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Computer-based drill and practice games as support tools for English second language learners

ABSTRACT

Computer-based drill and practice games may play an important part in supporting outcomes-based education by automatizing the sub-skills required for life-long learning. South African schools vary in diversity from resource advantaged to resource deprived. This article indicates that, although resource-advantaged learners may benefit from computer-based drill and practice games, they prefer strategy games. Resource-deprived learners, however, prefer twitch games. Drill and practice games are a combination of the two. Depending on their resource levels, different intrinsic motivators cause learners to continue playing these games, although for both groups recognition is the most important motivator. Lower levels of psychomotor skills and game literacy prove to be a problem for resource deprived learners only in the early phases of learning to play computer games. Resource deprived learners showed a greater improvement in language proficiency resource advantaged ones.

1. Introduction

This article reports on an investigation into the application of educational computer games in English Second Language (ESL) teaching at grade six level for resource-advantaged (RA) and resource-deprived (RD) learners. Where the current outcomes-based South African educational policy shows a marked swing away from rote learning in favour of problem solving (Ministry of Education, 1997) care should be taken not to neglect essential basic knowledge and skills (Hirsch 1987). In this respect computer-based drill and practice games could play an important role in ensuring automaticity of such skills (Anderson 1980; Gagné 1985). This could be particularly useful in schools where English as the medium of instruction is not the mother tongue of learners (Stern 1990). With the great diversity of learners, particularly in terms of available resources, it becomes important to determine the extent to which simple computer-based drill and practice games can augment the learning process both for resource deprived and resource advantaged learners.

2. Research problem

The aim of this research was to establish how educational computer games could contribute to the successful teaching of ESL in a South African context, with special reference to grammar in grade six.

The specific research questions driving the research were:

- How and to what extent can current South African governmental policies and principles regarding ESL be supported by computer-based drill and practice games?
- What is the relationship between the affective and psychomotor abilities of learners and the successful integration of computer games?
- What is the relationship between the cognitive proficiency of learners and the successful implementation of games?

3. Defining educational computer games

For the purpose of this article, the authors define computer games as instructional activities that provide motivation, entertainment, competition and reinforcement while presenting a superficial or simulated reality. Computer games should motivate learners to enjoy a learning activity (Rieber 1996).

3.1 Games and the ESL syllabus

The ESL syllabus for grade six learners aims to enable them to communicate successfully in English for personal, social and educational purposes. The specific outcomes are to:

- listen to and understand English;
- speak it clearly and fluently;
- develop reading and writing skills;
- control English grammar structure and vocabulary; and
- experience a sense of enjoyment and achievement in their mastery of the language (Ministry of Education 1997:84).

Educational computer games might successfully support the above outcomes as suggested by Bitter, Camuse and Durbin (1993:146) who state that games can:

- assist learners to achieve desired objectives;
- be compatible with instruction or supplement that instruction;
- teach skills that are not easily taught through other media;
- compensate for weaknesses in a teacher's teaching style;
- promote learning; and teach high-level and low-level objectives.

Certain sections in the curriculum, which generate low learner interest and motivation, may be significantly strengthened through the use of carefully selected and integrated educational computer games (Rieber 1996).

Computer games could be used to convey a variety of aspects such as:

- facts and principles;
- processes;
- the structure and dynamics of systems;
- skills, such as problem-solving, decision-making or the formulation of strategies;
- social skills, such as communication; and
- attitudes (Alessi and Trollip 1991:182).

3.2 Types of games

Jones (1997:4) recognises two types of games: strategy games and twitch games.

3.2.1 *Strategy games*

Strategy games require higher-order thinking skills and problem solving skills for successful completion. They require users to perceive the larger problem and to plan strategies to solve it. Strategy games generate feelings of accomplishment and satisfaction. The types of games mentioned by Alessi and Trollip (1991:172) that can be classified under strategy games are:

- adventure and role-playing games;
- board games;
- logic games.

While strategy games require the use of higher order thinking skills, twitch games rely on fast thinking.

3.2.2 *Twitch games*

Twitch games require users to react quickly to stimuli. The advantages of these games are that movement is quick and feedback is immediate. This keeps users actively engaged. However, the level of engagement is superficial and does not stretch beyond the basic level of seeing, pointing and clicking. The following games, as classified by Alessi and Trollip (1991) would fall into Jones's (1997) category of twitch games:

- arcade games;
- gambling games;
- combat games; and
- psychomotor games.

In all these games players receive immediate feedback and have to point and click to win the game.

Many educational games contain a combination of strategy and twitch games, but one type will always dominate (Jones 1997:4). This study focuses on drill and practice games, as a combination of strategy and twitch games.

3.3 Drill and practice games

3.3.1 *What is drill and practice?*

Drill and practice activities involve exercises, physical or mental, that are performed regularly and with constant repetition (Alessi and Trollip 1991). They are often associated with rote learning and behavioural learning theory (Salisbury 1990).

In computer-based drill and practice repetition is provided according to a fixed pattern. The routine is usually quite simple (Geisert and Futrell 1990:84). The computer presents a question, problem, or situation that corresponds to the target category of behaviour and requires the learner to make a response that is then evaluated for adequacy. The learner is given immediate feedback to each response and there is usually some form of correction or remediation of incorrect responses (Hannafin and Peck 1988:55). The speed with which a computer can provide knowledge of results for each practice item is something that a teacher, using a paper/pencil exercise, cannot match. In addition, computer graphics can, if used appropriately, enhance a drill exercise by holding the learner's attention. (Geisert and Futrell 1990:85).

Drill activities can be distinguished from practice activities. Drill concerns factual memorization, and practice concerns the development of skill fluency (Grabe and Grabe 1996:87).

3.3.2 *Why drill and practice?*

Drill and practice activities are used in teaching because they provide practice for defined skills.

Research in learning suggests that the role of drill and practice in school learning may be more important than many teachers realize (Salisbury 1990:24).

There are at least three ways of applying drill and practice in the curriculum (Geisert and Futrell 1990:86):

- to maintain a performance previously reached by a learner;
- to automatize skills already demonstrated by the learner; and
- to remind the learner of some information or skill that is prerequisite to a new lesson.

Drill and practice activities are developed because the learners' initial exposure to academic facts or skills is seldom sufficient for an adequate level of mastery (Grabe and Grabe 1996:93). Extended study is required before facts or skills can be considered mastered.

Drill and practice seems to be a necessary learning component for the automatizing of sub-skills (Anderson 1980:76; Gagné 1985:90). In order for a person to perform complex intellectual tasks such as reading, many of the sub-skills involved need to become automatized (Geisert and Futrell 1990:87), i.e. a learner must be able to perform certain sub-tasks without consciously thinking about them. As a skill becomes automatic, it requires less attention and interferes less with other ongoing cognitive processes (Spelke *et al.* 1976:89). Multiple discrimination skills like naming objects are often prerequisite for more complex tasks involving classification, application of rules or problem solving (Geisert and Futrell 1990). It thus implies that for a learner to become proficient in higher order thinking skills (Bloom 1956) like analysis, synthesis and evaluation, the lower order skills (knowledge and comprehension) must become automatic.

3.3.3 *Why drill and practice games*

While drill and practice exercises tend to be boring and repetitive, presenting them in the form of games could help alleviate the problem. Games are fun to play and they could provide inexpensive real-world background experience (Maddux, Johnson and Willis 1992:184). Learners can be challenged through choice of action, effected through direct manipulation of the world of interest, with quick and clear feedback, and enjoyment and intrinsic motivation can be optimized (Quinn 1997:9). Csikszentmihalyi (1990:9) states that enjoyment results when an activity meets one or more of the following components:

- challenge is optimized;
- attention is completely absorbed in the activity;
- the activity has clear goals;
- the activity provides clear and consistent feedback as to whether one is achieving the goals;
- the activity is so absorbent that it frees the individual, at least temporarily, from other worries and frustrations;
- the individual feels completely in control of the activity;
- all feelings of self-consciousness disappear; and
- time is transformed during the activity.

Although enjoyment cannot ensure learning, it could prolong the learner's engagement with the learning material (Rieber 1996). Computer games offer motivational challenges that create

competitive environments and affective experiences of fun in which learners can engage (Alessi and Trollip 1991; Quinn 1997:3).

Alessi and Trollip (1991:31) state that something is "fun" when it is intrinsically motivating. However, studies by Lepper, *et.al.* (1998:1) have shown a downward spiral in intrinsic motivation for learning from the third grade through to the eighth grade. The following techniques can be applied as effective motivators (Lepper, *et al.;* Sethi, Dialdin and Drake 1998:1):

- wording that highlights the learner's competence rather than the teacher's control;
- descriptions of goals to emphasize how well the learner can perform from acquisition of skills;
- reward systems that are based on individual mastery of materials for each learner; and
- recognition for individual improvement rather than recognition that based on skills relative to other learners or some general standard.

4. Research methodology

4.1 *Evaluation research*

Schumacher and McMillan (1993:519) define evaluation research as the determination of the "worth of an educational program, product, procedure, or objective or of the potential utility of alternative approaches to attain specific goals". They mention three reasons why evaluation research is conducted:

- planning;
- improving; and
- justifying procedures and products (such as educational software) Schumacher and McMillan (1993:520).

Educational evaluation research is the process of making judgements about the merit, value, or worth of educational programs (Borg and Gall 1989:752).

Two types of evaluation were applied in this study: static evaluation and dynamic evaluation. The static evaluation involved an evaluation by an independent evaluator in order to investigate the extent to which games complied with the educational principles and with the requirements of the syllabus of ESL.

The dynamic evaluation in this study involved a small-group evaluation where the selected games were employed in certain primary schools.

The dynamic evaluation was conducted in two phases:

- a pilot run was conducted with one school to ensure that the problems in the questionnaires and interviews as well as technical problems could be addressed before visiting the other five schools; and
- field tests were conducted at the remaining schools.

The measuring instruments used during the dynamic evaluation were:

- interviews,
- questionnaires,
- implementation logs, and
- anecdotal records.

The experimental design prevented players from assisting those sitting next to them because each would play a different game. Learners were also unable to copy each other's answers because each played a different game and therefore completed a different questionnaire from the next.

4.2 Selection of games

The games that were selected had to be:

- educational drill and practice games;
- supporting the primary school curriculum; and
- reasonably priced.

The following grammar games, that complied with the above-mentioned criteria, were selected from *Ten out of Ten Education Systems*, based in the United Kingdom (UK):

- *Sniper, Cover up, Word Fit, Librarian and Cheers.*

4.3 Selection of research subjects

4.3.1 *Participating schools*

Six schools were selected through the e-mail facility on the Internet. A request was posted through e-mail to all the connected primary schools in the Eastern Cape. The message requested schools which possessed the necessary hardware requirements and which were willing to participate in this research, to apply. The six primary schools who replied:

- taught ESL as a subject;
- were situated in the Eastern Cape;
- were willing to participate in the research;
- would allow 15 grade six learners and their English teachers to be involved in playing the games for at least three hours; and
- had the necessary hardware requirements to operate the games.

4.3.2 *The learners*

Fifteen learners each from six primary schools were selected for this research. A stratified sampling method was used so that "individuals in the population who have certain characteristics are presented in the sample" (Borg *et al.* 1989:98).

The average age of the learners was 13 years. The home language at three of the six schools was mostly Xhosa. Learners were subjected to a pretest and a posttest to establish whether their language proficiency improved after the games were played. These tests covered English grammar with which they were familiar.

The learners were divided into two groups according to their access to resources and technology as: Resource advantaged (RA) or resource deprived (RD) learners. RA learners came from favourable socio-ecomomic environments and had ready access to electricity, water and food. Because of their socio-economic standing they were exposed to technological resources like video games, computer games and media such as television, and films. They were aware and reasonably well informed about world and technological issues as a direct result of this exposure.

RD learners came from disadvantaged or deprived socio-economic environments where there was a lack of amenities such as electricity and running water. They did not have ready access to electronic media. Some of these learners knew how to play video arcade games, but had limited understanding of the working of the games they played. Interviews with these learners and their teachers their lack of stimulation resulted in inadequate language usage and a diminished awareness about world and technological issues.

4.3.3 *Determining game literacy*

For the purposes of this study we define game literacy as the recognition that the program is a game and that games have certain possibilities and limitations. Game literate learners are able to operate the game and instruct the game to perform certain functions (abort, play, feedback or adjust number of players).

This study differentiates between two types of game literacy: strategy-game literacy and twitch-game literacy. Strategy-game literacy pertains to Jones's (1997:4) definition of strategy games. Strategy-game literate learners are be able to use higher order thinking skills to solve the problems presented in the game. Twitch-game literacy relates to Jones's (1997:4) definition of twitch games. Twitch-game literate learners are able to use basic level skills like seeing (eye-hand coordination), printing (concentrating) and clicking (reaction) to win a game. The numbers of resource advantaged and strategy-game literate learners were corresponding. The same applied to resource deprived and twitch game literacy.

5. Findings

5.1 How and to what extent can current South African governmental policies and principles regarding ESL be supported by drill and practice games?

5.1.1 *Requirements of the ESL syllabus*

Table 1 indicates requirements of the ESL syllabus for grade six that are supported by the different games:

TABLE 1: GAMES RELATING TO THE REQUIREMENTS OF THE SYLLABUS

Syllabus requirements	***SNIPER***	***COVER UP***	***WORD FIT***	***LIBRARIAN***	***CHEERS***
Forming of words			✓		
Spelling	✓	✓	✓	✓	
Punctuation	✓		✓		
Adjectives	✓	✓			
Nouns		✓		✓	✓
Adverbs		✓	✓		✓
Use of tenses	✓	✓			✓
Concord	✓		✓	✓	
Word order	✓	✓	✓	✓	✓

The following ESL syllabus requirements could be supported:

- an understanding of how words are formed and the ability to apply this knowledge (e.g. how to form an adjective from a noun);
- a reasonable control of spelling and punctuation;
- a knowledge of the main word classes (nouns, verbs, adjectives, adverbs) and how they are used; and

- an understanding of and reasonable accuracy in the use of tense (e.g. past, present and future) and mood (i.e. active and passive), concord and word order, especially as these enable effective communication.

The games were evaluated in terms of the following educational principles:

- lifelong learning;
- flexibility of choice; and
- creative and critical thinking skills.

5.1.2 *Lifelong learning*

Lifelong learning involves "the development of human potential through a continuously supportative process which stimulates and empowers individuals to acquire all the knowledge, values, skills and understanding they will require throughout their lifetimes and apply them with confidence, creativity and enjoyment in all roles, circumstances and environments." (Longworth and Davies 1997:22). Lifelong learning includes activities that come from living and life itself. In this regard, formal education, non-formal education, social and recreational activities and just plain living all play a process role leading to the product of lifelong learning (Hatton 1998:2).

According to the *White Paper on Education and Training* lifelong learning aims to:

> ...put the learners first, recognising and building on their knowledge and experience and responding to their needs (Department of Education 1995:21).

It was found that the games evaluated could support the educational principle of lifelong learning only in part. When learners played these games they did not construct new knowledge. The games were all drill and practice games where learners applied lower order thinking skills to practice and reinforce existing knowledge. The focus in these games was on accuracy which could be regarded as an elementary language skill. The games allowed learners to attain proficiency.

5.1.3 *Flexibility of choice*

Flexibility of choice implies offering learners options in terms of what, where, when, how and at what pace they learn (*White Paper on Education and Training* , Department of Education 1995:21). By their very nature as drill and practice games, the programs offered very little flexibility of choice. Only the difficulty levels could be adjusted. In theory, should the facilities allow, learners could also be offered a choice in terms of when and at what pace they learn.

5.1.4 *Creative and critical thinking skills*

Creative and critical thinking involves the capacity to question, acquire, reason, weigh evidence and form judgements (Department of Education 1995:21).

It was found that none of the games could support the principle of creative and critical thinking because they were drill and practice (twitch) games. The games did not allow learners to utilize higher order thinking skills which underlie this principle. Nevertheless it is important to note that although the principles were not directly supported, the games could influence them indirectly by laying the foundation for their accomplishment.

5.2 What is the relationship between the affective and psychomotor abilities of learners and the successful integration of computer games?

The following sub-questions can be formulated with specific reference to both RA and RD learners:

- How did the games motivate learners?
- How did learners' psychomotor skills (mouse, keyboard) affect their performance?

5.2.1 *How did the games motivate learners?*

The games motivated resource advantaged as well as resource deprived learners to continue playing through the challenge it presented them. The games stimulated sensory and cognitive curiosity, challenged players to be in control of the game and provided for experience of exogenous fantasies, competition and recognition by means of an achievement record for their sustained efforts.

When the games were evaluated they were found to include many intrinsic motivational factors (Malone 1981; Malone and Lepper 1987).

TABLE 2: INTRINSIC MOTIVATIONAL FACTORS OF COMPUTER GAMES

Motivational factor	**Requirement**	**% RA and RD learners agreeing that they experienced it**
Challenge	Learners experience challenges in games when games are not too easy or too difficult, if they offer difficulty levels, levels of goals and feedback.	60% RA 100% RD
Curiosity	Curiosity is generated by activities that are novel, but not totally foreign to learners. Games can stir sensory and cognitive curiosity. Sensory curiosity is enhanced by different audio and visual effects and cognitive curiosity is enhanced by activities which deal with topics that interest learners are interested in.	73% RA 70% RD
Control	Characteristics for enhancing control in a game are contingency, choice and power. Contingency allows for a feeling of control when the outcome of the game is dependent on the responses of the learners. Choice contributes to a feeling of control where learners can choose between things such as levels of difficulty, names, character roles to play and the use of sound effects. The sense of control can be further enhanced if actions and choices result in powerful dramatic effects through the use of sophisticated graphics and sound effects.	76% RA 62% RD
Fantasy	Fantasy is defined as an environment which evokes mental images of physical and social situations not actually present. The fantasy context can be further classified as being either exogenous or endogenous to the game's content	36% RA 47% RD
Competition	Some type of scoring mechanism is usually employed to foster competition between players	38% RA 34% RD
Recognition	Recognition is achieved through providing natural channels (The Hall of Fame) for learners' efforts to be appreciated by others	100%RA 100% RD

Recognition was found to be the strongest motivator over all, while competition and fantasy proved lowest in the ranks of intrinsic motivators. It must be noted that learners worked individually and on different games, thus eliminating the possibility of competition against their peers. Furthermore the fantasy was exogenous to the content of the game, and consequently had low intrinsic value. RA learners regarded control as the second highest motivator, while RD learners returned curiousity as second most important motivator. The reason for this may be that RA learners had a higher strategy-game literacy and therefore were not so curious about the outcome of the game. RA learners, having played many games, liked to be in control, whereas RD learners, not having played many, were stimulated by curiosity. Although both groups put competition and fantasy on the lower end of the scale, RA learners placed competition higher than fantasy and RD learners reversed the order. Again this could be because RA learners tended to be more competitive, while RD learners were more likely to be attracted by fantasy.

5.2.2 *How do learners' psychomotor skills (mouse, keyboard) affect their performance?*

The games were mouse driven. The keyboard was only used to check achievement records. It was found that if resource advantaged and resource deprived learners used the mouse and the audio and visual devices in the games they felt that their eye-hand coordination, concentration and reactions improved. The games encouraged learners to react quickly to questions.

The results from the questionnaires that the learners completed are shown in table 3

TABLE 3: THE PSYCHOMOTOR ABILITIES OF LEARNERS

Statement	**Percentage (%)** RA and RD learners
By using the keyboard I could improve my reactions	75.6% RA 74.6% RD
Using the mouse improved my eye-hand coordination	76% RA 75% RD
I prefer to use the keyboard rather than the mouse	40% RA 60% RD

The results indicated that:

- Learners felt that their keyboard skills did not improve as it was only used to check achievement records. However, learners felt that using the mouse improved their reactions and eye-hand coordination. This was mainly because these were drill and practice games which stressed speed and accuracy. The faster they reacted, the higher their scores were.
- The resource advantaged and resource deprived learners were divided about preference of using the keyboard or the mouse. This was mainly because most resource deprived learners were not used to operating the mouse when they interacted with the computer.

Table 4 presents a summary of teachers' opinions of learners' psychomotor abilities.

TABLE 4: INTERVIEW RESULTS ABOUT THE PSYCHOMOTOR ABILITIES OF LEARNERS

Question	Results
How can the mouse and the keyboard improve your learners' psychomotor abilities?	Most of the teachers felt that the mouse could have improved their learners' psychomotor abilities because they were forced to react to the questions by clicking the mouse button as quickly as possible. The RD learners however, struggled to operate the mouse because at most schools they had not been exposed to it when they used the computer. Mr Ntamesi (Cebelihle Primary School) Mrs Kunqwana (Garrett Primary School) and Mr Gerber (Môrewag Primary School) felt that their learners struggled with the mouse because they thought their learner's eye-hand coordination was poorly developed. Mrs Zono (Ntyatyambo Primary School) stated that her learners could not use the mouse very effectively because she thought they did not concentrate enough and were used to being "spoon fed".
How can the audio and visual devices influence learners?	All the teachers agreed that the audio and visual devices in the games forced learners to react more quickly and this in turn helped learners to concentrate more and to improve their eye-hand coordination.

Table 4 indicates that the teachers also felt that the use of the mouse and the audio and visual devices encouraged their learners to improve eye-hand coordination, concentration and reactions.

The anecdotal records confirmed these results. It was found that at the schools where most learners were resource deprived, they initially battled to operate the mouse and this had an effect on their results in all the games. These learners struggled to concentrate and their eye-hand coordination was poorly developed. However, the more exposure they had to the games, the more their scores improved. Eight resource deprived learners indicated to the assistants that the use of the mouse and the sound in the games encouraged them to achieve better results. This was an indication that the use of the mouse, the sound and colour helped them to concentrate more and to improve their eye-hand coordination in order to achieve better results.

5.3 What is the relationship between the cognitive proficiency of learners and the successful implementation of the games?

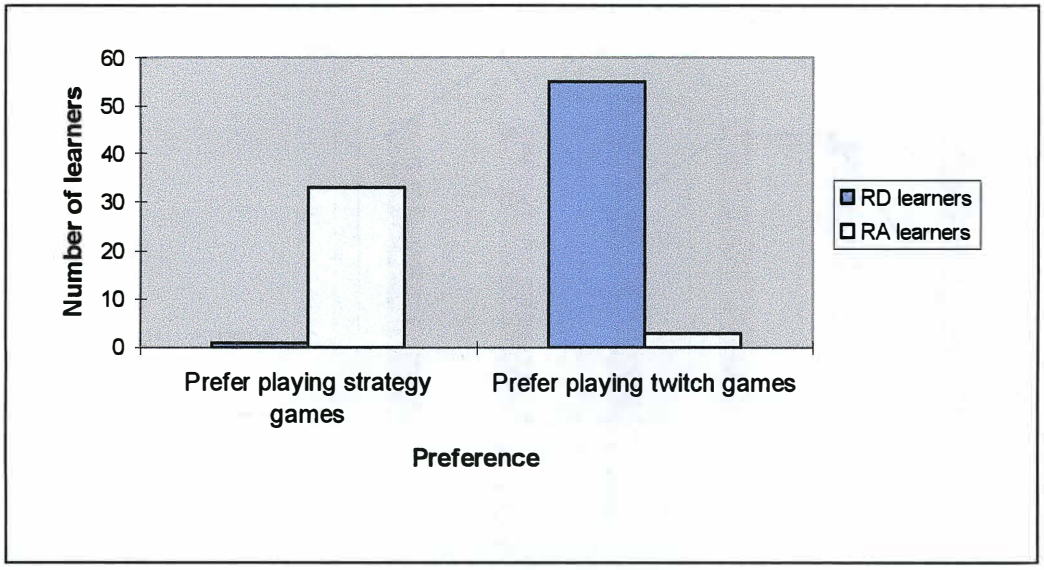
For the purpose of this article, cognitive proficiency is regarded as game literacy and achievement in English language tests.

5.3.1 *Game literacy*

The learners participating in this study were more twitch-game literate than strategy-game literate. A statistically significant relationship was found between game literacy and resource levels. RA learners were twitch and strategy-game literate and RD learners were only twitch-game literate.

Resource deprived learners who were twitch-game literate were less comfortable playing the games than the resource advantaged learners who were both twitch and strategy-game literate. The same result was found when the preferences of learners for either twitch games or strategy games were tested. Figure 2 indicates the results:

Figure 2: RA AND RD LEARNERS' PREFERENCES FOR TYPES OF GAMES



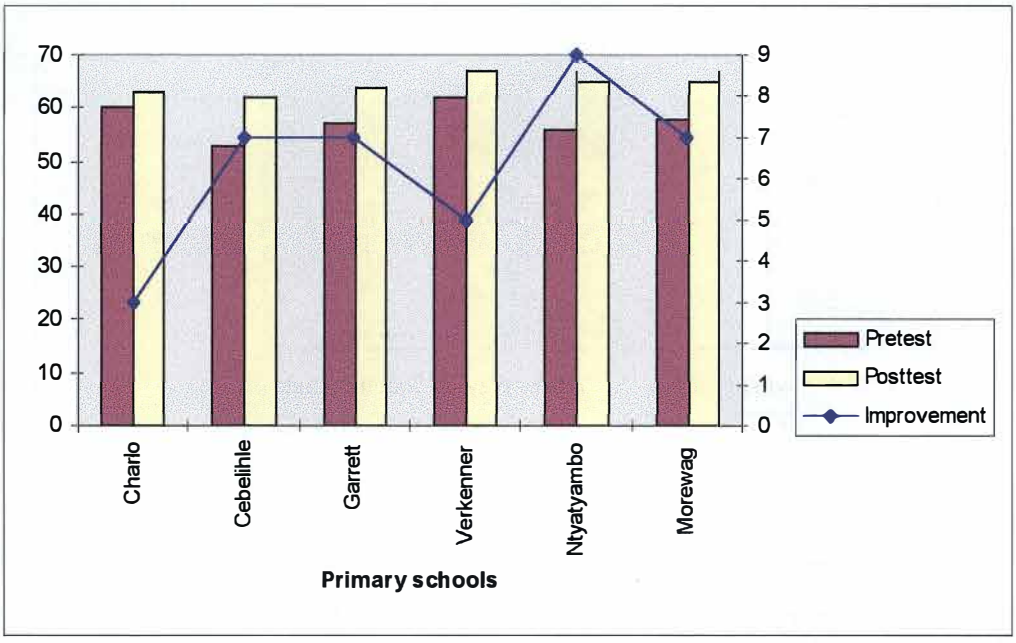
It is evident that RD learners preferred to play twitch games, while RA learners would rather have played strategy games. RA learners indicated that they enjoyed playing the games, but became bored after a while. RD learners, on the other hand, indicated that although they enjoyed playing the games, they had found them difficult at times. It can thus be assumed that drill and practice games were too easy for RA learners because they are more often exposed to computer-assisted instruction than RD learners. This assumption is supported by Sutton (1991:500) who states that learners in affluent schools have more frequent opportunities to use computers in ways that require higher order thinking skills and in ways that place control of learning and technology in the learners' hands. It was found that RD learners were hardly exposed to any computer-based instruction activities, let alone less innovative software.

Game literacy only had an initial influence on the achievement of scores in the games. Resource deprived learners battled at the outset, but continued playing of the games alleviated this problem and learners were found to use the games successfully to become more competent in ESL.

5.3.2 *Language proficiency*

Predictably there was a significant improvement in all the learners' language proficiency after the computer games were played. Although the same result might have been achieved through conventional teaching (Clark 1994) this section focuses on the relationship between resource levels and the improvement of language proficiency. Figure 3 illustrates the language improvement of learners at the different schools.

FIGURE 3: LANGUAGE PROFICIENCY OF PARTICIPATING LEARNERS AT SCHOOLS



It can be seen that the marks of the learners at Ntyatyambo Primary School (the most disadvantaged school) improved the most (9%). Charlo Primary School, with most RA learners, showed least improvement. Table 2 also indicates that 100% of RD learners found the games challenging while only 60% of RA learners felt this way. Taken together with the preference shown by RD learners for twitch games (cf. Fig 2), this contradicts Crook's (1994:26) contention that less innovative software (drill and practice) are over presented in disadvantaged communities. It could be argued that RD learners might find strategy games too difficult and intimidating. Simple drill and practice games may be a non-threatening way of introducing computers.

6. CONCLUSION

This study established that educational computer drill and practice games could support ESL teaching in grade six by indirectly influencing the educational principles of life-long learning, flexibility of choice (Ministry of Education 1997:xi). The subject matter of the games was in keeping with the current syllabus for grade six. Although the drills provided very little flexibility of choice apart from difficulty level, they could be used at the learners' own convenience should facilities allow. The games did not promote critical thinking skills as they were drill and practice games that concentrated on rote learning.

Recognition was found to be the strongest intrinsic motivator for both RA and RD learners, while fantasy and competition were the weakest motivators for the two groups respectively.

RA learners preferred strategy games and RD learners preferred twitch games. RD learners initially had problems mastering the game playing techniques, but once they had become familiar with computer games, performed well. RD schools benefited more from the games than did RA schools.

It would seem that simple, colourful drill and practice games have a useful role to play in supporting the English language skills, particularly of resource disadvantaged learners.

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