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A Computer Aided Learning Tool for Readers

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وسيلة حاسوبية لتعليم القراءة

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خلاصة : تم إعداد برمجية لتعليم الطلاب القراءة السريعة والناقدة من خلال تمارين توسع مجال الرؤية لديهم ، وتحسن من قدرة عيونهم على الحركة يمينا وشمالا ، وتقلل من ميل العيون للنظر إلى الوراء أثناء القراءة ، وتنمي مخزونهم من معاني المفردات ، وتشحذ مهاراتهم في القراءة المرورية والقراءة الناقدة . يستعرض البحث خصائص البرمجية هذه ، ويشرح قيمتها التعليمية ، ويبرهن على منفعتها بالتجربة العلمية .

ABSTRACT: A bilingual piece of software has been developed to cultivate student speed and critical reading abilities by expanding their visual span, improving their eye movement, reducing their visual regression, developing their stock of vocabulary, and by honing their skimming, scanning, and critical understanding skills. This paper overviews the software, explains its educational value for language teaching, and experimentally demonstrates its utility.

With the large volume of information that the internet has made available, honing people's reading skills has lately acquired special importance. At their finger tips, people can access a massive amount of information that has the potential for being of benefit and/or harm to them individually and to their communities. They need to sift through some such information quickly and at the same time critically; therefore, it is necessary that they be equipped with good reading skills.

Although teaching reading is basic to any literacy program, educators tended in the past to relegate it to a secondary position once learners became competent in decoding the written language. Educators felt that there was little they could do to teach reading after learners master the skill of deciphering the written word. Nowadays, however, there is renewed interest in the methodology of teaching reading and educators have started to find better ways to facilitate learning (Crawley and Mountain, 1995).

Eskey (1986, p.5) says, "No one can teach anyone how to read, or even how to read more effectively... [but] anyone can learn to read, and/or to read more effectively". To facilitate learning to read, educators are beginning to enhance their work with computer-assisted language learning devices, part of which is the bilingual reading program presented here. This reader is not unprecedented in the teaching of English, yet it is a firstling in the field of Arabic reading. Whether teaching Arabic to native speakers or foreigners, schools and universities in the Arab world tend to ignore speed reading as a skill and focus more on comprehension. This software offers carefully prepared exercises that improve both speed and comprehension at intermediate and advanced levels. Setting out to explore the software and to describe its activities, let us first discuss briefly what reading involves.

Reading is a skill that involves complex cognitive processes. Visual information is converted to neural signals that go to the working memory for processing. To decode this information, the working memory retrieves conceptual and linguistic information, which match the visual information from the long-term memory. Cognitive psychologists are in agreement that long-term memory information is both linguistic and conceptual. Once a visual phrase is matched with conceptual information and grammatical patterns in the long-term memory, meaning comprehension is said to have been achieved. In other words, reading triggers thinking, or as Perfetti (1984) defines it; reading is "thinking guided by print".

In reading, two important processes take place: movement of the eyes and comprehension. Fast reading implies training the eye muscles to move across the page at fast rates, but does comprehension match up with speed in eye movement? Research shows that eye movement is mechanical and its speed is measured in milliseconds, whilst decoding the written word is neural and is carried out at much faster rates. Masson (1986, p. 602) concluded from various experiments that, "Many of the critical comprehension operations that precede memory encoding and elaborative processes can be executed in much less time than it takes the eyes to move from one word to the next in normal reading".

Literature Review

In the field of language teaching, there is some debate as to the extent of contribution that Computer Assisted Language Learning (CALL) can make; therefore, numerous studies have been conducted to assess the value of CALL software in the teaching process. Some came out in strong support for CALL, whilst others lent only qualified support.

Using pre- and post-tests design, McKane and Greene (1996) examined the effectiveness of theory-based computer-assisted instruction for reading with incarcerated adults, reading below the ninth-grade level and concluded that there was a significant achievement gain for CALL instruction compared to traditional instruction for the Lowest Grade Equivalency Levels. Greenlee-Moore and Smith (1996) found that reading from interactive software increased comprehension when subjects read longer and more difficult narratives than when they read shorter and easier texts. Hong (1997) found that the reading proficiency of second year business Chinese learners could be much more efficiently achieved with the assistance of multimedia technology. Tozcu (1998) studied the effect of direct vocabulary instruction, using CALL, on (1) vocabulary knowledge, (2) reading comprehension, and (3) speed of word recognition and found that treatment students showed significantly greater gains on all three than did the control students who did not use CALL. Midobuche (1996) investigated the effect of one piece of software on the development of English reading skills of a group of language minority students. Using students' scores on the Comprehensive Test of Basic Skills, she discovered that the experimental group performed much better than did the control group that received no CALL instruction.

In contrast, Batchelder (1997) investigated the efficacy of using Math and Reading CALL instruction with inmates but found that there was no quantitative evidence that computers alone could produce superior academic achievement of incarcerated students. Batchelder recognized, however, that CALL's advantages extend beyond improvement in standardized test scores. Pigg (1996) tested whether Paragraph Builder could effectively teach fifth grade pupils how to identify topic sentences. He learned that this program did not help students with limited English proficiency, but it did improve other students' mean scores on the post-test. Using a pre-test/post-test design, Johnston (1996) evaluated the effectiveness of CALL for teaching adults reading skills. She found out that there was no significant difference in post-test scores for CALL instruction.

Clearly, what determines whether CALL software is beneficial to the teaching process is circumstances. CALL programs are but learning resources that can be either put to good use or bad use. Sponder (1993) rightly concludes that computer technologies are only as effective as a learner's willingness to embrace them and a teacher's enthusiasm for using them.

The effect of CALL software on individuals varies from one learner to another (Geisert, et al, 1990); therefore, it is more realistic to think of CALL as having differential effect on learners. This will be demonstrated in the last section of this paper by the experimental study we conducted. In this spirit, Cortez (1996) compared the effects of CALL and traditional classroom instruction on the academic achievement of at-risk ESL and non-ESL urban secondary school students, using their scores on the Test of Adult Basic Education. He discovered that CALL students did significantly better than traditional instruction students did on language in the medium ability group, that non-ESL students were better than ESL students in the easy ability group on spelling, that Black students were better than Hispanics in the difficult ability group on language, and that female students did significantly better than males did in math, language, reading, and spelling. CALL does not have a uniform effect on all learners.

Program Functions

USER PROFILE AND RECORD OF LEARNING: The program, RapidReader, asks the user to log in. If they have already enrolled in the course (ie, their user name exists in the user database), it will load their user information and past results and allow them to proceed in their training. If their user name does not exist, they are required to enroll in the course by filling out a user-profile form supplying such information as their name, identification number, course title and number, and the language they want to practice reading in.

A learner record is kept for every user who logs on the program (Figure 1). This record keeps track of all their activities including warm-ups.

Using a result wizard, the user can view graphically any part of their record of learning, be it the number of times they did an activity or the results they obtained. Access to this record is given only to the user and their course facilitator (ie, the teacher, if used in a classroom). Teachers can have a grade-book-like record for each of their students whereby the marks obtained by a student are averaged daily for each activity accompanied by the total number of times they practiced each activity; thus, giving the teacher a greater ability to monitor their students' performance inside and outside the classroom. The teacher can even get statistics and graphs on their students' performance.

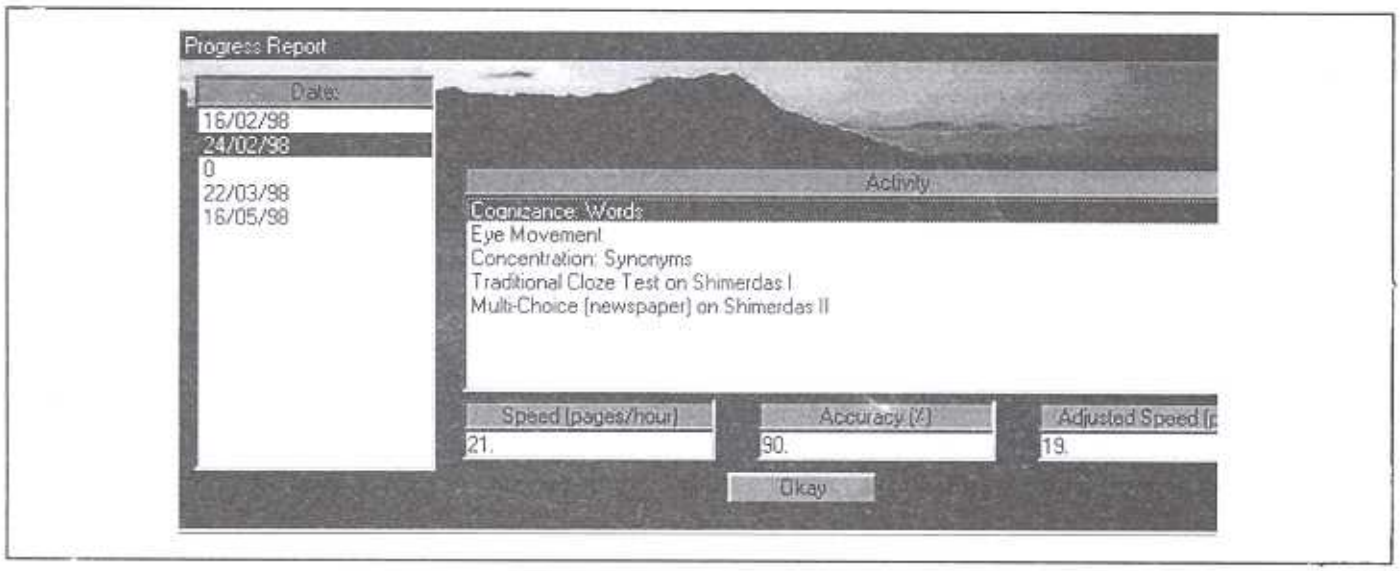

Figure 1. Record of Learning.

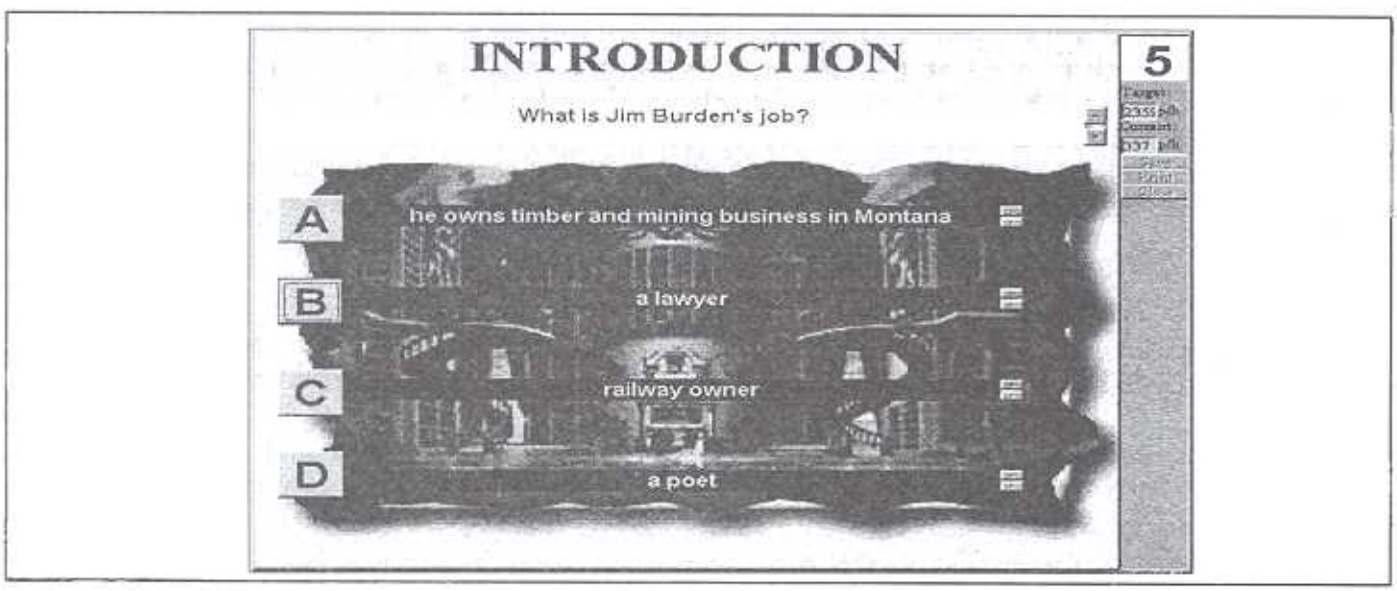

Figure 2. Multiple ChoiceQuestions.

PLACEMENT TEST: To evaluate the progress users achieve with the program, a placement test is given to them upon enrollment in the course. It consists of four parts: a relatively long reading passage followed by comprehension questions, passage organization questions, and a vocabulary test. The reading passage is designed to assess a user's reading speed, and the comprehension questions test their understanding of what they read. The passage organization test is intended to find out whether the overall organization of a reading material is understood by the user; this is a skill essential to scanning and skimming. The vocabulary test, on the other hand, gauges the type of reading passages the user can cope well with. Speed, comprehension, knowledge of a passage organization, and vocabulary are integral to efficient reading. Smith(1984), Grabe (1986), and Jensen (1986) agree with this view suggesting that improvement in speed is contingent upon knowledge of the organization of a reading material, of the author's purpose and point of view, and of an adequate stock of vocabulary. Eskey (1986, p.11) exhorts that "the teacher must be constantly concerned with how fast his students read, there being a direct relationship between reading speed and reading skill, between memory requirements and comprehension" and he concludes that "the good reader, by definition, reads fast". Our program takes all these factors into account; it prepares for the student a reading course that begins only one step higher than their current reading level.

The placement test reports to the user three results and performs some calculations to decide on their reading level. It tells them their raw reading speed by timing them as they flip through the pages of the reading passage and by dividing the number of words in the passage by the duration of their reading. It quizzes them on their comprehension by giving a set of multiple choice questions that are displayed one at a time with four answers for each (Figure 2).

The user clicks an answer and gets immediate feedback: if they answer correctly, they get a tick, but if they do not, an arrow pointing to the correct answer is displayed. A brief delay after the marking allows students to reflect on their answers. Upon the completion of the test, the user is given their comprehension mark as a percentage. Then RapidReader calculates their comprehension-adjusted reading speed by finding the ratio of the comprehension mark from the raw reading speed. Thus, a user who reads the placement test passage at 90 pages/hour (henceforth p/h) and obtains 70% on the comprehension test will get the comprehension-adjusted reading speed of 63 p/h. RapidReader then recommends to the user a step higher speed target but gives them the option of setting their own target. A lesson is prepared in accordance with what target the user strives to achieve.

OPTIONS: Users can modify the program's default settings through the options tab strip. They can change the font type, size, and color of their reading material, modify their user profile, and can change the target speed. It might not be important to have the option of changing the font in a reading passage, yet it stimulates reading and makes it a comfortable activity. Changing the user profile is allowed here to give the user options of modifying the information they entered upon registration in the course. If they made a mistake in the spelling of their names, for example, they could adjust it here.

Reading speed plays an important role in activities other than comprehension; the stimulus material in the cognizance, eye movement, and concentration activities is displayed at speeds determined by the target the user sets for themselves, so it is essential that they have control over their target speed at any point in the program. They may find the target speed too slow for an activity that demands little cognitive resources, such as cognizance and eye movement, or too fast for an activity that is cognitively taxing such as concentration and comprehension.

In a list and textbox format, there are 22 speeds that the user can choose from, or they can enter a different speed in the textbox. We arbitrarily decided to increment these speeds by 7 p/h. The highest speed in the list is 154 p/h although some literature reports the fastest attained speed to be 135 p/h, assuming page length of 400-words (Smith, 1984). The reason why RapidReader has higher speeds in the list and allows the user to set for themselves even higher speeds in the textbox is because some activities can be used for preliminary training on skimming where such speeds are indeed attainable.

ACTIVITIES: RapidReader fosters three basic reading skills: speed reading, comprehension, and vocabulary building. To facilitate skill development, this program classifies speed reading into three types: rapid reading, skimming, and scanning, and it identifies the fundamental components of the reading skills and offers exercises for each of them (Figure 3).

As part of a warm-up routine, users are offered cognizance, eye movement, and concentration exercises to drill them on focussing, to train their eye muscles on moving at higher speeds, and to improve their comprehension.

Classroom experience has shown RapidReader's warm-up activities to be quite entertaining. Students compete with one another when asked to do them and the teacher has to cajole them into moving to different activities. Students from other departments have also been seen doing the warm-up activities for entertainment. When RapidReader is used in the classroom, teachers are encouraged to get their students to do warm-up exercises regularly before they get them to do a comprehension activity.

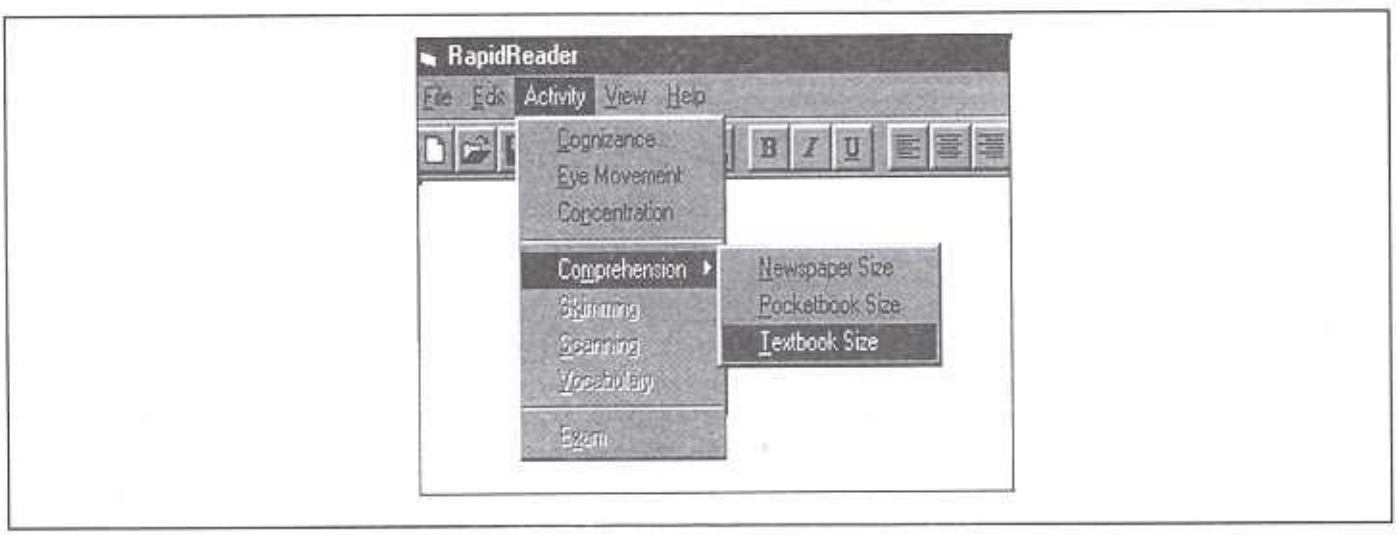

Figure 3. Activities Menu.

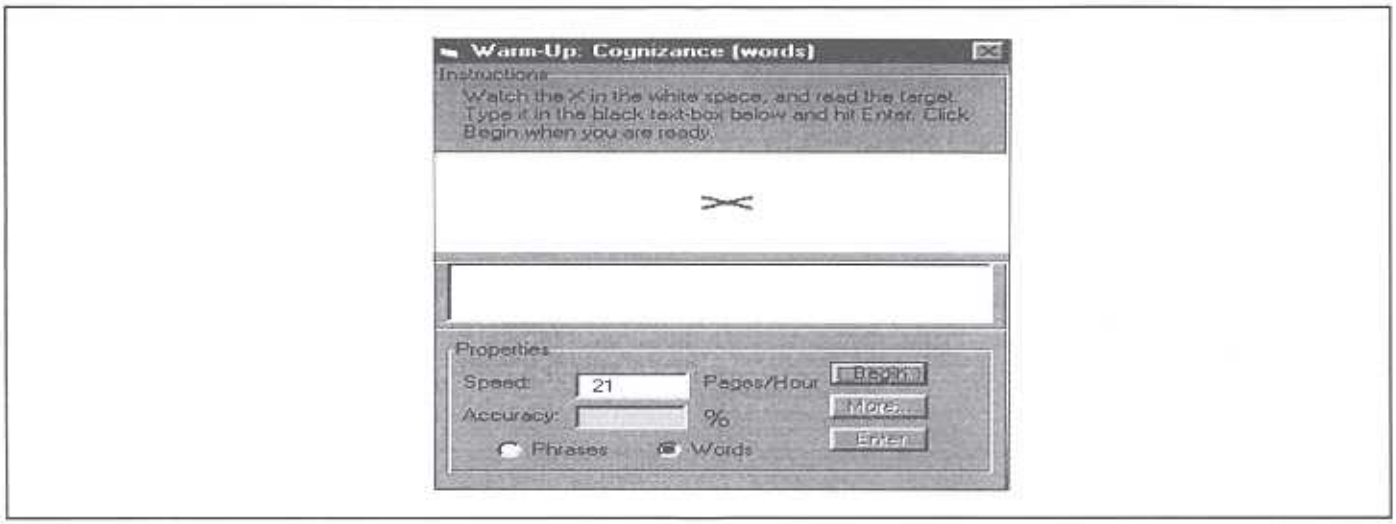

Figure 4. Cognizance Form.

COGNIZANCE: Cognizance is an integral component of reading. Without being able to discern words, no one can claim to be able to read; and without being able to perceive words quickly, speed reading is impossible.

RapidReader develops the user's ability to focus on the reading material at varying speeds through a set of exercises which flash words or phrases for a duration of time reflecting their target speed (Figure 4). Thus, if the user's speed is 7 p/h, then the pages are multiplied by the average number of words in a page and the sum is divided by the number of seconds in an hour. In other words, (7 pages * 400 words/page) / 3600 seconds in an hour = 0.77 seconds. This is the duration for which the flashed stimulus remains on the screen if the user's target speed is 7 p/h.

Once the item has been flashed, the user is requested to identify it. Their response can be either in the form of typing what they saw in a text panel or selecting from a list. There is a two-second delay after the response has been entered or selected to give the user time to get ready for the next stimulus. The option of typing responses is attractive to teachers who adopt an integrated skills teaching approach because they can make the activity not only teach focussing but also spelling. Students will read the flashed item, remember how it is spelled, and type it in the text box. RapidReader alerts users when they type a wrong letter by beeping but does not prevent them from typing it anyway. The program then compares their input with the target item and if there is 100% match between them, it will count the answer correct. Matching the flashed target with items in a list, on the other hand, is an option that the user may opt for if their typing skills are not adequate.

In the cognizance form (Figure 4) where the activity is carried out, there are three boxes; one for the speed at which the items are flashed, the second is for the progressive score, and the third is for typing the user's response. There are also three buttons; one to press when the user is ready to start an exercise, the second to display the list of stimuli and the user's corresponding responses, whilst the third is the enter button. If desired, the stimuli and responses can be stored to a file where the user's profile is also appended.

Upon the completion of a cognizance exercise, the user is promoted, demoted, or held back automatically. If they score ≤50% they get demoted one level down, ≤75% they remain at the same level, and >75% they get promoted to the next level up. Our promotion score is higher by 15% from that suggested by Jensen (1986, p.113), the reason being the importance we place on the belief that comprehension should not be sacrificed for speed. To allow for flexibility, however, the user may also promote themselves against the recommendation of RapidReader by simply entering the desired level in the speed box.

EYE MOVEMENT: Eye movement is another essential component of reading. One needs to move their eyes across a line to be able to read it, and they need to do so quickly to master speed reading. Hence, eye muscle development is vital to the advancement of good reading skills.

RapidReader develops the user's eye muscles together with comprehension skills through a set of exercises in target-hunting (Figure 5). The intentions are to get the student to move their eyes from right to left if they are reading Arabic and left to right if they are reading English, and to get them- at the same time- to decode every word, compare it with the target, decide whether they are identical or not, and if so count it as a target occurrence. Thus, RapidReader ensures that students not only read the stimuli but also understand what they read. It, furthermore, increments their reading speed in accordance with the accuracy of their responses.

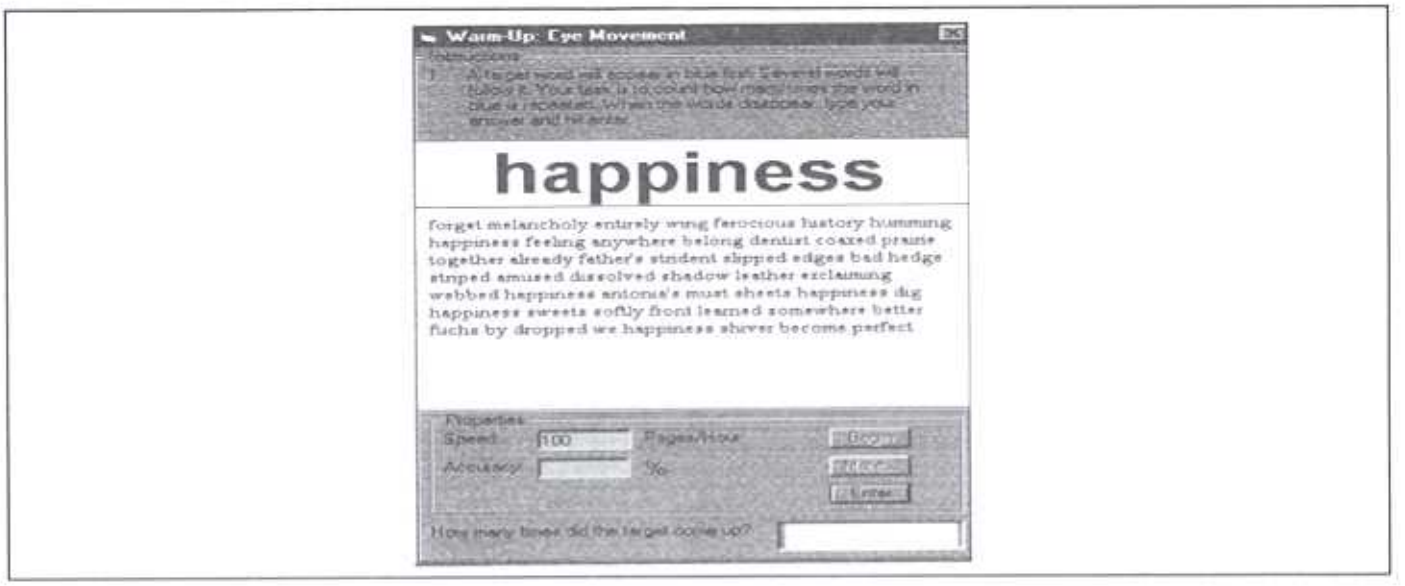

Figure 5. Eye Movement Form.

Figure 6. Concentration Form.

The eye movement activity is comprised of light exercises that put the user in a reading mode by requiring them to spot the copy of a target word from a group of foils. The items from which users identify the target copy are displayed one at a time in a paragraph format; they are displayed at a specific speed. The user's task is to count the number of times the target copy appears in the paragraph as it does, because the paragraph will disappear once the last item has been displayed. Obviously, the target copies are displayed at random. A score is given upon the completion of an exercise.

When the eye movement activity is done for the first time in a session, RapidReader displays targets and foils at the target speed set upon the launch of the program. It does not take note of any speed achieved in other warm-up activities whether in the present or a previous session. We believe that the only speed level that reflects a user's aptitude is the one achieved during a comprehension activity. Hence, the starting speed at which eye movement exercises are offered is the overall speed. As in cognizance, users are promoted, demoted, or held back automatically, but they can over-rule the recommended target by specifying their own speed levels.

CONCENTRATION: This activity is identical to eye movement except that users count here the synonyms or antonyms of a target item (Figure 6). The reading speed achieved here tends to be significantly lower than in eye movement and that, in turn, is lower than that achieved in cognizance. The cognitive effort involved in each of these activities is a determining factor.

Concentration does not only require that users read the stimuli then recognize the item that matches the target but also decode the target and each of the foils and compare between their meanings. When they find a synonym or antonym of the target item, the user clicks it and a new target appears. Obviously, these mental activities require far more cognitive resources than the simple task of matching items in terms of identity. Deciding on whether an item is identical to the target or not is yet more cognitively taxing than the simple perception of a flashed item, as is the case in the cognizance activity.

The motivation for this activity is to circumvent the frequently sited deterioration of comprehension as speed improves. Foreign language learners often complain that there is a trade off between speed and comprehension. In this activity, users are trained to concentrate while reading rapidly; they learn to decode quickly every item they read. If practiced frequently, this activity is capable of improving users' comprehension under the pressures of speed reading; the authors have seen students making giant strides in comprehension. Students consistently scored high marks in the multiple-choice comprehension questions at the end of reading passages; that is an indication that they managed to read the stimulus material fully and to understand it at the same time. Obviously, no claim can be made as to how profound the comprehension was. If only two types of comprehension are identified: linguistic and critical, then one can say with confidence that a satisfactory level of linguistic comprehension is achievable. The comprehension required for writing a critique on a literary piece requires contemplative reading and that can hardly be achieved with speed reading.

COMPREHENSION: The aim of all activities is to improve users' reading comprehension. Whether it is cognizance, eye movement, concentration, vocabulary building, skimming, or scanning, the ultimate goal is to improve the skills of reading fast and correctly understanding what is being read. Each of these activities focuses on one or more specific aspect of speed reading and comprehension. There is yet a separate activity for comprehension which consolidates all warm-up activities and has additional goals of its own. Comprehension offers three sizes of reading material: newspaper size, pocketbook size, and textbook size (Figure 7). It also gives five levels of use: elementary, where users have a pacer to help them move their eyes across a page; lower elementary, which still has pacing but it prevents regression; upper intermediate, which offers timed reading but without any pacing; and advanced where users are completely unaided but the program discretely keeps track of their speed.

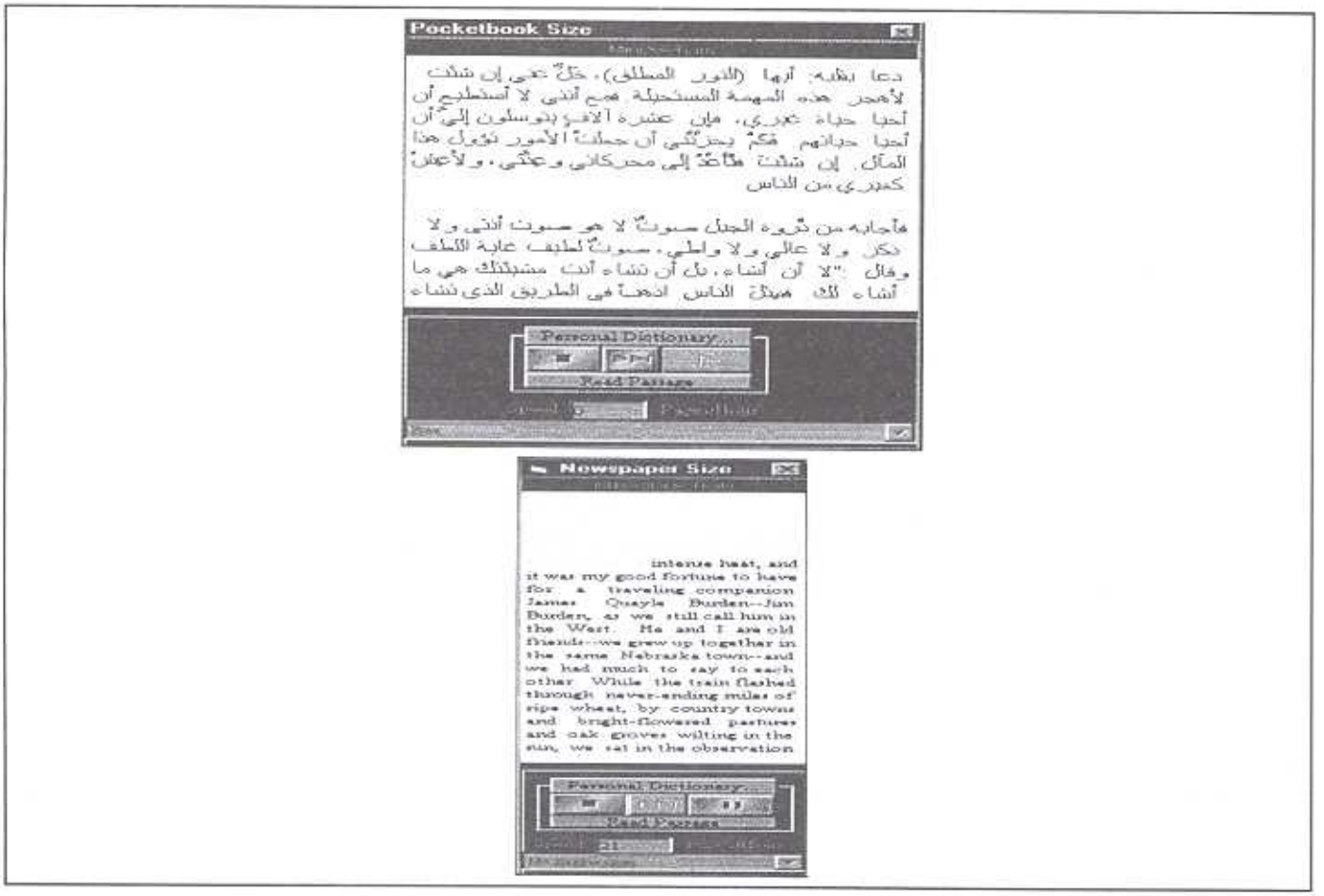

Figure 7. Reading Passage Sizes.

RapidReader offers three sizes of reading material to reflect what users encounter in the real world. The most frequently encountered reading material sizes are: a single column text as in newspapers and magazines, a double column text as in popular novels and pocket size books, or a triple column text as in textbooks and reference material. In these sizes, the eyes move different distances across the page and have different numbers of fixations per line. RapidReader acknowledges these differences and trains users on the three conditions.

Pacing is thought to be necessary for the early stages of training for several reasons: (1) It encourages the student to move their eyes across which is an integral aspect of reading. (2) It makes them read in phrases; scholars (eg, Weaver, 1980) are of the opinion that word-by-word reading hinders comprehension and speed. (3) It helps them focus on reading and consequently improve their reading speed. (4) It enhances their text prediction skills. Traditionally, teachers encouraged their students to use their fingers or pens as pacers, but RapidReader uses instead a highlighter. This is a yellow rectangle of approximately 2.5 cm length that moves across text lines at the user's target speed. Its length has been determined by the fact reported in the literature (eg, Smith, 1984) that the eye is capable of making four fixations per second and that each fixation is two to three words long. Beginners can start at the paced reading level that RapidReader offers.

Although rapid eye movement is essential to efficient reading, the tendency of back skipping is an acknowledged impediment. Back skipping, also called regression, is a backward movement of the eyes during the reading process. Some regression is accepted as normal (Rayner, 1981), but it is inefficient readers who practice it regularly (Mahon, 1986). Often the causes are lack of concentration, poor vocabulary, or bad habit. RapidReader addresses this problem in the concentration and the vocabulary activities and it also addresses it here in comprehension. At the lower intermediate level, users are offered reading exercises that have pacing, and no regression features. RapidReader highlights the phrases that users must currently read and at the same time dims those that are supposed to have been read; this way users are discouraged from reading back.

Once users are trained to move their eyes across in a forward motion and not to regress, they will have developed good reading habits. What they need next is sheer practice. RapidReader gives them two types of practice: timed reading and free reading. In both, they get texts without any pacing or dimming, but in timed reading a page remains on the screen for a duration of time reflecting their target speed, then RapidReader flips it automatically. Free reading, on the other hand, is real world reading where the user has complete control. RapidReader's role is simply to time them in order to keep track of their speed.

VOCABULARY BUILDING: A serious hindrance to fluent reading is the frequency of unfamiliar words; they slow down the reading and deteriorate the comprehension. Therefore, any serious reading program must offer ways of improving students' vocabulary (Aweiss 1993). RapidReader offers four such ways; it teaches word parts (prefixes, suffixes, and roots), gives training in conventionalized expressions (phrasal verbs, speech formulas, and idioms), furnishes the opportunity to compile personal vocabulary lists, and provides word games.

It is claimed that learning about 30 word parts in English is a key to unlocking the meanings of about 14,000 words (Smith, 1984). It is, indeed, an excellent investment to get language learners to master a few Greek and Latin prefixes, suffixes, and stems since they can increase their stock of vocabulary by so much. Knowing these affixes and roots will facilitate rapid reading and will improve overall comprehension. They will make it possible for students to guess the meaning of some unfamiliar words and will help them remember the definition of new words that they may encounter in textbooks. RapidReader gives exercises to teach quite a few affixes and roots; at first, affix and root meanings are introduced, then users are asked to select the meaning of a word from a list, to match words with their meanings, to choose a word to fill in the blanks, or to unscramble letters of a word.

The second aspect of vocabulary building that RapidReader fosters is conventionalized expressions, sequences of words that tend to occur in a more or less fixed pattern. These constitute the bulk of a language vocabulary. According to Pawley and Syder (1983, p.215), "By far the largest part of the English speaker's lexicon consists of complex lexical items including several hundred thousand lexicalized sentence stems". It is also true of most other human languages; speakers learn prefabricated phrases and clauses, collocates, quotations, and memorized texts and use them as templates to express some familiar or novel ideas. Most word sequences in a language are conventionalized to one degree or another. The most highly conventionalized expressions are what is often referred to as 'frozen idioms' (eg, it is raining cats and dogs), where the words and the syntax are fixed and the meaning of the expression cannot be derived from the individual meanings of its constituents. The least conventionalized expressions, on the other hand, are schematic speech formulas in which grammatical categories are fixed but most words are unspecified (eg, 'The ADJ-er, the ADJ-er' and 'NP1 V like NP2' in 'The bigger the better' and 'She danced like an angel', respectively). RapidReader uses cloze exercises to develop students' conventionalized expressions (Figure 8). It offers them excerpts from some reading passages in which some parts of a conventionalized expression would be deleted and they are asked to supply these parts.

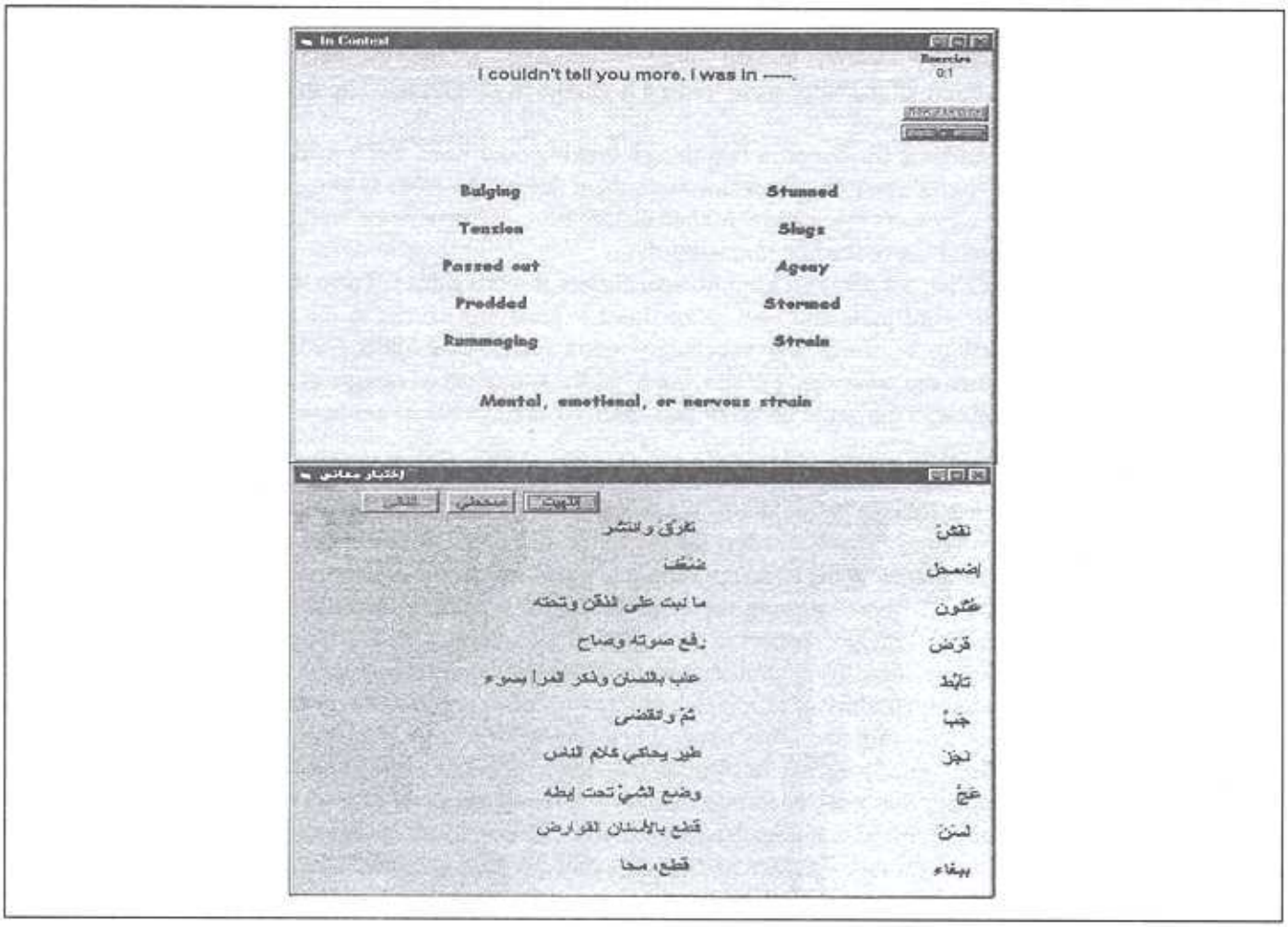

Figure 8. Vocabulary Exercise Forms.

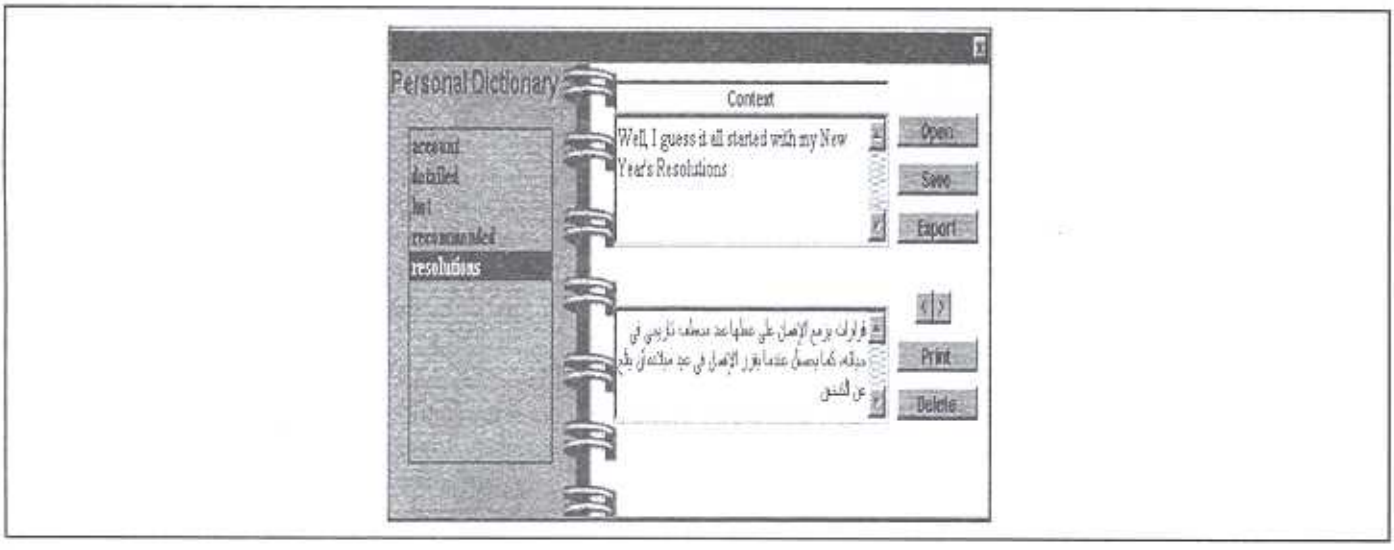

Figure 9. Personal Dictionary Form.

RapidReader gives the learner 10 items to choose from for filling the blank (Figure 8). To help them make the right choice, pointing the mouse on an item will get it highlighted in red and will offer a clue in purple. The clue is a definition of the word that appears at the bottom of the form. Thus, the learner is given two things to figure out the speech formula element from: the context of the stimulus sentence and the dictionary meaning offered in the form of a clue.

The nicest feature for vocabulary development that RapidReader offers is the facility for getting the user to compile their own vocabulary and expressions list. When users come across an unfamiliar or an interesting word or expression in some reading passage, they can simply highlight it and click a button. RapidReader will copy the item and the sentence

it occurred in into a dictionary-like vocabulary list (figure 9) which is formatted in three text panels: one for entry-items another for the sentence in which it occurred, and the third for student notes. Since the last panel is editable the student may choose to write the meaning of the entry word in their language (e.g., Arabic). The student may print or export it to another software package.

What motivated this feature is the belief in two things: looking up a word while in the process of reading is an interruption that breaks the reader's concentration and slows them down. The other is using a dictionary while reading constitutes a bad habit that educators discourage. Mahon (1986) says, "Overreliance on dictionaries makes reading a tedious translation exercise and fluent reading impossible".

The last vocabulary building activity that RapidReader fosters is word games. These are not much different from the exercises given to teach word parts and conventionalized expressions except in the elements of challenge and competition. They are used to reinforce the vocabulary users learn. Like other vocabulary-teaching software, RapidReader offers card games and crossword puzzles, but it has the additional advantage of using items from the user's personal vocabulary list. This way the game becomes personalized and more relevant to the user.

SKIMMING AND SCANNING: To get a general idea about the text to be read and to determine appropriate reading strategies, students are taught to preview a passage before setting out to read it. They are usually taught the skills of skimming and scanning for this purpose. Skimming involves reading the title, table of contents, introductory and concluding paragraphs, the first sentence of some paragraphs in the text, etc. aiming to get at the nature of the text content and its main ideas. Scanning, on the other hand, involves knowing the organization of a reading material in order to locate specific information in it. People usually skim newspapers to get a general idea about what is happening around them but scan telephone books to look up some company's number or dictionaries to find the meaning of an unfamiliar word.

Both of these skills are indispensable for efficient reading; they allow readers to skip parts of the text to get at the gist of it or to find some specific information they need. When people have large quantities of text to go through, they start reading selectively. Since human language has built in redundancies (Chafe, 1976 and 1992; Halliday and Hassan, 1976), efficient reading requires that people learn to identify the redundant parts of a text and to skip them. A close examination of how ideas are expressed in human language shows that new ideas are usually expressed in familiar and conventional ways. As much as language speakers like novelty, they prefer it to come "wrapped in familiar packaging" as Pawley (1985, p.93) puts it. He says, "Effective creativity is highly constrained, comprising variations on familiar themes. The rules of syntax provide certain constraints but evidently they allow a freedom that is often too great for the purposes of ordinary speech exchange, which demands that ideas be packaged for a fast ride". The skill of skim-reading taps on this tendency of human language and seeks after the new ideas in texts.

RapidReader's skimming activity has several types of exercises that gradually take the user to the stage when they can devour reading material without worrying about its volume. With the aid of automatic pacing, users are trained to skip different types of information. At first, they learn to skip function words. These include pronouns, auxiliaries, determiners, and prepositions. Function words are low on content; they rarely carry ideas that an author would want to communicate to their readers. Hence, skipping them does not constitute a grave compromise on the information contained in a reading material. In the second stage, users learn to skip nominal and verbal modification; ie, adjectives, adverbs, and adjectival and adverbial clauses and phrases, parenthetical statements, etc. In the third stage, they are taught to skip unnecessary details, examples, restatements, summaries, and irrelevant and familiar material. In the fourth stage, they learn to read only the topic sentences in a reading material. In the last stage, they are given complete freedom to leaf through some reading material using the strategies they learned in the previous stages, meanwhile their speed is discretely monitored.

Closely associated with skimming is the scanning technique, an intense target-oriented search for specific information. Without high speed skimming, locating information in texts is extremely slow. Furthermore, a good knowledge of the organization of information in a text is crucial to successful scanning. If one wants to find in a telephone directory a specific number, they need at least two things: (1) the ability to skim-read without being distracted by irrelevant details, and (2) the knowledge that the directory consists of two column lists; one column for the names of telephone owners arranged alphabetically with the surname being first, and the other for the telephone numbers. Users will decide to look up the surname of the individual for whom the telephone number is sought. They do so, not by skim-reading all the names in the directory until they find it, but rather by flipping through the pages looking at the key letters at the top to locate the page with the sequence of letters closest to that in the surname. Then they skim-read the few names that share the sequence until they find the surname they are looking for. The target number will appear in the second column opposite the name.

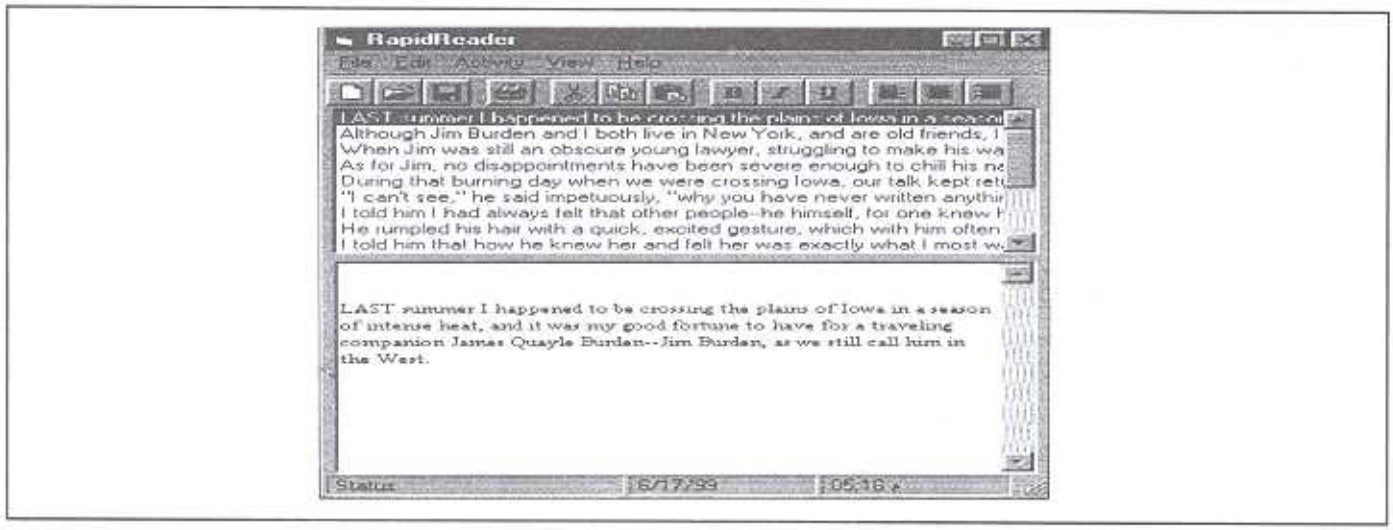

Figure 10. Summarization Form.

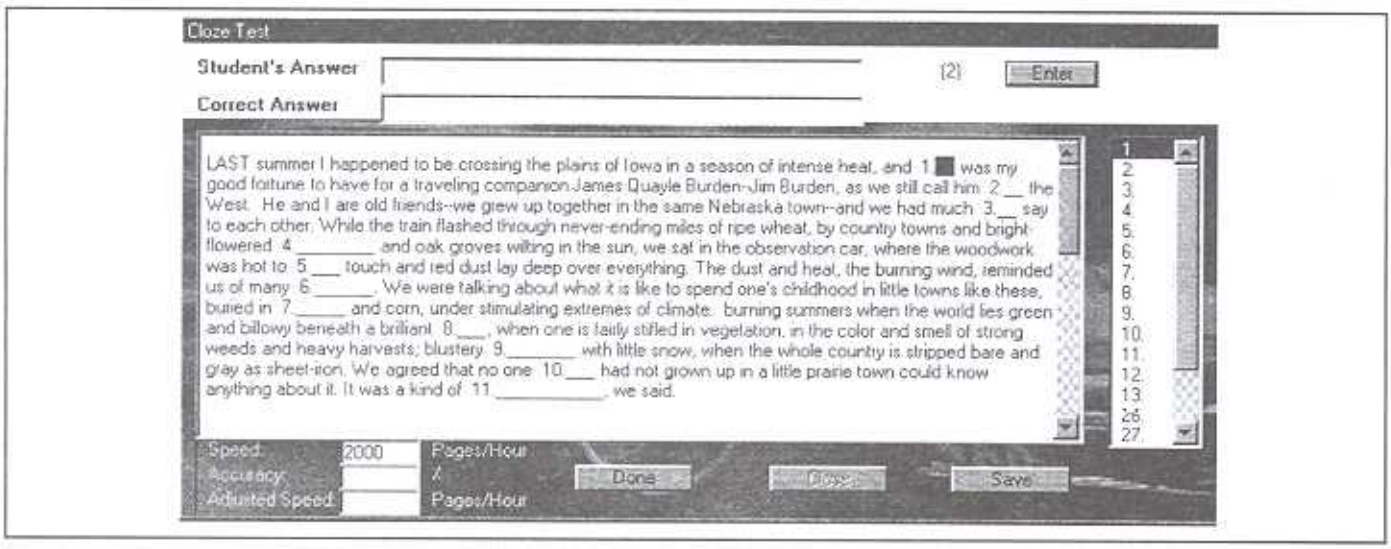

Figure 11. Cloze Test Form.

Scanning is hard to teach, but the various skills fostered by RapidReader are instrumental in honing a user's scanning technique. The cognizance activity trains them to focus better, the eye movement to move their eye muscles fast, the skimming to skip the unnecessary information and focus only on the relevant.

What RapidReader offers to develop users' scanning technique are two things: a brief explanation about information organization, and exercises in scanning different types of material. It offers a concise description of how essays, narratives, hard news stories, and feature newspaper articles are organized, and concisely introduces the traditional rhetorical styles. Most importantly, RapidReader offers exercises that help users state their queries precisely and train them on how to find information and where to search. There are exercises that are based on telephone directories, dictionaries, indices, bibliographies, statistics tables, road maps, etc.

SUMMARIZATION: A unique feature of RapidReader is the facility in which the skills of reading are integrated with those of writing and grammar. It tests users' understanding of the material they read for comprehension or did skim-reading on by requesting that they either summarize it (Figure 10) or complete a modified cloze comprehension test (Figure 11). The first is an open-ended test in which learners are asked to give a synopsis of the main ideas in the passage that they read. It is a teacher-marked rather than a computer-marked test, so it gives the teacher the opportunity to assess their students' overall comprehension of a reading passage and their general language proficiency at the same time.

The cloze procedure in its standard form, on the other hand, requests students to supply the missing n^{th} words in a copy of a passage they read. It is a classical test that has come under attack; critics (eg, Shanahan, Kamil, and Tobin (1982) and Klein-Braley (1984)) are not happy with the arbitrary deletion of every n^{th} word in a passage and claim that

such a random deletion procedure does not provide a reliable measure of language proficiency or reading ability. For this reason, RapidReader gives the learner choice. It offers traditional as well as modified cloze tests. The modified version of the cloze procedure is where only key words are deleted, the key words that the teacher deletes manually. Undoubtedly, a student who succeeds in comprehending a skimmed or rapid-read passage must be able to supply missing key words in a reproduced version of it.

DATA SETUP WIZARD: To offer teachers the most flexibility, RapidReader allows them to setup reading material of their choice for each and every activity, be it a placement test, or a comprehension, cognizance, eye movement, concentration, vocabulary building activity, or a word game. RapidReader is unique in this regard. Many speed readers on the market are less versatile; they confine training to the supplied data.

With its data setup wizard, RapidReader avoids limiting learners to the reading material in its database. Teachers can use the data wizard to format their own material in a way that can be read by RapidReader. If they decide to teach a long novel, it would not be appropriate to load the whole novel and defer comprehension until the end. The data wizard, with guidance from the teacher, can divide up the novel into chapters. It can also prompt them to type their comprehension questions in a text field, then ask them to enter their multiple choice answers in separate fields and to tag the correct answer. The wizard also formats the word and phrase lists used in cognizance and eye movement, the synonym and antonym lists used in concentration, the word and conventionalized expression lists used in vocabulary building, the skimming and scanning data, and the words used in the word games.

Real World Test

RapidReader has been under testing for the past two years at an English department that teaches language skills to non-native learners of English; this department is where the first author works. Once the program is fully developed, an attempt will be made to test it out with students of Arabic as a foreign language.

To learn about the value of this program in the teaching of English reading skills, an experiment was conducted. The participants were 28 first year students at the English Department, Sultan Qaboos University. The reading passage used for the test was a short story by Guy de Maupassant, entitled "The Hand". Students were given this story as part of a placement test in the first week of semester to find out their reading speeds upon entry into the course. Students were asked to read the story for comprehension as fast as they could and were told that the computer would time them as they started and finished, then they would be tested on their comprehension with multiple choice questions. They were able to flip pages on the computer in a forward direction but not in a backward direction to prevent getting from the passage answers to the subsequent multiple choice questions. There was neither a time limit on answering the multiple choice questions nor students were timed. At the end of semester and after 14 weeks of training with RapidReader, a comprehension post-test was administered to the same students under similar test conditions. The reading passage used was another of Guy de Maupassant's short stories, "The Hair Pin".

Repeated measures analysis of variance was applied to students' reading speed values on the pre- and post-tests, to find out if they differed significantly. The results in Table 1 were obtained.

There was a clear difference between the class' scores on the pre- and post-tests [$F(1,27)=328.447$, $p<0.0001$)] (Table 1), indicating that reading with RapidReader does in fact improve reading speed. The class' mean reading speed upon entrance into the course was 9.964 p/h, whilst their mean speed at the conclusion of the course was 18.929 p/h, an improvement of almost nine pages; i.e., the class was able to almost double their reading speed. It must be noted that all the speed values mentioned here are comprehension-adjusted unless otherwise stated; i.e., students' raw reading speed values are scaled down by their comprehension scores. If we consider the differences among students, we will notice that they remained unchanged over the pre- and post-tests [$F(27,28)=0.36$, $p<0.9952$]. This implies that slow students in the pre-test remained relatively slower than other students despite the improvement that happened to their reading speed. Figure 12 depicts the improvement that each student made between the times of the pre- and post-tests.

Notice the students' differential improvement over the two tests. The case of students 1 and 16, on the one hand, and 7 and 18, on the other, illustrates extreme examples of the ones who improved their speed the most and those that improved it the least. Student 1 acquired an additional speed of 14 p/h when she moved from 6 p/h on the pre-test to 20 p/h on the post-test, and student 16 improved her speed by 19 p/h, moving from 5 to 24 p/h on the experimental tests. On the other hand, students 7 and 18 improved by 3 p/h each, moving from 14 to 17 p/h and 9 to 12 p/h respectively. Evidently, computer-assisted language learning software does not benefit all students in a uniform way; nevertheless, this graph shows a clear overall improvement for the class as a whole.

Target speed is the raw speed at which a student reads a passage, whilst attained speed is the target speed scaled down by the comprehension score that the student obtains. Thus, if one read a passage with RapidReader at a pre-set raw

TABLE 1

One Factor Anova-Repeated Measures for Pre-Test (p/h) vs Post-Test (p/h).

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Between subjects	27	422.339	15.642	0.36	0.9952
Within subjects	28	1217.5	43.482		
treatments	1	1125.018	1125.018	328.447	0.0001
residual	27	92.482	3.425		
Total	55	1639.839			

Reliability Estimates for-all treatments: -1.78 Single Treatment -.471

Comparison:	Mean Difference:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Pre-Test vs. Post-Test	8.964	1.015*	328.447*	18.123

*Significant at 95% level

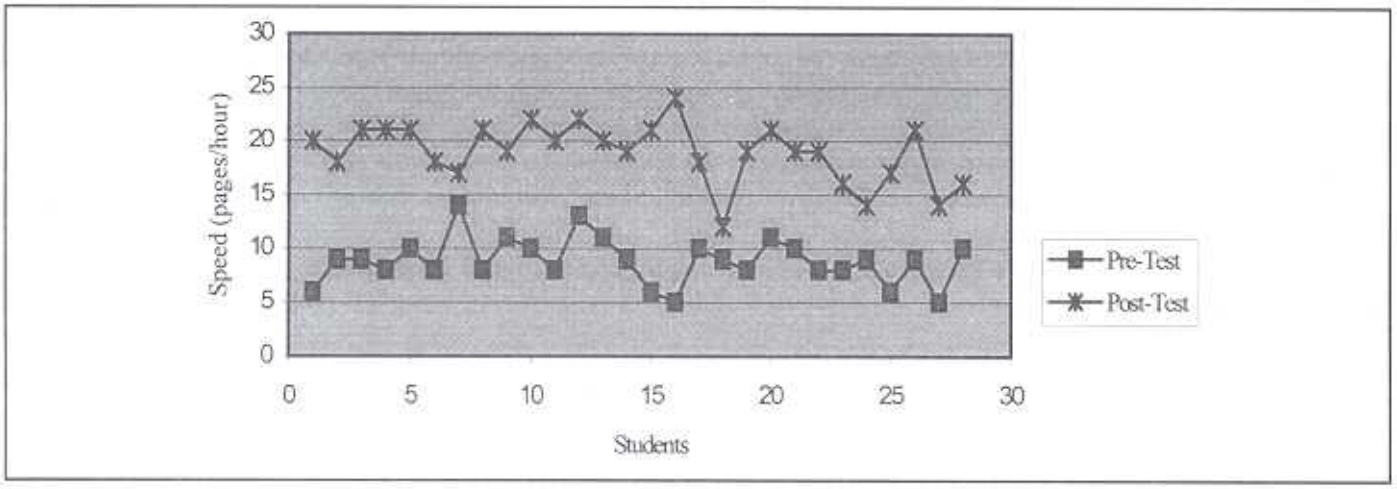

Figure 12. Invividual Reading Speed.

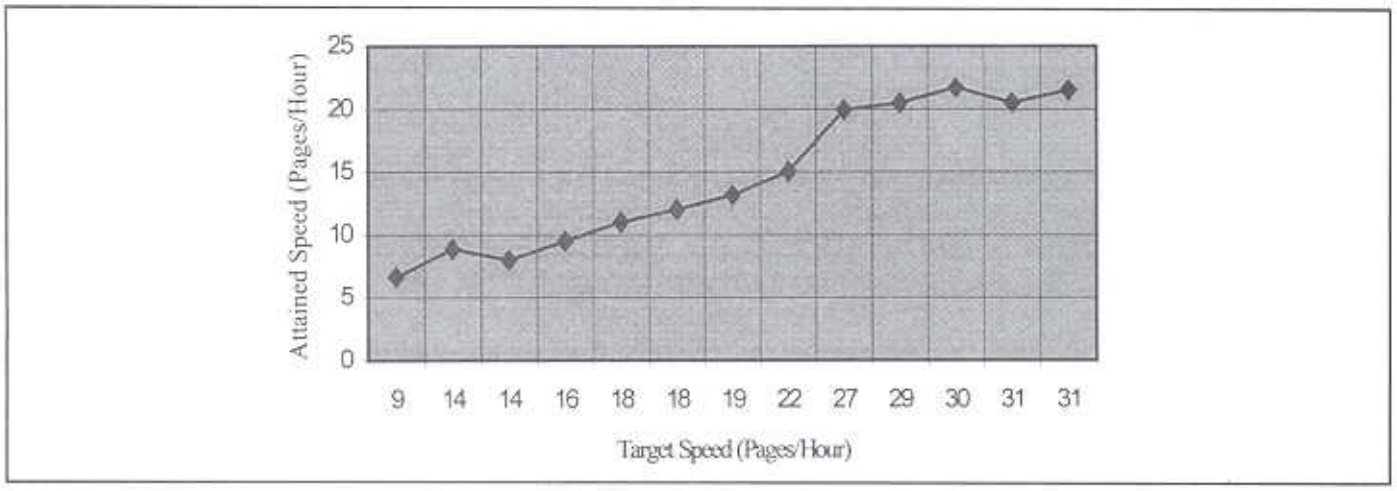

Figure 13. Target Vs Attained Speed Over a Period of 14 Weeks.

speed (i.e., target speed) of 22 p/h, for instance, and they got a score of 80% on the test that examines their comprehension, then their attained speed would be recorded as 17.6 p/h (being 80%*22). Figure 13 depicts mean class reading speed plotted against the pre-set target speed that the class read at. Each point on this graph represents the mean speed of the class in one test. Tests were at least one week apart except in the cases of repeated values on the X-axis; these represent tests that were given one day apart.

TABLE 2

One Factor Anova-Repeated Measures for Post-Test (%) vs Pre-Test (%).

Source	df:	Sum of Squares:	Mean Square:	F -test:	P value:
Betweensubjects	27	5106.214	189.119	3.19	.0016
Within subjects	28	1660	59.286		
treatments 1	1	330.286	330.286	6.706	.0153
residual	27	1329.714	49.249		
Total	55	6766.214			
Reliability Estimates for- All treatments:			.687	Single Treatment:	.523
Comparison:		Mean Diff.:	Fisher PLSD:	Scheffe F-test:	Dunnett t:
Pre-Test vs. Post-Test %		4.857	3.849*	6.706*	2.59
*Significant at 95% level					

Notice that the improvement of reading speed over the duration of one semester is incremental. Because the class was not formally tested at regular intervals, one can see a sudden jump at the target speed of 27 p/h but that is not a genuine sudden improvement. It appears that speed improvement becomes harder as the number of pages increases but that will need to be verified experimentally. Albeit, the CALL specialist author of this paper has never had the chance to teach the same group of students a second level reading course; therefore, it has not been possible to check if improvement will stagnate at higher target speeds.

The magnitude of difference between target and attained speed in Figure 13 is worthy of observation. At lower reading speed this difference is small (e.g., between 9 and 6.6 in the first test, being 2.4 p/h) but it becomes larger at higher target speeds (e.g., between 31 and 20.5 in the test before last, being 10.5 p/h). Does this imply that comprehension deteriorates at higher reading speeds or will it improve with more practice? Once again, without teaching the same group of students a higher level reading course it would be difficult to find out the answer.

In terms of comprehension, the class' mean score (analyzed in Table 2 above) does not appear to have improved by the end of semester. The score was 80.75% on the pre-test but was 75.89% on the post-test. This should not be interpreted as deterioration in comprehension due to reading speed improvement, however. As explained above, the speed values that were considered throughout this study are those normalized by comprehension. Therefore, they themselves reflect comprehension. The claim that both reading speed and reading comprehension doubled is justified. In fact, the mean score on the post-test is quite positive; it effectively says that despite the doubling of reading speed, students' comprehension did not deteriorate.

Conclusion

RapidReader is a comprehensive reading package that is demonstrably capable of improving both reading speed and reading comprehension. It can be used to teach English or Arabic, reading or vocabulary, comprehension or speed reading. It is based on sound psycholinguistic theory and good pedagogy. It has some outstanding unique features that make a significant contribution to CALL. We further conclude that CALL systems can be effective teaching tools. In order for them to achieve the goals they are intended for, however, teachers and students must have a positive atttitude and enough enthusiasm.

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