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Pre-teaching Technical Vocabulary in an Introductory Information Systems Course: An Experiment Involving Non-native Speakers of English

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ABSTRACT

Learning a programming application can be considered similar to learning another language. Students have to learn the terminology, their functions (ie. grammar) and the skill of writing short programs (ie. composition). This is especially difficult for students who are non-native speakers of English (NNS) as they cope with both the English language and a programming language. The purpose of this study is to determine if the pre-teaching of technical vocabulary in an introductory information systems course enhances the learning outcomes for these NNS students. This study considers some of the theories on pre-teaching and language learning, particularly, grammar and vocabulary acquisition. The experiment compares two groups of students - the control group works independently and the treatment group attends hands-on classes that introduce them to the Visual Basic programming language and its terminologies. The aim of this experiment is to establish if there is a difference in the performance between these groups. The results indicate that the treatment group is consistent in averaging higher scores demonstrating an overall enhanced learning outcome. The paper challenges educators of introductory IS classes to consider strategies for technical vocabulary acquisition within the curriculum.

INTRODUCTION

Increasing numbers of students who are non-native speakers of English (NNS), are enrolled in tertiary institutions in New Zealand. The majority of these students prefer to read courses in Science, Technology and Commerce rather than Arts. The Department of Management Science and Information Systems (MSIS) at The University of Auckland, has a large proportion of NNS students enrolled in the introductory information systems (IS) classes. These students have varying degrees of competency in the English language. Such diversity has made the teaching of the subject highly difficult. This is especially so when they are required to work in a self-instructional computer laboratory environment.

Past observations of NNS students found many requiring a lot of help in the computer laboratory. These students, learning through self-instruction, struggled to accomplish what the manuals instructed and many found it difficult to ask for help. Trimble (1985) believes that highly specialised technical vocabulary needs special attention as technical words in text can affect comprehension. Research has shown that pre-teaching of these words can have a positive effect on comprehension. Rutherford (1987) supports the practice of "drawing the learner's attention to features of the target language", this avoids some of the pitfalls that beginners make. It is the aim of this study to link learners' performance to the pre-teaching of technical vocabulary found in Microsoft Visual Basic.

This study compares the performance of two groups of introductory level tertiary students, who are non-native speakers of English (NNS), learning the Microsoft Visual Basic (VB) programming language. The performance of the groups is measured by two assignments and statistically analysed for any significant difference. It attempts to link pre-teaching of vocabulary to enhanced learning outcomes in Visual Basic.

The aim of this experiment is to initiate research that may help the plight of NNS students learning software applications at tertiary level. The results of this experiment can be used to encourage IS educators to review current teaching practices and plan for a diverse classroom.

VOCABULARY LEARNING

The primary goal of the Microsoft Visual Basic module is to provide students with an environment in which they can learn and practice a basic programming tool. A variety of methods are used to help students in the learning of the program - lecture/ demonstration and independent lab work. However, with each new class of students, it has become more difficult to cater for everyone. The diversity of the classes has become extreme. Most students have no knowledge of programming, many have little experience with computers (less than 6 months) and some have limited knowledge of English.

In many ways learning a programming tool can be compared to learning another language. The learner has to contend with:

- new terminology - as in vocabulary of a new language;
- writing code with syntax different to 'everyday English' - as in different sentence structures of a new language.

In the *Guidelines for Vocabulary Teaching (Madden, 1980, pp.111-117),* the author makes a distinction between vocabulary that can and cannot be guessed from the text. In the case of technical vocabulary, students facing "confusing sub-technical vocabulary or unfamiliar noun strings" (Trimble, 1985, pp. 128) can find no help in standard dictionaries. The number of words that can be confused and misunderstood is relatively large. Stopping to work out word meanings slows reading and hampers comprehension. Madden (1980) concludes that important vocabulary that cannot be guessed from the text should be pre-taught.

Two studies by Kameenui, Carnine and Freschi (1982) find that the pre-teaching of new terminology or low-frequency words

has a significant positive effect on comprehension. The pre-teaching, in Kameenui *et al.'s* study, involves mastery learning, words are given followed by the learner answering questions which use the word in context. Nunan (1991) also suggested that "...we should begin by teaching the new items in context..." (p.122). However, learning words without learning the structure of the language would be futile, structure gives the overall patterns, without which the words make no sense (Cook, 1991). Therefore, the pre-teaching of basic rules for the construction of sentences can be invaluable.

Learning a new language is more than the transfer of aspects of the native language into the new language. Students need to have 'encountered' an appropriate form of English in order to reproduce or use it. Thus, the speech of a learner often shows rules and patterns of their own language systems. Krashen (1981) distinguishes between 'acquiring' and 'learning' a language, the latter being a conscious effort to learn facts about the new language. To avoid some of the pitfalls that beginners make, Rutherford (1987) advocates *"conscious raising"* in teaching - "the drawing of the learner's attention to features of the target language", ie. pre-teaching.

In this study, the use of the term 'pre-teaching', therefore, refers not only to terminology being presented, explained and introduced in context but also programming code explained. This approach to the introduction of technical vocabulary is based on Rivers' (1983) argument that vocabulary should be presented, explained, included in different activities and experienced in its different contexts and ultimately it is learned by the individual. The details are discussed in the next section.

METHODOLOGY

Research Design

Introductory level tertiary IS students, who are non-native speakers of English (NNS), were invited to register their interest in the study where Visual Basic (VB) specific vocabulary would be presented, explained and introduced. The student respondents were divided into two groups:

1. the Treatment Group - attended two hands-on introductory classes (in computer lab) on terminologies specific to VB.
2. the Control Group - instructed themselves using the prescribed manual.

The Treatment Group consisted of 14 NNS students and the Control Group 33.

The Classes

Procedures

All classes were held in the a PC Lab. On arrival at the lab, subjects chose to sit at whichever computer or with whomever they pleased. For the first class, students were asked to read and fill in a consent form allowing the use of their assignment marks in VB, for the research project - no individual marks were used.

Set-up

Each student had access to a computer that they could work on throughout the class. Students were free to move about and work in pairs. In front of the class was a data projector displaying the instructor's computer screen. This permitted the class to see exactly what was being done and the consequences of each action.

The instructor was a lab demonstrator who had two years experience helping students master Microsoft Office applications including Visual Basic. Her usual role in the lab was to facilitate the learning of students working through a manual. Her role in the project was to plan and deliver the two introductory lessons on VB. The instructor was assisted by a lab demonstrator who assisted students as and when required during the class.

There were two classes: (1) Introduction to VB terminology, and (2) Writing code.

Lesson Content

In planning the lessons, three questions were asked:

a) What would be classified technical vocabulary?

With reference to Trimble's (1985) classification of technical vocabulary, most of the terminology in VB such as all the control buttons in the Toolbox are technical 'noun compounds'. This implied that it was necessary to introduce as many of these terms as possible to enhance learning and comprehension.

b) How can technical vocabulary be introduced in context and can it be introduced in a way that might enhance the memory of it?

Rivers (1983) contends that while vocabulary cannot be 'taught' it can be presented, explained, included activities and experienced in context and ultimately learned by the individual. Based on Rivers' suggestion, VB terminology was introduced in this way:

* Presented and explained - only a few VB terminology was shown and explained,
* Activities - students were shown how to 'discover' the names and functions of the rest of the terms for themselves. Students were encouraged to note down all the new terms on their handouts and keep them for reference. This follows a suggestion given by Brown (1980) on the 'use of cards' to write the new word on so as to have it handy for reference. This was also an important learning strategy that could be used across the curriculum in self-instruction.
* Experienced - students worked on a short exercise taken from the manual. At each step the important points about the 'properties' of the controls were highlighted and questions were answered.

c) How can programming codes be introduced and practiced in a meaningful way?

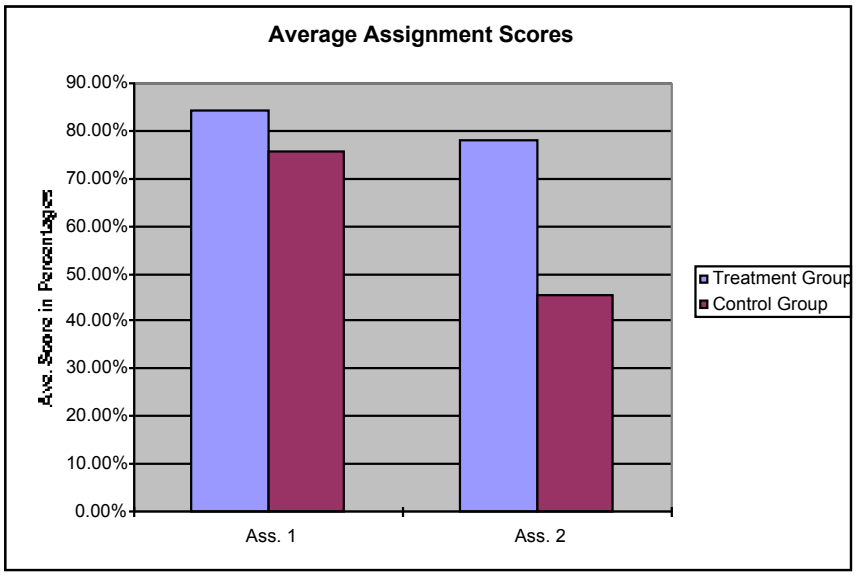
Programming code for VB is in English but the syntax of the code is certainly not Standard English. In the same exercise that introduced the function of controls, examples of simple codes were explained. The second lesson was a project - to create a calculator to show the grade (A+, A, A-....) of a given mark. Basic rules of coding were explained, eg. symbols were used instead of certain words, the function of parenthesis and punctuation marks. Students were encouraged to think for themselves, after the first two lines of code, students were asked to try to work out the next step. The solutions were revealed only after some attempts were tried. Instead of copying the solutions students were asked to analyse where they had gone wrong. At this stage, discussion amongst the students was encouraged. These activities applied Kohonen's (1992) theory of 'experiential learning' which states that experience alone are not sufficient for learning, 'it must also be observed and analysed consciously' (p17).

DATA ANALYSIS

The learning outcomes were measured by the results of two VB assignments. Average scores for each assignment were computed for each group. The average score for each assignment was computed by summing the results of all the students within the group and then averaged by the number of students in each of the groups. The average scores were then translated into percentages (refer to Figure 1).

There was consistency in the results, with the Treatment

Figure 1: Average Assignment Scores for Control and Treatment Groups



group scoring better overall. However, it is interesting that the Treatment group performed considerably better, averaging 33% higher than the Control group in Assignment 2. In Assignment 1 the difference was less marked, the Treatment group average was only 11.4% higher that the Control Group.

A further analysis to test for statistical significance between the mean score of the 2 groups was also performed. The mean score for each group was computed by summing the results for both assignments and then averaging it by the number of students in each of these groups. The Two-sample *F* test was then used to compare the mean scores of both the treatment and control groups. The results of the *F* test indicate that there is a statistical significance between the mean score of these two groups, this means that there is a link between the pre-teaching of technical vocabulary and the performance of the learners. Table 1 presents the results of the *F* test.

The results of the analysis show that the calculated *F* value is larger than the critical value for both assignments. This implies that there is a statistical significance in the mean score between the test and control groups (at $p<0.05$). The study can therefore conclude that the pre-teaching of technical vocabulary enhances the learning of VB as manifested in superior assignment results.

DISCUSSION

The purpose of the study was to determine if there was a link between learner performance and pre-teaching of technical vocabulary in Microsoft Visual Basic. As previous studies were based on language learning this study aimed to investigate the implications of pre-teaching of terminology in teaching computer applications. The results indicate that there is significance in the learning outcome of the groups tested.

The Treatment group was consistent in averaging higher scores for both assignments and the Two-Sample *F* Test shows a significant difference (at $p<0.05$). These findings corroborate with the two studies by Kameenui linking pre-teaching of low-frequency vocabulary with enhanced comprehension (Kameenui *et al.*, 1982). The key points in the Kameenui *et al.* studies were for learners to master the new vocabulary, apply them in context and this in turn increase the level of understanding of the text.

For Assignment 1, the results were encouraging, both Treatment and Control groups returned relatively similar scores. The Treatment group score was as expected better than the Control group. These results do suggest that the group that had technical vocabulary and code writing pre-taught, did have a slight edge over the control group. Student experiences and comments from the Treatment group were also very positive, for example:

> "...it's (referring to the class) really good..."
> "...the others (those in the Control group) asked us to teach them what we learned!"
> "Some good tips, saved us some time..."
> "Should do this at beginning of the year, with Windows."

In addition, members of the Treatment group were often seen helping others with the manual — an added dimension that was not expected.

The disparity in the Assignment 2 results was great, with the Treatment group scoring 33% higher than the Control group. One possible reason for this, was the complexity of the assignment. In order for students to complete the assignment they had to work through the whole manual and do some experimenting with code writing. The Control group students had only the manual to guide them. Working through the manual was a slow process, especially for learners who had to continually refer to earlier chapters for information. O'malley and Chamot (1990) suggest that the retention of technical terms (declarative knowledge) is often a problem. This may have been the problem the Control group faced. Treatment group students on the other hand used their completed handouts to refresh their memory, assisting in their reading and learning. Also according to Kohonen (1990), the presentation and repeated use of the new terms in classes in an 'experiential' learning experience will enhance the learning of unfamiliar terms, this would have been the advantage the

Table 1. Results of the Two-sample F *test Comparing the Mean Scores of the Treatment and Control Groups*

Mean Scores of the Treatment and Control Groups compared				
	Ass.1 Treatment Group	Ass.1 Control Group	Ass.2 Treatment Group	Ass.2 Control Group
Mean (out of 2)	1.75	1.55	1.60	1.07
Standard Deviation	0.378	0.532	0.567	0.944
Observations	14	33	14	33
Degrees of Freedom	(1,101)		(1,101)	
F	1.979		2.775	
F critical (one tail)	1.566	Note: the comparison is significant at $p<0.05$	1.566	Note: the comparison is significant at $p<0.05$

Test group had in class.

The second possible reason is that students in the Control group could have been struggling with the concept of self-instruction. In order for learners to take charge of their own learning they must know how. Perhaps students coming straight from high school or a cultural background outside of New Zealand had found it hard to come to terms with no 'teacher directions'. As such, leading to poor management of their learning objectives and thus leaving them with insufficient time to complete their assignments.

IMPLICATIONS

The implications of this study could affect the way computer training is delivered. Overall findings of this study give support to:

- Kameenui *et. al's* (1982) studies - linking pre-teaching of low-frequency (technical) vocabulary to enhanced comprehension; and
- Rutherford's (1987) 'conscious raising' in teaching grammar.

The results suggest that teacher intervention, in the form of pre-teaching of technical vocabulary can be linked to enhanced learning outcomes. This therefore supports the introduction of pre-teaching of technical vocabulary in the learning of Microsoft Visual Basic.

Ballard and Clanchy (1991) believed that many 'overseas students' go into 'learning shock' when they encounter the different learning and teaching styles at tertiary institutions outside their home countries. Thus overseas students in New Zealand may find learning and teaching styles to be culturally distinctive to what they were brought up with and quite different from their country of origin. The findings of this study supported the idea of "Learning Through Language", a programme that was introduced into New Zealand secondary schools to improve language and learning and cultural awareness (Whitehead, 1992). Whitehead argued that the teaching of learning strategies *within the context of subject studies* would benefit students who are non-native speakers of English as well as native speakers. Perhaps, there should be a similar programme, introduced at the tertiary level.

Duplass (1995) implied in his paper that the final outcome of his study showed no significant difference in the knowledge gained by those students who participated in computer instructional lab but they did complete their assignments more quickly. This study, however, showed that given only a four week period to learn VB and only one week to do each assignment, student outcomes do attest a difference. The Treatment group did perform consistently better than the Control group. Perhaps, this is reason enough to consider pre-teaching for VB (and perhaps other software applications) in the tertiary institution environment as all courses run on a strict time schedule and students are expected to complete assignments within a limited time.

LIMITATIONS

When interpreting the results of this study or attempting to make generalisations, it is necessary to consider the limitations imposed by its design and methodology.

The sample population of this study was made up of individuals that felt that they 'needed a little help with Visual Basic'. These respondents might have been prompted to come forward by their motivation and/or attitude to learning. This meant that the sample population was an unrepresentative sample. This in turn would introduce a bias into the results of the study and therefore not truly representative of the general NNS population.

The size of the sample population is another limitation. Henry (1990) implicated that sampling error decreases as the sample size increases. Better timing, such as conducting the study earlier in the course may have accorded a better response and thus larger samples. In general, statistical tests comparing data categorised into groups require large sample sizes for adequate power and accuracy. The statistical test that was used to analyse the data of this study is one such test.

This study was guided by a simple research design that focuses on the pre-teaching of technical vocabulary. There are other factors not considered in this study which could have impacted on learner performance. These factors centre on learner diversity (Thompson, 1996) and include differences in attitude to learning (Sheerin, 1991), motivation (Dickinson, 1987) and cultural orientations (Esch, 1996; Little, 1996). In addition, the data from the two assignments shows only the effects in the short term - four weeks of a 12-week course. The time factor - shortness of the experiment - can also distort the accuracy of the results.

FURTHER RESEARCH

The conclusions drawn from this study can be used as a basis for future research. To better assess the impact of pre-teaching of software, several studies can be considered.

Self-instructional learning strategies had not been considered in this study. For learners to be self-instructional, they must have the skills to manage their own learning (Holec, 1988; Dickinson, 1987). These skills can be learned and in the case of tertiary students may already possess these useful skills. Learners with these skills will then be competent to assume more and more responsibility for their own learning, to become autonomous learners, faring better than those who have not these skills. The idea of helping students 'learn to learn' can be explored further.

Future research needs to test the generalisability of the findings of this study. This study investigates pre-teaching of technical vocabulary in Microsoft Visual Basic only. Other applications can be studied to achieve more generalised findings in the field of software education. The use of larger sample populations and taking the study through the whole course can also contribute to the generalisability of the findings.

Finally, although this study looks only at the non-native speakers of English, it can be a basis for future research in the area of pre-teaching in the general IS subject classroom, or the use of learning strategies within the IS subject classroom.

CONCLUSION

The focus of this study was on the pre-teaching of technical vocabulary found in Microsoft Visual Basic to students who are non-native speakers of English (NNS). The results of this study give support to Kameenui *et. al's* (1982) and Rutherford's (1987) findings which link pre-teaching to enhanced learning outcomes. The study can therefore conclude that teacher intervention, in the form of the pre-teaching of technical vocabulary can explain the enhanced learning outcomes of the students in the Treatment group, as in this particular case of software application learning.

The study contends that more consideration should be given to planning for the diverse classrooms. As the intake of NNS students is on the increase in tertiary institutions in New Zealand, information systems educators are challenged to bring into the subject classroom and its curriculum, the strategies for vocabulary acquisition. NNS students have to cope not only with the specialised content of the IS subject but also the complex task of learning the English language.

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