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The relationship between keyboarding skills and self-regulated learning

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Keyboarding as writing apparatus is an essential skill in the technological era and more self-regulated learners perform better in keyboarding than less self-regulated learners. In order to indicate this, students registered at the Faculty of Arts for a compulsory keyboarding and word-processing course completed a questionnaire to identify both more and less self-regulated learners. From the literature it is deduced that keyboarding has become a necessary skill for writing in a technological era. The results of the empirical study indicated that self-regulated learners performed better in keyboard skills tests than less self-regulated learners.

Introduction

Technological progress and development has not only resulted in information being made available faster and easier, but it has put more pressure on computer users to develop skills (such as keyboard and computer skills) in order to best utilise the technology and to improve communication, for example, in the use of e-mail.

Higher education institutions also require their learners to have good communication, writing, and computer skills (Meadows, 1993:31), in view of the fact that these skills are used daily by professional and non-professional people and learners to find and store information, record thoughts and ideas, communicate and solve problems (Zimmerman & Rodrigues, 1992: 4; Flower, 1981:19). Duke (2000:1), Anonymous (1999:1), Jones (1996:88), Palar (1995:1), Steffee (1995:28) and Klopping (1993:41) are of the opinion that without the necessary keyboard and computer skills the potential of the computer cannot be fully realised. According to Cole (in Palar, 1995:1) computer keyboard skills have the same advantages for writing skills as the pocket calculator has for mathematicians.

The assertion is often made that first-year students do not possess the necessary thinking and writing skills which will allow them to achieve success in their fields of study (Swart, 1999:72; Zimmerman, 1997:73; Mitchell, 1999:11; Du Toit Heese & Orr, 1995:23). Deficient keyboarding skills and inadequate metacognitive abilities (Van der Riet, Dison & Quinn, 1998: 220) in learners are given as reasons for first-year students not succeeding in their studies. Swart (1999:74) stresses that students should receive training that will put them in a position to monitor their thinking processes while they are writing. Through continuous observation done by the first-mentioned author, it appears that learners have not mastered touch-typing and that they have to repeatedly look down at their hands while they formulate sentences which they key in by means of the keyboard. In addition, assignments handed in are generally riddled with typing and spelling errors.

Literature review

Keyboarding skill, as a motor skill, is defined as the ability of learners to key in information into the memory of the computer with the minimum effort and energy use. Hames (2000:1), Wentling (1992:30), Valdez and Sollie (1990:32), and Russon and Wanous (1973:69) are of

the opinion that learners can be considered as skilled keyboard users when they are able to accurately key in data into the memory of the computer in a minimum time, with minimum use of energy, and with a high degree of consistency and flexibility.

According to Russon *et al.* (1973:69; 120; 301) keyboarding skills consist of three facets, namely, perceptual-motor, sensory-motor and conceptual-motor skills. Keyboarding skills are regarded as a perceptual-motor skill, since learners are transferring text from a book or notes (perceptual skills) and have to plan the layout of the document, while with the use of their fingers (motor skills) they are keying in the information on the keyboard (Bower, 2000:7; Robinson *et al.*, 2003:2; Lee & Swinnen, 1993:295; Russon, 1973:120). On the other hand keyboarding skills are regarded as a sensory-motor skill, since, on the keyboard, learners must learn where the keys are situated while they type in data (Robinson *et al.*, 2003:2; Russon *et al.*, 1973:120). In addition keyboarding skill is regarded as a conceptual-motor skill, because learners must formulate sentences while they type (Russon *et al.*, 1973:307-310).

According to Weiss (2000:1) and Dembo (1991:269) short-term memory has a limited work capacity and information can only be remembered for a short while. McCutchen, Covill, Hoyne and Mildes (1994:256), as well as Hayes and Flower (1980:40) are of the opinion that: (a) the limited work capacity of the short-term memory; (b) the interactive nature of the writing process; and (c) the tempo of activation during which words are transferred from the long-term memory to the short-term memory to formulate sentences have a negative effect on the learner's ability to plan and revise whilst typing. In view of the limited capacity of the short-term memory, it is therefore necessary that automatisms are developed with regard to keyboarding skills and reading skills before learners can use the computer keyboard effectively.

Ineffective keyboarding skills inhibit learners' thought process (Parr, 1995:223) and the fluency with which they type because they are uncertain about the position of the letter keys. In consequence, the limited capacity of the short-term memory is overtaxed, because learners are simultaneously having to concentrate on keyboard skills, the formulation of sentences and the content of the learning task. The necessity of good keyboarding skills, as a requirement for writing skills and the prevention of the overloading of the short-term memory, is supported by the following extract:

> The writer needs to have complete command of the art of writing so that his entire attention may be placed upon the thought to be expressed rather than upon the form. In business it is absolutely essential that the mind be freed from all thought of technique or form, as a digression in thought or an ambiguous form may lead to great loss of time or money (Thompson, 1911:12)."

Keyboarding skills offer the same advantages for the computer user as the pocket calculator does for the mathematician and prevent the overloading of the short-term memory during the keying-in of data. Keyboard skills can thererfore be regarded as an essential computer skill (Pisha, 2002; Sudhindra, 2001:1; Zimmerman & Kitsantas, 1999:248), which raises productivity and promotes writing skills (Zimmerman & Risemberg, 1997:73; Ober, 1993:36; Wentling, 1992:30).

According to Zimmerman (1998:4) self-regulated learning consists of three phases, namely, the forethought phase, the performance or volitional control phase, and the self-reflection phase (see Figure 1). During the forethought phase the learner decides on his/her strategies and formulates goals for the execution of the learning task. In the second phase, the performance or volitional control phase, the goals serve as guidelines for the execution of the learning task,

as well as for the monitoring of progress. In the last phase, self-reflection, the goals are used to evaluate the learner's plan of action during the execution of the task. The information gathered during self-reflection is used to make any adjustments, if necessary, to ensure the successful completion of tasks (Schunk, 2001:1). The phases and subprocesses of Zimmerman's model for self-regulation are illustrated in Figure 1.

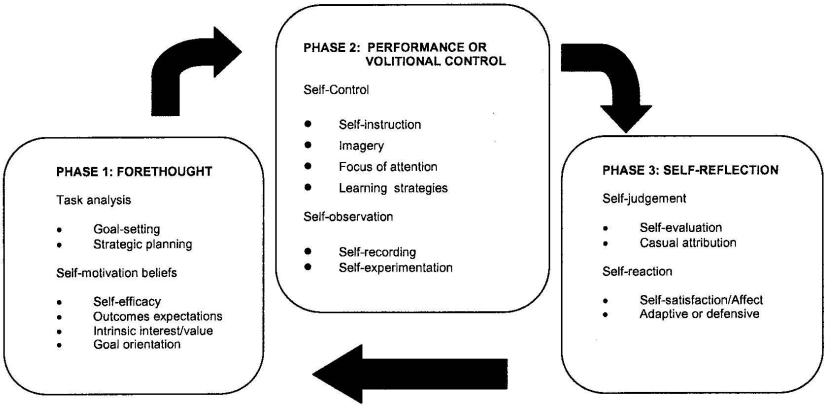

Figure 1 Diagram of the phases and subprocesses of self-regulated learning (Pintrich & Schunk, 2002:188; Zimmerman in Schunk & Zimmerman, 1998:137-159; and Zimmerman, 2000:16)

Phase 1 refers to all processes and expectations which are carried out by learners in advance so that learning can take place. The key variables in task analysis are the setting of goals and the formulation of a strategic plan for the execution of the learning task. Goals set standards for the learners by which they can measure their progress, and by which they are motivated, and they focus the learners' attention upon relevant task requirements and serve as a departure point for effective strategies for the completion of a learning task (Schunk & Ertmer, 2000:634).

Strategic planning (see Figure 1) refers to the selection of learning strategies (Zimmerman, 2000:16) or methods to obtain the goals set (Schunk, 1998:3).

Self-motivation consists of self-efficacy, outcomes expectations, intrinsic interest or value and goal orientation. Outcomes expectations refer to the results of certain actions during the execution of a learning task (Pintrich & Schunk, 2002:161; Bandura, 1997:22), whilst self-efficacy, in contrast, refers to the leaner's personal expectations, for example, that the learner will obtain an A symbol for keyboarding skills. Learners with high expectations of self-efficacy and high expectations of outcomes in terms of a learning task have more self-confidence, are more dedicated, persevere in the execution of a learning task, and have a higher cognitive commitment with regard to the task than learners with low outcomes expectations. From this it can be deduced that computer-typing students who are confident that they will master touch-typing

will be more motivated and dedicated than learners who think that their motor skills are inadequate.

In phase 2, the performance or volitional phase (Zimmerman, 2000:18), two types of controlled will processes are identified, namely, self-control and self-observation. Volitional strategies help the learner to achieve set goals by channelling the energies of the learner in the direction of the goals.

Self-control processes, such as self-instruction, imagination, focusing of attention, and learning strategies help the learners to focus and to optimise their efforts (Zimmerman, 2000: 18). Imagination and visualisation refer to the creation of pictures (for example, the layout of a QWERTY keyboard) in the thoughts and self-control processes which are used during the encoding of data (Zimmerman, 2000:19; Zimmerman, 1998:4; O'Malley, Russo, Chamot & Manzanares, 1988:220). These forms of self-control especially are used in conjunction with writing skills and keyboard skills (Lewis, 1991:23). According to Zimmerman (1998:8) less self-regulating learners are not always aware of the important role of imagination in the learning process. We corroborate Zimmerman's (1998:8) assumption that less self-regulating learners mostly make use of the trial-and-error method instead of mental rehearsal, during the learning of keyboarding skills.

The purpose of focusing attention is to improve the learner's concentration and to reduce covert processes (distinguishing between "b" and "d") and other external factors (noise in the computer room) which could hamper the execution of the learning task. More self-regulated learners are able to use various techniques to improve their attention focus, for example, in the control of their learning environment, the elimination of disturbances in learning environments and not continually becoming bogged down by previous errors (Zimmerman, 2000:19).

Metacognitive knowledge, which is an important component of self-regulating learning, is used by learners to formulate learning strategies (Schunk, 2000:401). Self-regulating learners will, amongst other things, make good use of repetition as a learning strategy while developing keyboard skills, and of organisation, expansion and concept monitoring during the keying-in of data with the keyboard.

Self-observation is regarded as the metacognitive awareness of the learner of him/herself as learner (McCombs, 1986:10) and consists of two processes, namely, keeping one's own records and self-experimentation (Zimmerman, 2000:17). A typical example of record-keeping would be the speed report cards and the technique control cards which are completed by learners in the computer room, particularly during introductory instruction, to monitor the progress in technique and typing speed (Enslin, Saayman & Weitz, 2001:232; Russon *et al*., 1973:216-219).

Self-reflection is the third phase in Zimmerman's model for self-regulated learning and consists of two subprocesses, namely, self-judgement and self-reaction. Self-judgement, which includes self-evaluation, refers to the process in which the learners evaluates him/herself in terms of set goals or previous achievements. If, during self-evaluation, learners become aware that their progress, in terms of the learning task, is not satisfactory (for example, frequently looking down at their hands while they type), one of the following can occur, the learners continue until they have mastered the set goals, or they give up (McCaslin & Good, 1996:662). Two forms of self-reaction are identified, namely, self-satisfaction and adaptive deductions (Zimmerman, 2000:23).

Self-satisfaction includes perceptions of satisfaction and/or dissatisfaction in terms of the

learner's achievements (Zimmerman, 2000:23). With regard to keyboarding skills, those learners who consider the necessity of keyboard skills in a technological era to be important, will experience a higher level of dissatisfaction if they get weak marks in a test, than those learners who do not consider them important (Zimmerman, 2000:23).

Adaptive or defensive deductions (see Figure 1) refer to the conclusions that learners must make with regard to the execution of their learning tasks (Zimmerman, 2000:23). Adaptive deductions are important in view of the fact that it is through them that learners can be led to new and better forms of self-regulation.

In Zimmerman's model for self-regulation, in terms of learning tasks, self-reaction influences the forethought processes of phase 1. Self-satisfaction raises the self-efficacy expectations, goal-orientation and intrinsic interest in a learning task of well self-regulated learners, whilst dissatisfaction lowers these in less self-regulated learners (Zimmerman, 2000:23).

This research had a dual purpose. Firstly to determine whether or not keyboarding skills are a necessary skill and secondly to determine whether there is a correlation between the achievements of more or less self-regulated learners with regard to keyboarding and writing skills or not.

The assumption is made here that more self-regulated learners are more successful in keyboard skills tests than less self-regulated learners. Self-regulated learners are regarded as learners who plan and manage their own learning (Stoney & Olivier, 1992:2) and have the ability to monitor and control their own cognitive processes through related metacognitive processes (Hacker, Dunlosky & Graesser, 1998:167). From the literature review on self-regulated learning, it appears that various characteristics of self-regulated learning are typical and necessary for the successful mastering of keyboarding skills. These qualities, for example, the ability to work independently (Head, 2003:2-3; Russon *et al.*,1973:328), self-evaluation (Russon *et al.*, 1973:179), and motivation (Head, 2003:5; Russon, 1973:4), are characteristic of learners and essential for successful mastering of keyboarding skills.

Research methodology

Study population

The study population consisted of 396 humanities students who attended a course in keyboarding skills and word processing as a compulsory module in their curriculum in the 1st semester, or its equivalent in the 2nd semester.

Students who attended the 1st semester module constituted the experimental group and those who took the 2nd semester module were the control group.

A preliminary test consisting of components, namely, keyboard skills, application of word-processing functions, accuracy, as well as language, content, and context was typed by both the experimental and the control groups. *D* values were calculated after the test was typed to determine whether these two groups, at the time of the research, were more or less on the same level in their keyboarding skills, application of word-processing functions, accuracy, language, content and context. The conclusions which could be drawn (see Table 1) were that the two groups, with regard to keyboarding and writing skills at the time of the preliminary test, were more or less on the same level and therefore in terms of self-regulation and the influence of the study programme could be compared with each other.

Table 1 Difference between experimental and control groups in keyboarding and writing skills at preliminary test level

	Number		Average		SD		Minimum		Maximum		Effect size
Differences	E	C	E	C	E	C	E	C	E	C	
Test total	105	56	55.5	56.5	18.5	15.3	15.0	20.0	88.0	99.0	0.054
Keyboarding skills	105	56	10.1	10.3	8.4	8.4	-	-	20.0	20.0	0.026
Word processing functions	105	56	11.8	13.3	8.3	9.0	-	-	25.0	25.0	0.164
Accuracy	105	56	8.5	5.6	5.6	5.5	-	-	15.0	15.0	0.520
Language content and context	105	56	25.2	26.3	2.0	3.5	15.0	18.0	33.0	38.0	0.310

Small effect: *d* value of 0.2
Medium effect: *d* value of 0.5
Large effect: *d* value of ≥0.8

- **Preliminary test total** = Total of question 1 and question 2
- **Keyboarding skills test** = Keyboarding skills with reference to question 1
- **Word processing prelim. test** = Word processing functions with reference to question 2
- **Preliminary accuracy test** = Accuracy with reference to question 2
- **Language, content and context prelim. test** = Language, content and context with reference to question 2

Measurement instruments and data sources

To obtain data on the relationship between keyboarding skills and self-regulated learning, the following measurement instruments and data sources were used:

1. A preliminary and a follow-up test, with six questions in terms of planning, self-evaluation and self-monitoring at the end of the preliminary and follow-up test; and
2. a self-regulation questionnaire (see Table 2).

Zimmerman's (1989:335) self-regulation strategy served as basis for this questionnaire. The response choices in the self-regulation learning questionnaire consisted of a 5-point Likert Scale, where 1= "not at all characteristic of me" to 5 = "very characteristic of me".

The Cronbach alpha coefficients of the subscale were calculated to determine the reliability of the questionnaire. Only self-regulated learning strategies with values above 0.5 were selected for this research and are marked with an asterisk in Table 2. On the basis of this criterion, the following six variables of self-regulated learning strategies were used: self-evaluation, organising, goal-setting, keeping record, socialising and other.

Procedures

A quasi-experimental design (De Wet, Monteith & Van der Westhuizen, 1981:102) was used in this investigation, in view of the fact that the population was not randomly selected.

A self-regulated learning questionnaire was completed in order to collect data on the extent of self-regulation of learners. These data were used to distinguish between the more and the less self-regulated learners. In order to separate the more self-regulated from the less self-

Table 2 Reliability of the subscales of self-regulating questionnaire

Subscales	Description	Cronbach α coefficient
Self-evaluation	Refers to the learner's ability to evaluate him/herself in terms of set goals or previous achievements.	0.63
Organisation*	Refers to the learner's ability to organise and process data.	0.64
Goal-setting*	Refers to the learner's ability to plan the execution of the learning task and to formulate goals to carry out the learning task .	0.65
Gathering data	Refers to the learner's ability to gather data by various means to perform the learning task.	0.31
Keeping records*	Refers to the learner's ability to keep records of his/her progress during the execution of the learning task.	0.72
Structuring of the learning environment	Refers to the learner's ability to structure the environment in which the learning task will be performed.	0.46
Self-reward*	Refers to the learner's ability to reward or punish him/herself for the results of the learning task.	0.28
Repetition	Refers to the learner's ability to utilise various learning strategies during the performace of the learning task.	0.32
Socialising*	Refers to the learner's ability to use various forms of learning, during the performance of the learning task.	0.60
Revision	Refers to the learner's ability to revise his/her work after the learning task has been completed.	0.44
Other*	Refers to learner's ability, during the execution of the learning task, to engage various actions which will promote learning, but which are not included in any of the above.	0.55

regulated learners, the 25% percentile served as cut-off point (see Table 4). Learners with a point higher than the cut-off point were classified as more self-regulated learners, whilst those with a point lower than the median were classified as less self-regulated.

During the first ten contact sessions of the keyboarding skills and word-processing course the learners received keyboard skills instruction. The"skip-around" method was used during the instruction. The minimum speed requirement to be met at the end of the ten contact sessions was 15 words per minute (w.p.m.).

After the learners had received instruction in keyboard skills, both the experimental group and the control group typed a test (preliminary test) of 50 minutes, during class time. After the completion of the preliminary test, the experimental group received instruction in the use of word-processing functions, as well as the use of several self-regulation strategies, such as planning, self-evaluation and self-monitoring during the writing process. The control group received no instruction in the use of word-processing functions and self-regulation strategies during the execution of a learning task.

After the experimental group received instruction in the use of word-processing functions and self-regulation strategies, a follow-up test was done in class time. The control group also typed a test, but had received no instruction in word-processing functions and self-regulation

strategies during the execution of a learning task before the follow-up test.

The purpose of the follow-up test was to determine the extent of the impact of the instruction in the use of word-processing functions and self-regulation strategies.

Results

In order to determine whether the students in the first semester group and those who had had a course in keyboard skills and word-processing in the second semester had the same abilities in keyboard skills, *d* values were calculated in order to determine to what extent the two groups differed in the various components of the keyboard skills test (see Table 1).

Cohen's *d* values were calculated in order to determine whether the difference between the more self-regulated and the less self-regulated learners, with regard to keyboarding skills as criterion, was practically significant (see Table 4).

The influence of the instruction on writing skills was determined by deducting the marks learners obtained in the preliminary test from those obtained in the follow-up test. This difference was used to determine whether the instruction the experimental group received had any effect on their writing skills (see Table 3).

Table 3 Influence of instruction in the use of word-processing functions and certain self-regulation strategies on writing skills

	Number		Average		SD		Minimum		Maximum		
Difference in	E	C	E	C	E	C	E	C	E	C	Effect size
Test total	105	56	12.3	5.5	13.8	11.5	–31.0	–26.0	51.0	40.0	0.5
Keyboarding skill	105	56	3.4	–0.01	5.3	5.6	–14.0	–20.0	20.0	18.0	0.6
Word processing functions	105	56	6.2	2.9	8.0	5.8	–18.0	–20.0	25.0	23.0	0.4
Accuracy	105	56	0.9	0.2	5.5	6.0	–15.0	–15.0	15.0	15.0	0.1
Language content and context	105	56	1.6	0.6	2.1	2.9	–6.0	–6.0	10.0	8.0	0.3

Small effect: 0.2

Medium effect: 0.5

Large effect: ≥0.8

- **Difference in test** indicates difference obtained by: preliminary test total minus follow-up test total
- **Difference in keyboard** skill indicates the difference obtained by: prelim. keyboard skill minus follow-up keyboard skill
- **Difference in word processing** indicates difference obtained by msw(prelim. test) minus msw(follow-up test) (msw = MSWord)
- **Difference in accuracy** indicates difference obtained by accuracy prelim. Test minus accuracy follow-up test
- **Difference in language, content and context** indicates difference obtained from prelim. typing test minus follow-up typing test

From Table 3 it can be deduced that the instruction in the use of word-processing functions and the use of self-regulation strategies during the execution of a learning task in terms

of the difference between the preliminary test and the follow-up test (d=0.5), and the difference between the preliminary test and follow-up test in keyboarding skills (d=0.6) had a moderate effect. The difference with regard to the word-processing functions between the preliminary and the follow-up tests (d=0.4), the difference with regard to language, content and context between the preliminary and the follow-up tests (d=0.3) and the difference with regard to accuracy between the preliminary and the follow-up tests (d=0.1) had a small effect and is therefore not practically significant.

The deduction that can be made from this is that although instruction in the use of word-processing functions and the use of self-regulated strategies during the execution of a learning task had no practically significant effect on the use of word-processing functions, accuracy and language, content and context, nevertheless writing skills were to some extent improved by instruction in word-processing functions and self-regulation strategies. This deduction was made based on the effect size (d=0.5) with regard to the difference between the preliminary test and the follow-up test (see Table 3).

Table 4 Difference between the more and the less self-regulated learners of the total population with regard to keyboarding skills as independent variable

Differences	Number		Average		SD		Minimum		Maximum		Effect size
	SGL	Non-SGL	SGL	Non-SGL	SGL	Non-SGL	SGL	Non-SGL	SGL	Non-SGL	
Test total	7	4	66.0	39.5	20.3	24.0	22.0	17.0	80.0	50.0	1.10
Keyboard skills	7	4	16.5	9.25	7.3	10.6	-	-	21.0	19.0	0.68
Word processing skills	7	4	14.5	6.2	10.4	9.4	-	-	25.0	20.0	0.80
Accuracy test	7	4	9.4	3.0	5.3	6.0	-	-	15.0	12.0	1.06
Language content and context	7	4	25.4	21.0	1.5	3.5	22.0	17.0	26.0	24.0	1.26

Small effect: d value of 0.2
Medium effect: d value of 0.5
Large effect: d value of ≥0.8

- **Test total** = Total of question 1 and question 2
- **Keyboarding skills test** = Keyboarding skills with reference to question 1
- **Word-processing test** = Word processing functions with reference to question 2
- **Accuracy test** = Accuracy with reference to question 2
- **Language, content and context prelim. test** = Language, content and context with reference to question 2

From the table the following can be deduced:
The difference, between more self-regulated learners and less self-regulated learners with regard to language, content and context (d=1.26), test total (d=1.10), accuracy test (d=1.06) word- processing functions test (d=0.80), was of great educational significance, whilst the keyboard skills test (d=0.68) had only a moderate significance.

These effect sizes indicated that more self-regulated learners achieved better results in

keyboarding and writing skills than less self-regulated learners. Based on the results of the investigation it appeared that:

- More self-regulated learners are better achievers in keyboarding skills tests than less self-regulated learners.
- More self-regulated learners are better achievers in writing skills tests than less self-regulated learners.
- Instruction in certain word-processing functions and the use of self-regulation strategies can improve writing skills to some extent.

The conclusion that can be made is that well self-regulated learners are better achievers in keyboarding skills tests and writing skills tests than very poorly self-regulated learners.

Recommendations

From the literature study it appears that keyboarding skills are a necessary skill. If this skill is mastered in the form of touch-typing, it can greatly improve the productivity of computer users, since they will not be continually searching for the letter keys on the keyboard whilst keying in data. Furthermore it can also contribute to better sentence construction as the computer user can mainly make use of his/her short-term memory for the formulation of sentences.

It is recommended that the moment learners begin to use the computer keyboard as a writing tool, they should receive instruction in the correct posture and keyboarding skills and techniques, since incorrect keyboard techniques and habits, such as the hunt-and-peck method are difficult habits to break.

The use of self-regulating strategies must be taught, since self-regulated learning is not something that can be developed by simply giving learners a list of steps to follow. Learners' approach to learning must be altered. The above-mentioned requires demonstration by the teacher, continuous repetition and practice during the execution of learning tasks. The recommendation is that learners should receive instruction in self-regulated learning, in view of the fact that only seven out of the total population could be identified as more self-regulated learners. Furthermore, the statistics revealed that well self-regulated learners do better at keyboarding skills tests and writing skills tests than less self-regulated learners and therefore this indicates that a direct relationship exists between self-regulated learning and keyboarding skills. If learners possess keyboarding skills and are actively involved in their own studies they will be in a position to make a success of their studies in various disciplines.

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References

Anonymous 1999. A critical skill for the computer age. Gifted Child Today Magazine, 22:1-5.

Bandura A 1997. *Self-efficacy. The exercise of control.* USA: W.H. Freeman.

Bower GH 2000. A brief history of memory research. In: Tulving & Craik FIM (eds). *The Oxford handbook of memory*. New York : Oxford University Press.

Dembo MA1991. *Applying educational psychology in the classroom*, 4th edn. New York: Longman.

De Wet JJ, Monteith JLdK & Van der Westhuizen GJ 1981. *Opvoedende leer*. Pretoria: Butterworth.

Du Toit P, Heese M & Orr M 1995. *Practical guide to reading, thinking and writing skills.* Johannesburg: Southern.

Duke A 2000. *National study finds computer workers at risk for stress injuries.* Available at

http://biz.yahoo.com/bw/000329/ny_office1.html. Accessed 26 September 2001.
Enslin R, Saayman S & Weitz B 2001. *Rekenaartik vir Graad 10*. Enslin: Richardsbaai.
Flower L 1981. *Problem-solving strategies for writing*. Toronto: Harcourt Brace Jovanovich, Inc.
Hacker DJ, Dunlosky J & Graesser AC 1998. *Metacognition in educational theory and practice*. London: Erlbaum.
Hames R 2000. *Keyboarding and your child: keys to success*. Available at http://www.crews.org/media. Accessed 22 September 2001.
Hayes JR & Flower LS 1980. Identifying the organization of writing processes. In: Gregg LW & Steinberg ER (eds). *Cognitive processes in writing*. New Jersey: Erlbaum.
Head LWB 2003. *Typewriting/keyboarding instruction in elementary schools*. Available at http://www.usoe.k12.ut.us/ate/keyboarding/Articles/Bartholome.html. Accessed 2 March 2006.
Jones M 1996. 'The dinosaur' keyboard survives all comers. *Electronic Buyers' News*, 1034:1-2.
Lee TD & Swinnen SP1993. Automaticity variability and change in skilled performance. In: Starkes JL & Allard F. *Advances in psychology: cognitive issues in motor expertise*. Netherlands: Elsevier.
Klopping IM 1993. Don't lose control! *Business Education Forum,* 47:41-42.
Lewis SD 1991. Using mental training to enhance keyboarding instruction. *Business Education Forum,*23-25.
McCaslin M & Good L 1996. The informal curriculum. In: Berliner DC & Calfee RC (eds). *Handbook of educational psychology*. London: Prentice Hall.
McCombs BL 1986. The role of the self-system in self-regulated learning. Paper presented at the annual meeting of the *American Educational Research Association*, San Francisco, April.
McCutchen D, Covill A, Hoyne H & Mildes K 1994. Individual differences in writing: implications of translating fluency. *Journal of Educational Psychology*, 86:256-266.
Meadows S 1993. *The child as thinker. The development and acquisition of cognition in childhood.* London: Routledge.
Mitchell J 1999. Guiding students to develop academic writing skills. *Journal for Language Teaching*, 33:116-124.
Monteith JLdK 1990. Waarde van selfgereguleerde leer vir nuwe uitdagings in die onderwys. Suid-Afrikaanse Tydskrif vir Opvoedkunde, 10:453-459.
Ober S 1993. A philosophy for teaching keyboarding. *Business Education Forum*, 47:36-38.
O'Malley JM, Russo RP, Chamot AU & Stewner-Manzanares 1988. Applications of learning strategies by students learning English as a second language. In: Weinstein CE, Goetz ET & Alexander PA. *Learning and study strategies. Issues in Assessment, Instruction and Evaluation*. Toronto: Academic.
Parr JM 1995. When pens are *passe*: students reflect on written composition. *Journal of Research on Computing in Education*, 27:221-227.
Palar BH 1995. *The write stuff*. Available at http://www.findarticles.com/cf_0/m.../ article,jhtml?term=keyboarding+and+wordpro-cessing. Accessed 6 October 2002.
Pintrich PR & Schunck DH 2002. *Motivation in Education. Theory, Research and Applications*, 2nd edn. Ohio: Merrill Prentice Hall.
Pisha B 2002. *Rates of development of keyboarding skills in elementary school aged children with and without identified learning disabilities*. Available at http://www.cast.org/udl/Developmentof KeyboardingSkills353.cfm. Accessed 30 October 2002.
Prestebak J 2005. The truth about keyboarding and library media specialists. *MEMORandom*,14:1-10.
Robinson, Erickson, Crawford, Beaumont & Ownby 2003. *Methods of instruction for teaching keyboarding*. Available at http://www.usoe.k12.ut.us/ate/keyboarding/Articles/methodology.html.
Ropp MM 1998. *A new approach to supporting reflective self-regulated computer learning*. Available at http://ott.educ.msu.edu/tec/R&D/site98/site98ropp.html. Accessed 17 August 2002.
Russon AR & Wanous SJ 1973. *Philosophy and psychology of teaching typewriting*. Ohio:

Southern-Western.
Schunk DH 1991. *Learning theories: an educational perspective*. New York: Macmillan.
Schunk DH 1998. Teaching elementary students to self-regulate practice of mathematical skills with modelling. In: Schunk DH & Zimmerman BJ. *Self-regulated learning. From teaching to self-reflective practice*. New York: Guilford press.
Schunk DH 2000. *Learning theories: an educational perspective*. New Jersey: Prentice Hall.
Schunk DH & Ertmer PA 2000. Self-regulation and academic learning. Self-efficacy enhancing interventions. In: Boekaerts M (ed.). *Handbook of self-regulation*. San Diego: Academic.
Schunk DH 2001. *Self-regulation through goal setting*. Available at http://encass.uncg.edu/digest/2001-08.html. Accessed 14 August 2002.
Steffee J 1995. Teaching computer applications the right way. *Business Education Forum,* 28-35.
Stoney S & Oliver R. *Can higher-order thinking and cognitive engagement be enhanced with multimedia*? Available at http://imej.wfu.edu/articles. Accessed 17 April 2000.
Sudhindra BS 2001. *The art of acquiring the right skills*. Available at http://www.hinduonnet.com/the. Accessed 23 May 2002.
Swart M 1999. Righting writing wrongs through multimedia. *Journal for Language Teaching*, 33:72-70.
Thompson ME 1911. *Psychology and pedagogy of writing: a resume of the researches and experiments bearing on the history and pedagogy of writing*. Baltimore: Warwick and York.
Valdez G & Sollie S 1990. Keyboarding: a necessary traditional skill. In: Warger C. *Technology in today's schools*. Alexandria: Association for supervision and curriculum development.
Van der Riet M, Dison A & Quinn L 1998. Conceptual development through process-writing in a psychology II course. *South African Journal of Higher Education*, 12:220-226.
Weiss RP 2000. *Memory and learning*. Available at http://www.com/cf_0/m4467/10_54. Accessed 14 August 2002.
Wentling RM 1992. Business professionals and keyboarding skills. *Business Education Forum,* 30-32.
Zimmerman D & Rodrigues D 1992. *Research and writing in the disciplines*. Tokyo: Harcourt Brace Jovanovich College Publishers.
Zimmerman BJ & Risemberg R 1997. Becoming a self-regulated writer: a social cognitive perspective. *Contemporary Educational Psychology*, 22:73-103.
Zimmerman BJ 1989. Models of self-regulation: learning and academic achievement. In: Zimmerman BJ & Schunk DH (eds). *Self-regulation and academic achievement: theory, research and practice*. New York: Springer-Verlag.
Zimmerman BJ 1990. Self-regulated learning and academic achievement: an overview. *Educational Psychologist*, 25:3-17.
Zimmerman BJ 1998. Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instruction models. In: Schunk DH (eds). *Self-regulated learning. From teaching to self-reflective practice*. London: Guildford press.
Zimmerman BJ & Kitsantas A 1999. Acquiring writing revision skill: shifting from process to outcome self-regulatory goals. *Journal of Educational Psychology*, 91:241-250.
Zimmerman BJ 2000. Attaining self-regulation. A social cognitive perspective. In: Boekaerts M, Pintrich PR & Zeidner M (eds). *Handbook of self-regulation*. New York: Academic.

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