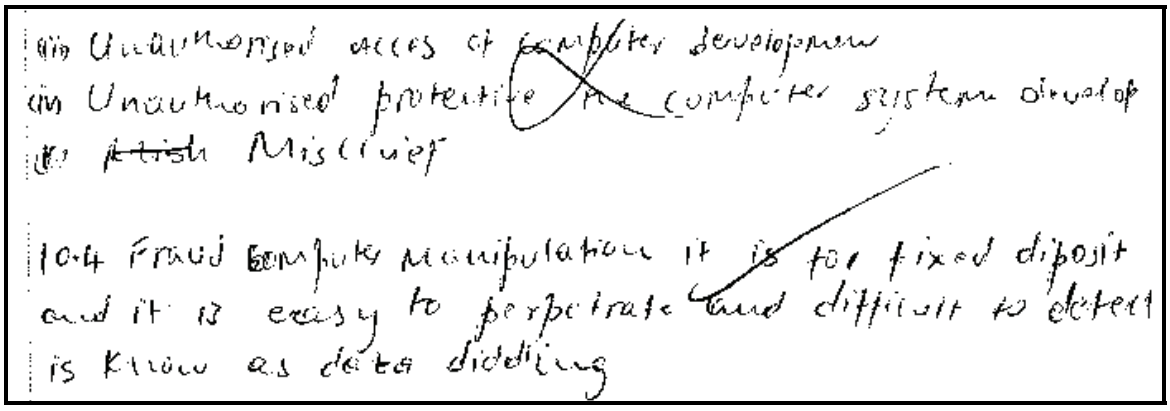


Figure 5 Quote from a learner's examination script: 2nd articulation problem

In the answer to the same question reflected in Figure 6, namely, *it can happen when some-one pay with money at lower costs*, it is also clear that language literacy plays a vital role in expressing oneself correctly.

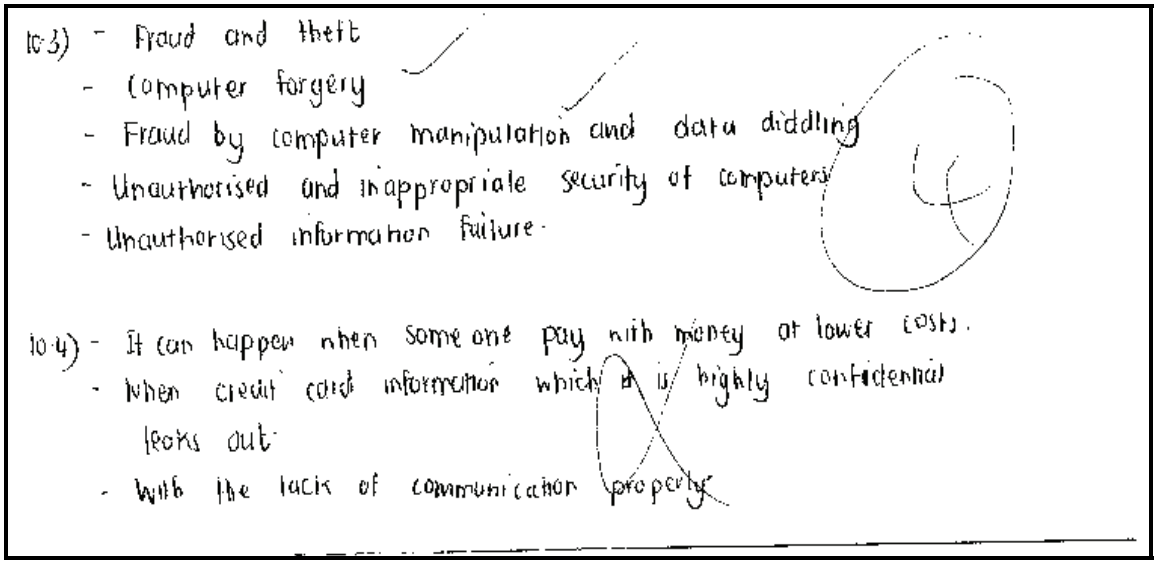


Figure 6 Quote from a learner's examination script: 3rd articulation problem

The questions above are all based on the final module (i.e. module 8) in the study material supplied to the students. The reason for failure is either because they do not get round to studying the final module or the language problem addressed in this paper. The pass rate for this question was 23%.

Incorrect Pattern Fitted onto a Question

A well-known researcher in Computing, namely, Michael Jackson (1994) discusses an approach taken by the ancient Greek mathematicians who separated the study of problems (i.e. exam questions in our case) from the related study of solutions (i.e. answers to these questions) and solution methods. A problem has an architecture part given by its principal parts and solution task. Jackson (1994) and Polya (1973) both explain the differences between, for example, problems to *find* or construct such as: *Given a transaction, show how it will be ana-*

lysed according to GAAP and entered into the books of a company and problems to *prove* such as: *Prove that a company is applying income smoothing from one year to the next* (Van der Poll, 2003). GAAP (Generally Accepted Accounting Principles) is a set of guidelines for conducting accounting practices in South Africa (Sowden-Service, 2004).

All the problems in our first-year accounting course are of the first kind, namely, to find the solution to a problem. Jackson (1994) coined this, the *problem frame* approach and the essence of his approach is to first concentrate on the architecture of the problem instead of immediately concentrating on the solution. Having established the architecture of the problem by determining its principal parts and solution task, one fits a problem frame or template, for which there is a known solution onto the current problem. Nowadays this technique is generally known as establishing *patterns* for actions or problems (Fowler, 2003).

The major challenge with the problem frame or pattern approach emerges when one identifies the principal parts of the problem incorrectly, i.e. we try to fit the wrong frame or pattern onto a problem. Learners seem to fall into this very same trap in the sense that they misidentify the frame to be fitted onto a particular examination question and subsequently fit the wrong answer onto the question. Some examples are given below.

Question 9.2 in the examination under discussion was: *Name the items which should be dealt with in a system design/development report*. The learner simply writes down words or phrases he or she loosely recalls from the entire study material (prescribed book and study guide). The learner's incorrect answer is reflected in Figure 7a and the correct answer is given in Figure 7b. In this paper we call this the *shotgun* approach. (The pass rate for question 9 was 8% in May 2005.)

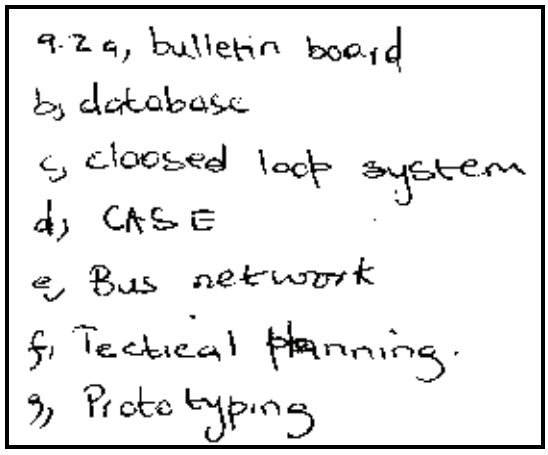


Figure 7a Learner's incorrect answer (shotgun approach)

a) Key decision analysis
b) System framework
c) Information flows
d) Database design
e) Controls
f) Authorities
g) Build proposals

Figure 7b Correct answer

In Figure 8 a learner wishes to list *uses* (i.e. looking for a verb) of communication systems but instead lists *users* (i.e. misinterpretation as a noun). It appears as if the learner either misinterpreted the question as *users* or decided to write down the users instead of uses because he/she happened to know this answer instead. The pass rate for question 6 during the May 2005 exam was 41%.

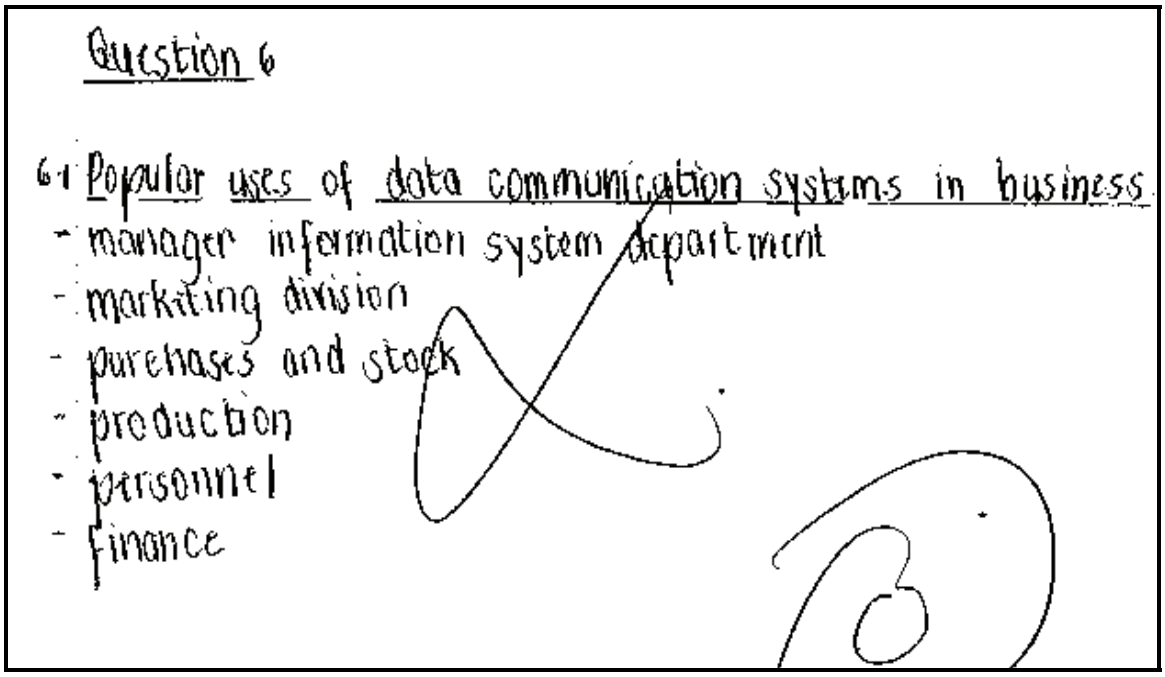


Figure 8 Verb-noun misinterpretations

The question asked to the response in Figure 9 was to *supply reasons why an information systems strategy is necessary*. The learner knew *users* of an information system and decided to list them instead of reasons. In this case there was a mismatch of two nouns on the part of the learner. It is clear that this learner knew something but we did not ask the *correct* question which this learner was prepared for. The pass rate for this question was 6%.

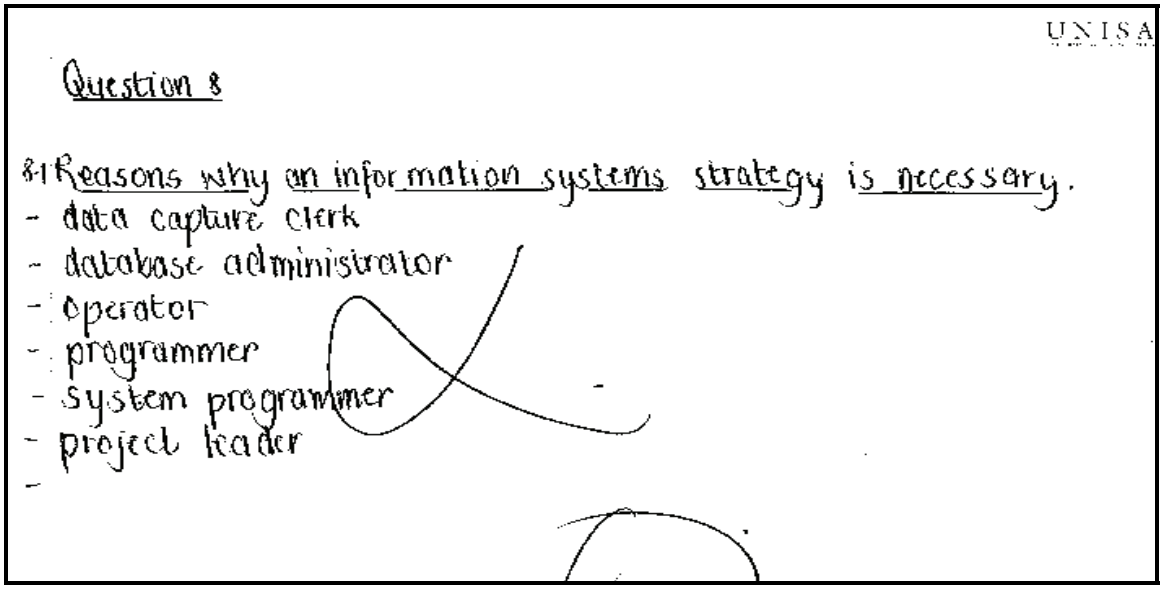


Figure 9 Conceptual misinterpretation

Relationships among Problems

The above classes of problems are interrelated in the sense that some classes are subclasses of larger classes which in turn are subclasses of the superclass which we call Learner problems. These interrelationships among the problems discussed above are summarised in Figure 10. In this figure we borrow the familiar *isa* (cf *is-a*) notation from the object-oriented paradigms (Martin & Odell, 1995) to denote that some instances of a class are actually occurrences of a larger superclass.

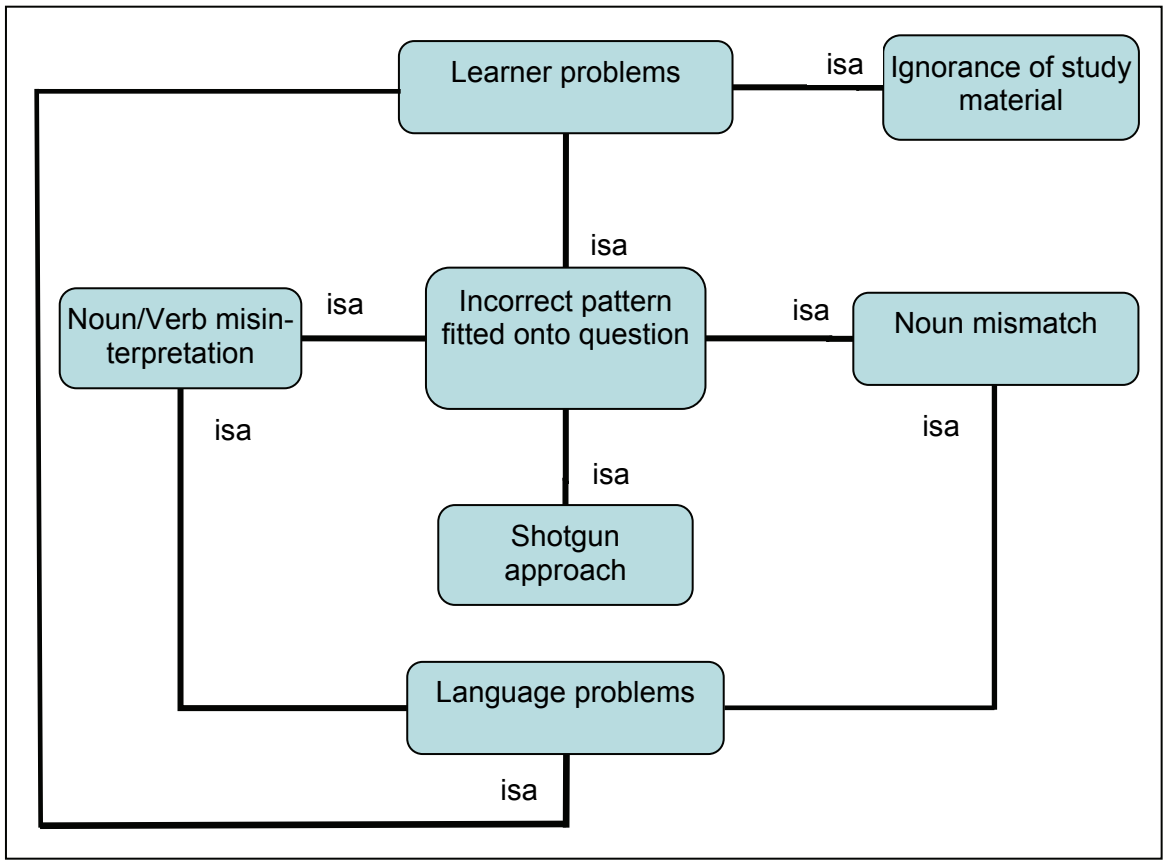


Figure 10 Diagram relating learner problems

Figure 10 shows that the class of all learner problems discussed in this paper are divided into three subclasses, namely, ignorance of the study material, incorrect patterns fitted onto questions and language problems. The class of incorrect patterns is further partitioned into three subclasses, namely, the shotgun approach, noun/verb misinterpretations and noun mismatches (e.g. confusing users with reasons). These latter two classes are hybrids in the sense that they are also instances of the larger class of language problems.

In the next section we propose some preliminary solutions to these problems.

Preliminary Solutions

The following mechanisms may be implemented. In each case an action is proposed and the particular problem in Figure 10 which our action aims to address is given in square brackets:

1. Introduce a bridging course, e.g. English for Accountancy learners studying computing concepts [language problems].
2. Perform a more frequent evaluation of learners [Ignorance of the study material]:
    2.1. Add practical work to supplement the theoretical content.
    2.2. Let the practical work count as part of the final mark.
3. Give a questionnaire in the form of an assignment to the learners to get a further grip on the whole problem [superclass: learner problems].
4. Organise contact sessions with learners. Note that this is not really the aim of a distance-teaching institution [superclass: learner problems].
5. Investigate the feasibility of using advanced IT tools, e.g. the use of intelligent CBT (Computer-Based Training) environments.

Naturally, the introduction of the above mechanisms assumes the availability of qualified staff to implement these ideas since it would introduce additional workload for the lecturers involved, typically 7000 learners for a first semester and 4000 during the second semester.

Conclusions and Future Work

The course under discussion in this paper is a first-year module which happens to be a compulsory module for learners in Accounting. In general learners may fail a subject for various reasons. One rather obvious reason may be a simple lack of interest in the subject. However, two other aspects clearly emerged through an analysis of the above examination scripts:

1. A proper comprehension of a language is a non negotiable prerequisite for the understanding of a content subject presented in that language.
2. Studying all, or at least a reasonable amount of the content referred to in the study material (i.e. prescribed book and study guide), and not just selected, small parts of it, is a further prerequisite to pass an exam.

Learners should be made more aware of the generic reasons as to why learners fail and of the value of using their study material to the full extent when preparing for an examination. The crucial part of helping learners to pass content subjects is to start at school level and to encourage full comprehension of a common second language.

The purely theoretical nature of the course under discussion may also have to bear part of the blame for the poor performance of its learners. A possible remedy to this problem is to include compulsory practical work aimed at improving the underlying theoretical knowledge of the average learner in the subject. Learners should also develop the skill of fitting the correct problem frame or pattern onto a given examination question.

Future work in this area would be a further analysis of learner scripts in the coming examinations as well as starting to implement the steps proposed above to help solve some of the problems pointed out in this paper.

References

August, D. (1994). *For all students: Limited English proficient students and goals 2000*. Washington, DC: National Association of Bilingual Education.

Collier, V. P. (1995). Acquiring a second language for school. Directions in language and education. *National Clearinghouse for Bilingual Education, 1*, 1-12.

Collins, J. (1995). Literacy and literacies. *Annual Review of Anthropology*, *24*, 75-93.

Fowler, M. (2003). Patterns. *IEEE Software, 20*, 56-57.

Hurley, S. R. & Tinajero, J. V. (2001). *Literacy assessment of second language learners.* Massachusetts: Allyn & Bacon.

Jackson, M. (1994). Problems, methods and specialization. *Software Engineering Journal, 9*, 249-255.

Martin, J. & Odell, J. (1995). *Object-oriented methods: A foundation*. James Martin Books. Prentice-Hall.

Polya, G. (1973). *How to solve it* (2nd ed.). Princeton: Princeton University Press.

Sowden-Service, C. L. (2004). *Gripping GAAP* (5th ed.). Gillitts: CSS Publishers.

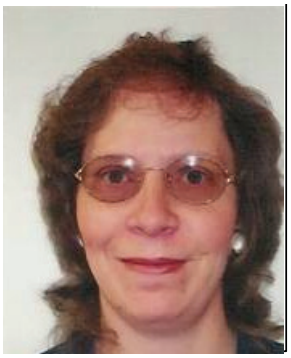
Tinajero, J. V. & Schifini, A. (1997). *Into English* (teacher's edition). Carmel, CA: Hampton-Brown Books.

Vacca, R. T. & Vacca, J. A. L. (1993). *Content area reading.* New York: HarperCollins.

Van der Poll, H. M. (2003). *Integrity issues of information created by book entries.* MCom Dissertation. University of Pretoria.

Wang, L. S. (1996). *Causal modelling research on language minorities' achievements. Theoretical studies in second language acquisition.* New York: Peter Lang Publishing.

Biographies



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