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The effects of personalized software assignments on computer knowledge and attitudes toward computers in a college-level computer literacy course: An experiment on constructivism

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THE EFFECTS OF PERSONALIZED SOFTWARE ASSIGNMENTS ON COMPUTER KNOWLEDGE AND ATTITUDES TOWARD COMPUTERS IN A COLLEGE-LEVEL COMPUTER LITERACY COURSE: AN EXPERIMENT ON CONSTRUCTIVISM

by

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ABSTRACT

THE EFFECTS OF PERSONALIZED SOFTWARE ASSIGNMENTS ON COMPUTER KNOWLEDGE AND ATTITUDES TOWARD COMPUTERS IN A COLLEGE-LEVEL COMPUTER LITERACY COURSE: AN EXPERIMENT ON CONSTRUCTIVISM

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The purpose of this true experimental study was to examine one aspect of constructivism: the effects of assignments or projects that were personalized for each student. The effects were evaluated in the context of college-level, introductory computer literacy students' achievement in both software proficiency and general computer literacy. This study also examined the students' attitudes toward computers, time spent to complete the projects, and resources consulted.

The study took place during eight weeks in the summer of 1993. During that time, the treatment group attended three hours per week of traditional instruction in computer literacy and 13 periods of labs (three hours each) in which they were taught

three software applications. They were instructed formally for one hour each lab period and, for the remaining two hours they worked on projects that were purposively personalized. Control group students followed exactly the same program except that their assignments did not contain any kind of personalization. Posttests were administered to all 108 students in software proficiency, computer literacy, and attitudes toward computers. Students also reported their uses of resources and the time they took to complete the projects.

This study's findings supported the constructivist position that personalizing encourages students to find alternative frameworks leading to better achievement (Perkins,1991b). When compared to the control group (n=56), the treatment group (n=52) showed higher computer literacy scores (df=1,106; F=4.01; $p<.05$). The interaction between group membership and gender was also significant (df=1,101; F=14.02; $p<.05$) as well as group membership and age (df=1,103; F=5.66; $p<.05$) for computer literacy scores. This suggests that the treatment may have been most effective for females and students older than 22 years of age. Finally, the interaction between group membership and previous instruction showed that students in their first computer course may have been disadvantaged by the constructivist treatment (df=1,104; F=6.27; $p<.05$). Those results supported the constructivist position that previous knowledge of the subject facilitates new learning constructions. The results also supported the constructivist position that females prefer a constructivist environment (Edmonson, 1989). No evidence was found that the treatment influenced software proficiency nor attitudes.

Suggestions for future research include the use of a larger sample, additional instructors, a pretest, the inclusion of variables related to the subjects (SES, major, ethnic origin), prescriptions to specific types of students, and a further investigation of the role of age and gender in constructivist instruction.

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CHAPTER 1

INTRODUCTION

The basic goals of education could be expressed as the retention, understanding and active use of knowledge and skills (Perkins, 1991a). Educators have found over the years that even though these goals are simple and obvious, they are noticeably hard to achieve. Fortunately, practitioners can rely on models and learning theories to help them in this difficult task. Two such theories are the information processing theory and constructivism.

Information processing is an objectivist theory. Objectivism can be described as a characteristic of a group of learning theories based on the idea that students' minds are a clean slate concerning the subject matter to be taught and that reality is something that comes from outside, more precisely from the teacher. Objectivism or positivism often means a heavy emphasis on memory, practice, lecture and repetition. It also means that the student's previous knowledge is considered erroneous or irrelevant and that it must be replaced by the new knowledge. In computer science or literacy, objectivism assumes that students have a fragmented or erroneous understanding of computers and consequently every piece of knowledge must be taught in detail and every procedure must be demonstrated. In the objectivist tradition, activities are carefully planned to maximize the retention of knowledge.

In constructivism, learning is a process that comes from inside one's mind. Constructivists believe that each learner confronts the external reality with his/her own reality, resulting in a more integrated knowledge. In practice, in a computer science or literacy class, constructivists would assume that students already have some knowledge about computers and therefore, that previous knowledge must be dealt with. This can be achieved by encouraging discussions, probing each student, and giving them assignments with a structure that is not imposed by the teacher but rather a flexible context chosen by the students and leading to a predetermined goal.

These theories (constructivism and information processing), like all learning theories, were proposed to enhance the learning process. They are also the learning theories of choice in educational technology (Perkins, 1991a). However, the supporters of each of these theories are involved in a very active debate, as shown in two special issues of *Educational Technology* in 1991. With this study, I gave an experimenter's point of view in the debate between objectivism and constructivism, by testing the effectiveness of an important aspect of constructivism: assignments in a personalized context.

Purpose of the Study

This study was conceived to compare personalized computer assignments and traditional computer activities dictated by the instructor. The purpose of this study was to determine if personalized computer lab assignments produce an effect on achievement in both software proficiency and computer literacy as well as on attitudes toward computers. Also, this study was designed to examine the effect of personalization on other variables of interest like software integration, reference consultation, faculty or peer involvement, skills learned, students' positive of negative comments, and time taken to complete the projects.

As Clark (1983) recommended, this research study focused on the characteristics of instructional methods instead of media type. More recently, he emphasized prescriptive research instead of descriptive research, therefore encouraging experiments with treatments that can be prescribed in a practical setting, and to specific learners (Clark, 1989). Glaser and Bruner (cited in Clark, 1989) suggested such experiments as well. Reigeluth (1989) also strongly favored prescriptive research. To make an analogy with swimming lessons, it is probably not the presence or absence of a pool that determine success in teaching swimming but rather what activities take place in that pool. By using a treatment involving activities personalized to each learner, as suggested by constructivists, this study addressed several questions.

Research Questions

Were the types of lab activities an important feature in producing different subject knowledge in general computer literacy and software proficiency? Were they also influential in the development of attitudes toward computers? To be more specific, did personalized assignments produce a different effect on achievement and attitudes than assignments that were structured by the teacher? Moreover, was the treatment more effective on certain types of students than others, like males or females, younger or older students, students that were previously acquainted with computers by way of ownership or past instruction or students that were totally novice? Finally, did personalized activities encourage students to work longer and consult more references and people as judged by the researcher using a review sheet completed by the students and by telephone interviews?

Hypotheses

Research hypotheses

1. College students enrolled in a computer literacy course that employs personalized assignments (Treatment) will have greater achievement in software proficiency and computer literacy than similar students enrolled in a computer literacy course that employs predetermined assignments (Control).

2. College students enrolled in a computer literacy course that employs personalized assignments (Treatment) will have more positive attitudes towards computers than similar students enrolled in a computer literacy course that employs predetermined assignments (Control).

3. College students enrolled in a computer literacy course that employs personalized assignments (Treatment) will dedicate more time to their assignments, consult more references and experts, integrate more pieces of software, collaborate more with their peers, learn a greater amount of skills and be more positive about their lab experience than similar students enrolled in a computer literacy course that employs predetermined assignments (Control).

Null hypotheses

Ho1: There will be no significant difference in software proficiency achievement between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control), when the effects of gender, age, home computer ownership and prior computer instruction are controlled.

Ho2: There will be no significant difference in computer literacy achievement between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control), when the effects of gender, age, home computer ownership and prior computer instruction are controlled.

Ho3: There will be no significant difference in attitudes toward computers between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control), when the effects of gender, age, home computer ownership and prior computer instruction are controlled.

Ho4: There will be no significant difference in the number of references consulted between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control).

Ho5: There will be no significant difference in the number of pieces of software integrated in the projects between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control).

Ho6: There will be no significant difference in the number of faculty members consulted between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control).

Ho7: There will be no significant difference in the number of student collaborations between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control).

Ho8: There will be no significant difference in the time dedicated to complete the projects between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control).

Ho9: There will be no significant difference in the number of times the assistants were consulted between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control).

Ho10: There will be no significant difference in the number of extra hours spent in the lab between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control).

Ho11: There will be no difference in the number of skills that students report as learned (Ho11a) or useful (Ho11b) between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control).

Ho12: There will be no difference in the number of positive comments (Ho12a), negative comments (Ho12b) and steps taken (Ho12c) between the group that had assignments in a personalized context (Treatment) and the group that had assignments in a predetermined context (Control).

Finally, Clark (1989) suggested that instructional technology research focus more on subjects' characteristics, therefore adding to the specificity of the prescriptive treatments to better fit each learner. These following null hypotheses addressed that suggestion.

Other Null Hypotheses (Interactions)

Ho13: There will be no significant interaction between group membership and gender on software proficiency (Ho13a), computer literacy (Ho13b) and attitude scores (Ho13c).

Ho14: There will be no significant interaction between group membership and age on software proficiency (Ho14a), computer literacy (Ho14b) and attitude scores (Ho14c).

Ho15: There will be no significant interaction between group membership and computer ownership on software proficiency (Ho15a), computer literacy (Ho15b) and attitude scores (Ho15c).

Ho16: There will be no significant interaction between group membership and previous computer instruction on software proficiency (Ho16a), computer literacy (Ho16b) and attitude scores (Ho16c).

Operational Definitions

The operational definition of subject knowledge was the scores obtained on the final exam of the course. This knowledge was divided between general computer literacy and software proficiency (Word, SuperPaint and Excel). The attitudes toward computers variable was measured by the CAIN or Computer

Anxiety Index (version AZ). The CAIN was developed by Michael R. Simonson and his research team at Iowa State University and is described in the instruments section.

A student was defined as traditional if he or she had not interrupted his/her studies previously. This definition encompassed students who were 21 years of age or younger. Everyone else was considered a nontraditional student. Martin & Martin (1988) used the same definitions.

Justification of the Study

Scragg (1987) stated that research in computer science education was important and "necessary to build a new department and is recognized among computer scientists as a valid research area" (p. 41). Moreover, the popularity of computer science courses is still very high and is an essential component for all majors these days as pointed out by Locklair (1991). He reported that a recent engineering alumni survey conducted by the University of Idaho showed that 69% of the graduates declared that there should be more emphasis placed on computer literacy in undergraduate programs.

For all the years that they have been around, computers have always been considered difficult to work with and were understood by only an elite. In that respect, computer science and manual skills are similar; they need efficient instructional techniques to provide understanding, retention and active use (Perkins, 1991a).

There are many learning theories that can be applied to teach the skills required to be computer literate. One of those, as suggested by Posner & Keele (1973), is the information processing theory. In that theory, the learning process takes the form of a loop linking the sensory system, the short-term memory system, the long-term memory system and the response system. The idea of a cyclic process was also mentioned by Best (1989), Lefrancois (1988), Slavin (1988) and by Anderson (1990) as an important part in any skill learning. The notion of computer activities and hands-on practice is then an essential component of computer literacy learning in the light of the information processing theory.

In an information processing point of view, the key to knowledge assimilation is to retain that information in the long-term memory and then be able to retrieve it at will. To obtain this, the knowledge must be mentally rehearsed (Slavin, 1988), to help the transfer from the short-term to the long-term memory. As Slavin (1988) pointed out, "the more mental processing we must do with a stimulus, the more likely we are to remember it" (p. 157). The information processing theory is the principal theory used by educational technology and computer-assisted instruction researchers (Perkins, 1991a). Its analogy with the computer's internal structure makes it a logical choice.

In the information processing theory, the relationship between theory and practice may be enhanced by three kinds of activity planning as described by Slavin (1988): 1. Distributed practice, or practicing regularly over a period of time, 2. Part learning, or the breaking of practice into smaller units and 3. Overlearning, or practicing beyond the point of minimal competency. The control group activities shared many of the characteristics related to the information processing theory.

The treatment activities were based on the constructivist theory. Constructivism, in contrast to information processing, is a newer theory which not everyone subscribes to in the educational technology community (Dick, 1991; Merrill, 1991). Constructivism emphasizes the construction of knowledge from individual learners' experiences (Jonassen, 1991b) and the adjustment of activities to each student (Koehler & Grouws, 1992). Constructivists do not believe in imposing existing packaged knowledge but instead they think that learning occurs when the students are in control over their activities (Cobb et al., 1991).

In constructivism, learning must take place in a realistic environment so that the knowledge can be transferred to other contexts (Dick, 1991; Mayer, 1992). In my study's treatment, that goal was achieved by providing students a flexible context in which they were encouraged to create original and personal outputs and layouts, therefore stimulating creativity, autonomy and reliability on their own previous knowledge. In constructivism, the learner does more than just rehearsing and shuffling information. He/she makes hypotheses and tests them using the apparatus (Perkins, 1991a). In my study, the treatment group activities were not a list of pre-defined operations to achieve a goal. In fact, to concur with the constructivist theory, these activities were goal-oriented and not at all procedure-oriented. Moreover, constructivism prescribes the construction of thinking strategies. By choosing data to be included as well as the format to present it, students were stimulated to develop their own thinking strategies. Constructivism also emphasizes the benefits of negotiation over imposition (Koehler & Grouws, 1992). An ultimate form of negotiation is letting the students deal with their own beliefs, goals, abilities and experiences in constructing products that were intended as interesting for them.

Goal-oriented teaching is a moderate form of constructivism and in its more extreme format, constructivism emphasizes goal-free teaching (Cole, 1992). The moderate form of constructivism is also called BIG (beyond information given) in contrast with the more strict WIG (without information given). WIG constructivism is also known as discovery learning (Duffy & Jonassen, 1991a). The difference is that BIG permits general pointers at the beginning of a session, therefore isolating generality from context but it gives the advantage of learning from instruction compared to learning only from experience (Merrill, 1991). The fact that the students in my study received theoretical lessons and general software information showed a definite BIG orientation.

Constructivism also differs from objectivism in dealing with misconceptions. Two common misconceptions in computer literacy are that computers are either intelligent machines that will solve all problems or evil machines that will doom the universe. In an objectivist perspective, those conceptions would be considered wrong and then discarded in favor of the "truth". In constructivism, both conceptions are considered to have a part of truth in them, therefore the student can learn the "truth" without entirely discarding his/her previous knowledge. With predetermined assignments, the learner confronts his/her ideas with the teacher's and feels pressured to put his/her ideas aside and comply with the assignments' requirements. By substituting assignments that are learner-chosen, each person can better reconcile the knowledge that comes from school and the knowledge that comes from elsewhere, therefore diminishing a problem caused by decontextualized learning, a problem that arises when generalized learning in school clashes with situation-specific competencies outside the school (Resnick, 1987).

As noted by Perkins (1991a), understanding comes when the learner struggles with mental operations like probing, forecasting and transferring. In other words, people learn better when they are in control. From the constructivist point of view, there are no linear chains of instruction, and the learner has more control over his/her learning. After all, the basic goals of education are retention, understanding and active use (Perkins, 1991a; Dick, 1991), and every educator is interested in achieving these goals. This goal of achieving autonomy with technology was predicted by Papert (1980) more than a decade ago in his book *Mindstorms*. "Increasingly, the computers of the very near future will be the private property of individuals, and this will gradually return to the individual the power to determine patterns of education" (p. 37).

In summary, this study addressed an important subject of instruction (computer literacy) (Scragg, 1987; Stoob, 1984), using a valid instructional environment for computer literacy (information processing theory) (Perkins, 1991a) and one of the most current research topics (constructivism) in the educational technology field (CTGV, 1991; Kozma, 1991).

This study also departed from traditional media studies and emphasized the learner instead of the technology, as urged by Clark (1983, 1989, 1991). This study also adopted a prescriptive research methodology, evaluating the treatment effect on different types of learners, as suggested by Clark (1989) and Reigeluth (1989). Finally, since constructivism has sparked much interest in other disciplines like mathematics and at other levels like elementary school, it is my belief that an experiment on a specific aspect of constructivism in computer instruction at the college level may provide an important base for further computer science and literacy education research.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Computer Literacy

Computer literacy has been over the years the subject of a heated debate in the computer science community. Some as Barnes (1986), suggested a computer literacy course in a nontraditional way (television programs, telecourse textbook and guide, software application projects). Others like Baker (1990), Juliff (1990) and Martin & Martin (1988) addressed the issues of the background of computer literacy course takers and made suggestions for objectives and content of a computer literacy course. Again, Martin & Martin (1988) found that almost all students "believe that it is important to learn computer technology in general" (p. 239). Baker (1990) suggested explicitly the use of computer software packages like word processing, spreadsheet and programming. Biermann (1990) even proposed an approach that was more technical in content.

McCraken (1984), Leuhrmann & Spain (1984), Tannenbaum & Rahn (1984) and Wilson (1986) expressed different opinions on computer literacy. McCraken (1984) was very critical in his article of the computer literacy approach that was the paradigm at the time. He suggested that "computer literacy be put on hold, unless and until we find a meaningful definition of it, defensible goals, and achievable means of reaching these goals" (p. 243). He wanted to emphasize the failure in the early 80's to equate computer literacy with BASIC programming.

Leuhrmann & Spain (1984) advocated teaching computer literacy in one course rather than across the curriculum. Tannenbaum & Rahn (1984) addressed issues in teaching students who were neither mathematically nor scientifically oriented to apply computers to their intellectual and creative pursuits. Suggestions were made for designing an introductory computer literacy course. Wilson (1986) advised a laboratory approach to teaching computer literacy. She suggested nine week minicourses linking computer basics and encouraged wider student access to computers.

Another important problem challenging computer literacy teaching is the motivation of the faculty to teach those courses. In fact, "many Computer Science departments take a dim view of Computer Literacy and, as a result, fail to realize the rewards which can develop from a successful and exciting program" (Bailey & Tidwell, 1986, p. 26). As a result, computer literacy instructors are sometimes not really experts with computers and their use (Parker & Schneider, 1987). The Computer Science professors "may not want to teach CS service courses, but we must ask ourselves if we are willing to let other departments teach them for us and effectively lose control of their content" (Parker & Schneider, 1987, p. 424).

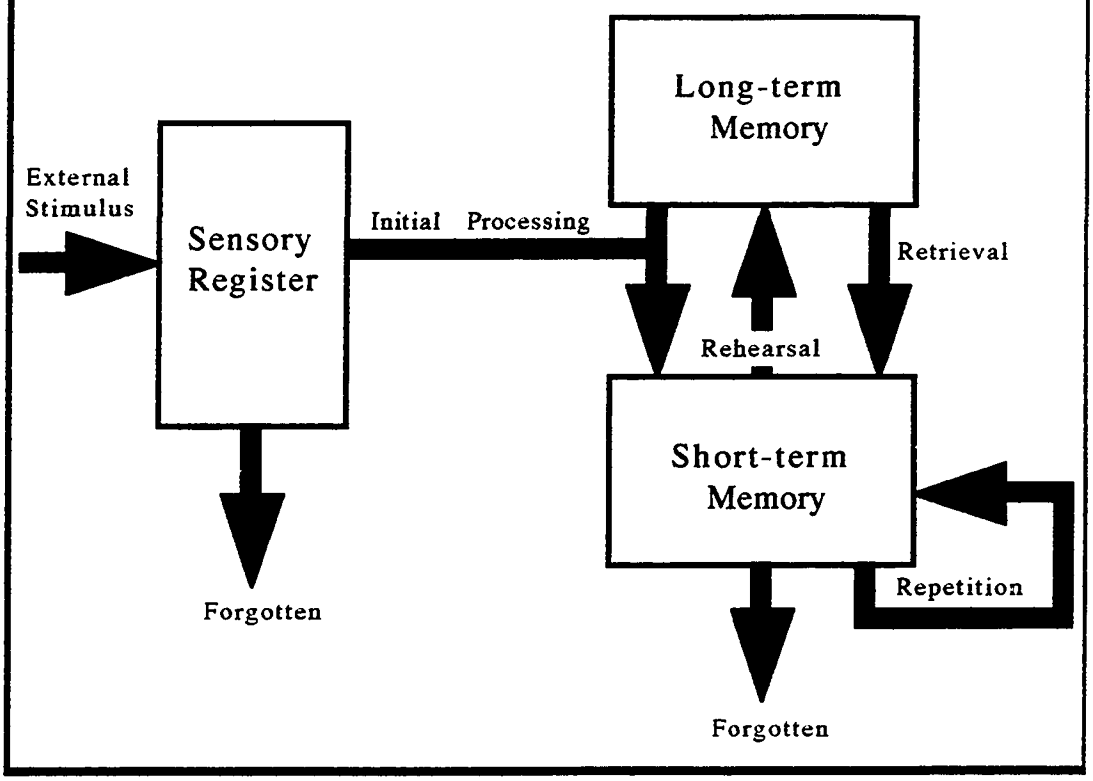
Computer science education specialists all agree that computer literacy is an important part in college education. Martin & Martin (1986, 1988) found that computer literacy classes improved students' knowledge of the role of computers in society. In a 1986 study, conducted in Jacksonville with 317 college students, 88% (traditional) to 95% (nontraditional) of the students felt that the course was important for their employment. Also, 56% (traditional) to 65% (nontraditional) thought that is was important as well in their home life. The 1988 study gave similar results on a sample of 395 college students. Then, 85.6% (traditional) to 94.2% (nontraditional) agreed that the course was important for their employment and 56.8% (traditional) to 70.5% (nontraditional) for their personal life. The effectiveness of computer literacy courses is also reported as a result of pilot projects developed by Ryder (1984), Dick, Black & Fenton (1987), Bailey (1987), Price, Archer & Moressi (1988) and Locklair (1991). However, these last experiments contained no quantitative information.

In conclusion, a comment by Sellars gave the real insight of what these courses are all about. "The aim of college computer literacy courses is to provide a broader supply of educated people who can help form public opinion and marshall public action from a solid base of knowledge" (Sellars, 1988, p. 59).

Information Processing

Information processing is a learning theory derived from cognitive psychology as opposed to behaviorism but in the objectivist tradition. The main interests of this theory are perception and memory. Information processing takes from a computer memory model showing three distinct areas: Sensory registers record the external stimuli from the senses, short-term memory stores the thoughts currently manipulated and long-term memory keeps large bodies of information permanently. Perception takes place only when the information is transferred from the sensory registers into the short-term memory, and learning when the content is transferred to the long-term memory. The information processing model has been associated with skill learning (Posner & Keele, 1973), therefore it is suitable to computer science learning. Figure 1 from Slavin (1988) shows the sequence of information processing.

FIGURE 1 - THE SEQUENCE OF INFORMATION PROCESSING



Note. From Educational Psychology - Theory into Practice (p. 145) by R. E. Slavin, 1988, Englewood Cliffs, NJ: Prentice-Hall. Copyright 1988 by Prentice-Hall. Reprinted by permission.

The majority of research on computer based instruction and media in the last two decades used the information processing model as a guideline to comprehend how information is perceived, stored and retrieved (Gagne, 1986). More appropriate to this study are the studies in computer literacy teaching. These studies, for the most part, originated from computer science specialists wishing to evaluate the effectiveness of their teaching. Most studies used part of the information processing theory as a base, emphasizing elements like rehearsal and repetition. However, in almost all cases, activities were determined in advance by the instructor, therefore suggesting a traditional objectivistic approach. Results of these studies appear in the more specific sections on computer assignments versus achievement and attitudes later in this chapter.

"Objectivism holds that the world is completely and correctly structured in terms of entities, properties and relations" (Duffy & Jonassen, 1991a, p. 7-8). Here, the reality is external to the knower and most if not all computer science and literacy courses used that assumption. Since computers have been a part of everyday lives for a short period, that premise made sense, but now that almost every student comes to class with a preconception about computers, maybe it was time for a new model.

Constructivism

Constructivism, a learning theory developed during the last decade, offered an alternative to theories in the objectivist tradition. It evolved from Piaget's theory of cognitive development. Constructivists were for the most part very critical of the American education system (Dick, 1991), considering that it had failed to prepare students for the real world. By providing them instruction in a realistic environment and selecting tasks that were relevant to their experiences (Perkins, 1991a), the constructivist view of instruction provided a better way to ensure the basic goals of education: "Retention, understanding and active use" (Perkins, 1991a, p. 18). In constructivist instruction, the learners played a more potent role in task management, therefore enhancing their autonomy (Perkins, 1991b) and a more meaningful kind of retention (Jonassen, 1991b). The constructivists had as prime objective to promote learning, which contrasted with the objectivist point of view of teaching content (Winn, 1991). To the constructivist, teaching content in a decontextualized environment encouraged shallow learning, hence poor retention (Duffy & Jonassen, 1991a).

In computer science and computer literacy, constructivism began to make sense in a society where many students were now acquainted with computers before they took their first computer literacy class. Students "arrive with prior mental constructs about science that are incomplete, fragmented, and often larded with naive theories or misconceptions that are plain wrong" ("The Science", 1992, p. 38). Constructivism, was mentioned as a way to deal with students' preconceptions, in a Piagetian genetic epistemology manner (Confrey, 1988). Constructivism was said to be anomaly driven; it confronted the learner with conflictual situations instead of avoiding them, as it was often the case in conventional instruction (Perkins, 1991b).

Dick (1991), warned that constructivism was often costly and hard to measure and evaluate. Many instructional designers, however, tried to avoid these pitfalls by combining elements of constructivism and objectivism. The result was a design somewhere between extreme constructivism and the tabula rasa of extreme objectivism (Merrill, 1991). The differences between objectivism and constructivism appear in Table 1 taken from Jonassen (1991a).

TABLE 1 - ASSUMPTIONS INHERENT IN OBJECTIVISM AND CONSTRUCTIVISM

	Objectivism	Constructivism
Reality	External to the knower	Determined by the knower Dependent upon human mental activity
	Structure determined by entities, properties, and relations	Product of mind Symbolic procedures construct reality
	Structure can be modeled	Structure relies on experiences/interpretations
Mind	Processor of symbols	Builder of symbols
	Mirror of nature	Perceiver/interpreter of nature
	Abstract machine for manipul. symbols	Conceptual system for constructing reality
Thought	Disembodied: independent of human experience	Embodied: grows out of bodily experience
	Governed by external reality	Grounded in perception/construction
	Reflects external reality	Grows out of physical and social experience
	Manipulates abstract symbols	Imaginative: enables abstract thought
	Represents (mirrors) reality	More than representation (mirrors) of reality
	Atomistic: decomposable into "building blocks"	Gestalt properties
	Algorithmic	Relies on ecological structure of conceptual system
	Classification	Building cognitive models
	What machines do	More than machines are capable of
Meaning	Corresponds to entities and categories in the world	Does not rely on correspondence to world
	Independent of the understanding of any organism	Dependent upon understanding
	External to the understander	Determined by understander
Symbols	Represent reality	Tools for constructing reality
	Internal representations of external reality ("building blocks")	Representations of internal reality

Note. From "Objectivism versus Constructivism" by D. H. Jonassen, 1991, Educational Technology Research and Development, 39(3), p. 9. Copyright 1991 by Educational Technology Research and Development. Reprinted by permission.

Most constructivist research studies have used qualitative methodologies (Jonassen, 1991b). Soo Hoo (1991) interviewed 13 middle school students and reported that they were capable of understanding and describing the process of knowledge construction. In addition, she found that students naturally work toward problem-solving when confronted with obstacles. She concluded that education must be reconsidered through students' eyes. Edmonson (1989) interviewed college students on their conceptions of scientific knowledge and learning processes. She found three types of learners: those who had logical positivist epistemologies, mainly males using rote learning for whom grades were important; those with constructivist point of views, mostly females using meaningful learning; and a mix of the two. She concluded that the positivist view of instruction in science often discourages female students and that constructivism could offer the most potential as an epistemological foundation since it emphasizes the learner's role in knowledge making. Dougherty (1989) interviewed and observed 11 middle school mathematics teachers on their cognitive conceptions and instructional practices. She found four levels of cognitive functioning among those teachers from concrete formalism, social pluralism, integrated pluralism, to abstract constructivism. She concluded that the teachers in the three first levels viewed mathematics in algorithmic ways while the abstract constructivist teachers viewed mathematics as a creative and dynamic discipline requiring critical thinking. She also concluded that abstract teachers are more likeky to use flexible lesson formats contrasting with the rigid and procedural structure used by concrete teachers.

There are no research studies distinctly linking personalized assignments to achievement and attitudes. However, Soo Hoo (1991) found that the students are more concerned with their interactions to the tasks than the tasks themselves. Also, Edmonson (1989) strongly suggested that the personal home knowledge has to be taken into account when developing tasks and instruction. Finally, realism and relevance to one's own experiences were paramount conditions of constructivism (Perkins, 1991a) and might be concretized with personalized tasks.

Also, there are no research studies clearly applying constructivist theory to computer instruction. However, some constructivist researchers are working on experiments dealing with constructivism in a computer or technology environment (Dick, 1991). Kozma (1991), even argued that constructivism could be the new theory needed to generate a new breed of research on media. In summary, constructivism showed promising results in different disciplines and at different levels, especially with female students (Edmonson, 1989).

Computer Assignments and Achievement

Computer knowledge or achievement in computer literacy has been the subject of many studies. These studies were typically tests of curricula instead of tests of theories. Most were conducted by computer literacy experts wishing to verify the effectiveness of their classes and practical assignments. However, looking at the design and content of these studies, I may classify them as experiments on media effectiveness based on information processing and objectivism. In fact most elements from information processing were there: distributed practice, part learning and sometimes overlearning.

Content

Computer science is an experimental science, like biology, chemistry or physics. This point of view was shared by many authors, among them Baldwin (1992) and Prather (1992). Of course, they were not alone. Scragg (1987) said clearly that "computer science is a laboratory discipline" (p. 38), as did Penny & Ashton (1990) stating that "most teachers of computer science would argue that computer science is a laboratory science" (p. 192). Schneider (1986) suggested that a computer literacy course should have "hands-on" experiences.

There are, however, a number of obstacles in computer literacy teaching. One major obstacle is the lack of appropriate textbooks which have "only very recently become available emphasizing the new approach of using software packages" (Martin & Martin, 1986, p. 33). Another obvious obstacle is the lack of equipment as noted by Halaris & Sloan (1985), who said that in every computer literacy course hands-on experiences are essential. Equipping a lab costs money and "the primary reason that computer science courses do not have "formal" labs, in the sense of a 3 hours block of time, is that most institutions could not afford the luxury of computer equipment" (Scragg, 1987, p. 38); it is unfortunately a major problem in almost all institutions. A good structured environment is essential for computer literacy as well as other computer science courses as summarized by Price, Archer & Moressi (1988): "We believed that we would be more successful in conveying an appreciation, interest, and capability in the use of the computer if the students were able to work with the hardware and software in a structured environment" (p. 14).

There are also human factors that can be problematic in computer literacy classes. Some researchers like Clark (1983) advocated that "consistent evidence is found for the generalization that there are no learning benefits to be gained from employing any specific medium to deliver instruction" (p. 445). On the other hand, interest for the practical aspect of software teaching may produce negative aspects such as that "students naturally enjoyed the "hands-on" training much more than the lecture and preferred to attend the lab rather than the lecture" (Bailey & Tidwell, 1986, p. 24). Results like these can encourage some departments to drop the lecture part altogether, therefore opening the course to criticisms like the one that "computer literacy is in danger of settling into a course of virtually zero intellectual content and attracting the ridicule of other academic departments" (Myers, 1989, p. 178). Martin &

Martin (1986), gave a warning about doing hands-on assignments only: "It appears that the computer literacy course even in its most current form (concepts, word processing, spreadsheets, databases and programming) is already not on target for a large number of students" (p. 33).

Fortunately, all is not bleak in the computer literacy courses' universe. A good computer literacy course can improve "the reputation of computer science among other academic departments" (Myers, 1989, p. 180). By giving well-conceived lab assignments and giving their responsibility to teaching assistants, "instructors in the lecture portion of the course are able to devote more time to preparing lectures since they are not directly involved with the student lab assignments" (Price, Archer & Moressi, 1988, p. 17). Another benefit of computer literacy labs is the social importance of knowing major software packages as reported by Clarke & Adkins (1988) following a course at the University of Georgia. They said that "many students have returned to indicate that the course has helped them in other classes and in securing employment" (p. 227).

Achievement Studies

Experiments were conducted, leading to recommend the inclusion of laboratory sessions in computer literacy courses. Bailey & Tidwell (1986), following a one year pilot project at East Tennessee State University, concluded that "it is important that each student have access to a machine during instruction so that he/she is allowed to carry-out tasks as they are described" (p. 25). Kneller (1986), taught computer literacy to adult students at the University of Southwestern Louisiana and found that "it is not speed of learning but exposure to the machines that ultimately leads to a profitable compatibility between learners and computers" (p. 37). Tharp (1987) went in the same direction in a more reserved manner by saying that "It may be helpful if the instructor and/or students have access to computer terminals for certain classes" (p. 421). Unfortunately, no specific data appeared in those reports.

The next studies, however, are much more interesting in terms of data and results. The study by Battista & Krockover (1984) measured the effects of computer labs in science and mathematics on computer literacy. The subjects were 94 preservice elementary teachers divided in 3 groups: A control group consisting of a regular mathematics teaching course without computers, a programming group consisting of a math teaching course with a programming component and the CAI group consisting of an earth science teaching course with a computer aided instruction segment. Since no randomization was possible they gave a pretest and adjusted the means with an ANCOVA. The results (subject knowledge and attitudes) showed a significant difference of the CAI group over the other two groups on an achievement test and an attitude test called the Minnesota Computer Literacy Awareness Assessment (MCLAA) tests. The MCLAA consisted of two tests, one for the cognitive components (knowledge about hardware, software, programming and application) and the other for the affective components (enjoyment, anxiety, efficacy, educational values, social values and technical values). The cognitive test is a multiple-choice test and the affective test is of likert-type with items like this one on enjoyment: "not amusing 1 2 3 4 5 amusing" (Dell'Aquila, Picciarelli & Provenzano, 1990, p. 48). In the Battista & Krockover (1984) study, the programming group and control group had approximately the same scores. The difference was significant at the 0.01 level for the following components: Enjoyment, anxiety, efficacy and educational values. It was not significant for social values, technical values, hardware, software, applications impact and programming.

The study done in Italy by Dell'Aquila, Picciarelli & Provenzano (1990) was a similar study on 36 preservice elementary teachers. Here, the treatment consisted of introduction to computers through the LOGO programming language. They also used the MCLAA tests and found the following components significant at the 0.05 level: Enjoyment, anxiety, educational values, social values, hardware, software and programming. It was not significant for efficacy, technical values and applications.

The Elder (1988) dissertation presented a study on 376 geography students using database programs to learn about information processing and geography. Here, the results were not significant. Hert (1988) had the same disappointing results in his dissertation using computers to enhance reading and writing skills. For these 275 students, he found no significant difference between the control and treatment groups.

Thweatt (1988) took two intact computer literacy classes and compared the switching of theory with labs to theory only. He found no significant difference in knowledge nor in attitude between the two groups. The only thing he found was an interaction with previous programming knowledge, in a sense that previous encounter with computers enhanced the effects of the treatment.

Researchers agree that programming is not enough, as did Locklair (1991). Dyck, Black & Fenton (1987), in implementing a computer literacy course with some Pascal programming at the University of Waterloo, said they "have been pleased by both the students' reactions and their accomplishments in it, and feel that the course meets a substantial need expressed by students and professors in other faculties" (p. 512). The same conclusion was reached by Price, Archer & Moressi (1988) at Winthrop College, following a course with 14 lab sessions including 11 on applications to "familiarize our students with the use of microcomputers and the applications of word processing, spreadsheet analysis, and data management" (p. 13-14).

Another even more popular point of view is to drop programming altogether and teach software packages in the scheduled lab periods. Martin & Martin (1988), in conducting a survey at the two main universities in Jacksonville, reported that "almost all of the students believe that it is important to learn how to use packaged software" (p. 239). Billings & Moursund (1988), did the same thing at The College of Wooster and reported that it was not necessary to know programming to make effective use of a computer. By comparing programming with spreadsheet teaching at East Tennessee State University, Bailey (1987) concluded that "with minimal effort students can learn to do practical applications and enjoy the fruits of their labor rather than experience the frustration encountered in so many programming classes" (p. 503). An early experiment by Ryder (1984) at Rutgers University demonstrated the positive aspect of software teaching and she related that "our design of a hands-on introduction to a variety of computer applications using a microcomputer . . . proved its utility; many departments are now requiring our course as part of their major" (p. 102).

This point of view however disagreed with that of hard-core computer scientists who still believed that "since computing is based on programs and programming, all students should understand the concept and process of programming" (Cherry, 1986, p. 40).

The approach using software shows a greater awareness of the computer science departments to the presence of non-majors in the classes. It was obvious that "little attention seems to have been given, until recently, to the needs of the student not wishing to major in computer science" (Price, Archer & Moressi, 1988, p. 13). There is also an increased interest in nontraditional students or adults. Here again, lab sessions appear beneficial as reported in a study done by Maren (1987) with older students at Brescia College. He gave 55 hours of hands-on instruction to 15 participants in a course called "Computer Literacy Course for the Older Worker". Altough he did not report any quantitative data, he nevertheless mentioned that by the end of the course, those students were comfortable with computers, used appropriate computer terminology, mastered a word processor and a database system. The only difficulty he came across was with the spreadsheet which, he said, only half of the students mastered. He said that "a computer literacy course directed at older students will require more contact time due to the tendency these students have to ask for immediate explanations of course material that seems unclear" (p. 28).

In summary, Clark (1983) doubted the benefits of computer labs when they are used to teach different disciplines. The conclusions of the Elder (1988) and Hert (1988) studies go in the same direction. However, when computers are the subject of instruction, as in computer literacy, the benefits seemed more evident as noted by Battista & Krockover (1984), Bailey & Tidwell (1986), Kneller (1986), Tharp (1987) and Dell'Aquila, Picciarelli & Provenzano (1990). Only Thweatt (1988) failed to find any evidence of positive effects of computer software labs on subject knowledge.

There is however, something of concern in all these studies on computer effectiveness. Clark (1983) was the one of the first to open the lid on potential problems with computer or media efficiency studies. He noted that the effect can be attributed to many other factors besides the presence of labs. Of these factors, the novelty effect and what is more import the difference in length and content of instruction could be the major element in differences between the groups. Moreover, he pointed out that now that media researchers seem to have understood his message, many computer technology researchers are still conducting studies on simple computer effectiveness (Clark, 1991). Recently, the *SIGCSE Bulletin* asked of its contributors to be more rigorous when designing experiments.

Attitudes Toward Computers

In order to efficiently work with computers, one must be comfortable with them. As Spresser (1985) pointed out, the way to eliminate intimidation by computers is to get better acquainted with them. Working with computers can be a very uncomfortable burden to some people but comfort with computing comes with "positive experiences, not just experiences" (Bernstein, 1991, p. 60). We must be careful in providing computer literacy courses enhanced with positive computing experiences, and be particularly aware of frustrations linked to bad machines and bad software. "Care must be taken in choosing software and hardware which is to be perceived as an aid rather than a barrier to learning" (Dyck, Black & Fenton, 1987, p. 511).

Morris (1992) conducted a study at Georgia State University with 28 older students enrolled in a computer literacy course with a lab component. He used a one-group pretest-posttest design and found that the differences were overall significant (even though he does not mention his alpha level) with a $t=-3.39$ on the 25 questions of the Raub attitude questionnaire, which is a general attitude toward computers questionnaire organized as likert scales items (Howard & Smith, 1986). The questions are presented as sentences like "I feel apprehensive about using a computer" and the subjects respond by choosing from "strongly agree" to "strongly disagree"

In an other study, Peterson (1987) noted an increase in attitude toward computers in a software-based computer literacy. Unfortunately, the author provided no statistical information.

Again, the most interesting studies were the ones carried on by Battista & Krockover (1984) and Dell'Aquila, Picciarelli & Provenzano (1990), whose results appeared in the preceding section on computer assignments and achievement. On the other side of the coin, Thweatt (1988) failed to find any evidence of benefit from computer labs on attitude nor knowledge.

Other experiments were being conducted to dissipate myths about older persons who were known to be reluctant to use computers. The previously mentioned Morris (1992) study was a good example of such studies. He said that "contrary to widely held stereotypes, many older adults view computer technology favorably and can benefit from acquisition of basic computer skills" (p. 72).

It is the same for managers who were supposedly not interested in computers, but "the fear that computer anxiety will pose a significant barrier to the penetration of technology into managerial work appears to be more myth than reality" (Howard & Smith, 1986, p. 615). The Howard & Smith (1986) study was conducted with 160 randomly selected managers in 13 organizations using the Raub questionnaire. They found that the average anxiety score for the managers was 8.69, a relatively low score compared with the 20.62 obtained by Raub (1981) with college students.

Women also have been targeted as uninterested or fearful of computers but again "at least among managers, the belief that older people and women will have less affinity for computers is more myth than reality" (Howard & Smith, 1986, p. 614). In the Howard & Smith (1986) study, they found no correlation between gender and computer anxiety.

Other gender comparison studies related to attitudes include the Ogozalek (1989) study conducted in Massachusetts with 212 students enrolled in introductory computer science courses. In that study, using a researcher-made questionnaire, she found significant differences between males and females on all the items. Bernstein (1991) made a similar study in New Jersey with 51 students. In that case, she found no significant difference between the genders on computer attitudes, showing a

F value of only 0.33. The Thweatt (1988) dissertation, done in Tennessee with 59 students in the treatment group and 67 in the control group, presented similar results of significant differences between genders in computer interest and computer knowledge ($p < 0.05$).

Another misconception is that students entering a computer literacy class fear computers. Martin & Martin (1988), analyzing the profile of students entering computer literacy courses at Jacksonville University and the University of North Florida, found that "approximately half of the students already felt comfortable using a computer" (p. 239).

Developing comfort and positive attitudes toward computers is also the way to enhance knowledge about them as expressed by Halaris & Sloan (1985) that "the mastery of computing is more than acquiring knowledge and skills. Achieving computer literacy is strongly related to attitudes" (p. 325). Bernstein (1991) also reported results that "showed that comfort with PC's was a significant predictor of test scores" (p. 59), closely linking attitude and achievement.

In summary, with good software and hardware, computer labs did very well in developing positive attitudes toward computers. The Battista & Krockover (1984), Peterson (1987), Dell'Aquila, Picciarelli & Provenzano (1990) and Morris (1992) all agree to confirm that hypothesis. Only Thweatt (1988) failed to find any evidence of lab effects. Clark (1991), warns researchers, on the other hand, that media selection has no effect on motivation either. Concerning age differences, Howard & Smith (1986) and Morris (1992) concur in concluding that age makes no difference regarding attitudes toward computers. With regards to the gender issue, Howard & Smith (1986) and Bernstein (1991) found no significant differences between the genders. However, Ogozalek (1989) found significant differences between males and females on every attitude topic she measured, and Thweatt (1988) found differences in computer interest between genders. Finally, my study was one of the first using the prescriptive approach suggested by Clark (1983, 1989, 1991) and the first one incorporating elements of the constructivist learning theory in computer science or computer-assisted instruction. It was also one of the first technology studies centered on the person rather than the equipment.

CHAPTER 3

METHODS

Population and Subjects

The target population for this study consisted of all college students, either traditional or older, enrolled in a computer literacy course in North America.

The accessible population consisted of the students enrolled in a course called Business Computing (8INF414) at the Chicoutimi campus of the University of Quebec in Canada, which was a computer literacy course for all majors but was mainly designed for first year undergraduate business administration students. The students were between 20 and 50 years of age. There were 59% females and 41% males from all socio-economic levels but mostly from middle class and upper-middle class backgrounds. The ethnic background was 96% French-Canadian and 4% from other French-speaking countries of Africa, Southeast Asia and the Middle East. Eighty-four percent of the subjects had their home in the Saguenay-Lac-St-Jean region which is located in the northeastern part of the province. Most of the students already possessed an associate degree in sciences or in social studies and those who did not (mainly adult students) had taken remedial courses in mathematics offered by the University before their enrollment. The Chicoutimi campus of the University of Quebec is a public university of approximately 6,000 students of which two thirds are adults studying part-time. About 5,000 are undergraduate students, the remaining being enrolled in graduate programs. Chicoutimi is a small city of 62,000 inhabitants located 140 miles north of Quebec City. Its economy is mainly based on services as it is the cultural, commercial and media center of the northeastern part of Quebec.

Power Analysis and Sample

According to common practice in educational research, I set the alpha level to 0.05 and the total power of the experiment to at least 80% (Cohen & Cohen, 1983). In a previous study, on the effectiveness of computer labs in general, Dell'Aquila, Picciarelli & Provenzano (1990) detected an effect size of 0.82 SD on attitude and 1.76 SD on subject knowledge. Battista & Krockover (1984) found effect sizes of 2.42 SDs for attitude and 0.98 SD for subject knowledge. According to Clark (1983, 1989, 1991), these effect sizes are probably inflated due to a number of confounding variables. With this in mind, and since it is an experiment that was never done before, I have concluded that any f^2 below 0.15 will not be considered significant. This setting is considered a medium effect according to Cohen & Cohen (1983). With 9 independent (including the interactions) variables, for a power of 0.80, a sample of at least 91 subjects was needed to detect a population R^2 as small as 0.13. The 9 independent variables were grouped in sets, as shown in Table 2.

TABLE 2 - INDEPENDENT VARIABLES AND SETS

COVARIATES:
Set A: Variables related to personal characteristics (attributes)
X1: Gender
X2: Age (less or more than 21)

Set B: Variables related to computer experience
X3: The subject owns a personal computer (Y/N)
X4: The subject had previous computer instruction (Y/N)

TREATMENT VARIABLE:
X5: The subject is in the Treatment or the Control group.

INTERACTIONS:
Set C: Interactions between treatment and computer experience.
X8: X3 x X5
X9: X4 x X5

Set D: Interactions between treatment and attributes
X6: X1 x X5
X7: X2 x X5

Table 3 presents the power analysis for each variable and set that entered the regression equation. The power with n=108 is also included as it is the total number of subjects.

TABLE 3 - POWER ANALYSIS

Variable (set)	alpha	power	sr^2	$ES(f^2)$	n	power for n=108
X5	.05	.80	.08	.09	87	.87
set C	.05	.80	.03	.04	315	.38
set D	.05	.80	.02	.02	563	.17
TOTAL	.05	.80	.13	.15	91	.88

The total power of the experiment was 0.88 and 0.87 for the group membership variable. However, the testing of the hypotheses on sets C and D had low power. This situation indicated the low probability of finding significant results if the effect sizes were near the expected values. It also means that the rejection or retention of the hypotheses would provide little or no information.

The subjects were the students enrolled in the computer literacy course during the spring 1993 term. There was no problem in finding an adequate sample size because each term the enrollment in that course was generally over one hundred.

The subjects were randomly assigned by a manual draw to the treatment and control groups. The number of students in the control and treatment groups were expected to be equal, however, because of students dropping after the first week the total number of students was 52 in the treatment group and 56 in the control group. Details on mortality are provided in the internal validity section.

Instruments

Subject knowledge (computer literacy and software proficiency) and attitudes toward computers were measured in this experiment, following the research of previous studies like Battista & Krockover (1984), Dell'Aquila, Picciarelli & Provenzano (1990) and Thweatt (1988). Subject knowledge was measured by the final exam of the Business Computing course. That test was composed of questions taken from a data bank of questions developed by Professor Marcel Pearson and other members of the faculty at the University of Quebec, Chicoutimi. The questions bank is updated each year to produce items with adequate difficulty levels and discrimination indexes. The bank has been in use since 1987, with its most recent update in August 1992. The specific questions for the test used in this study were selected by Mr. Pearson. The test was validated by the program council which was composed of 5 computer science professors. A reliability estimate was calculated with the KR-21 (n=108) and gave a value of 0.79 for the software part and 0.70 for the computer literacy part. The final exam consisted of 116 multiple choice questions. Forty questions covered the general computer literacy aspect and the other 76 the software or lab aspect. There was no penalty for guessing and students were notified of that fact in advance. The language of the exam was French. Both achievement tests are presented in Appendix B.

Attitudes were measured by the Computer Anxiety Index (CAIN) developed by Simonson and his team at Iowa State University. Reliability was estimated to be 0.94 using the Cronbach alpha method and test-retest reliability was found to be 0.90 (Simonson et al., 1987). The concurrent validity of the test was evaluated by correlating it with another measure of anxiety called the STAI (State-Trait Anxiety Index). Simonson et al. (1987) found significant correlations (0.36 and 0.32) between the CAIN and the STAI. These correlations were low because of the difference in nature between the two tests. However they were nonetheless significant. In my judgment, considering validity and reliability data reported as well as the items on the test, I believed the CAIN to be an adequate instrument for the purpose of this study. Some reviewers (Conoley & Kramer, 1989) had doubts about the test author's validity claims but recommended its use for research purposes.

The CAIN was presented as a survey (to mask its real intent) with 26 statements which the student answered on a six-point differential scale between *strongly agree* and *strongly disagree*. Since the range of each item is from 1 to 6, the total score may range between 26 and 156. I translated the CAIN to French, for use by French-Canadian students. The French version was validated for content by two experts in Computer Science at the University of Quebec and the adequacy of the translation by one professor of English. The French version was checked for reliability (n=108) by an internal consistency method (Cronbach's alpha), which gave a value of 0.82; and by equivalence with the English version (6 students took both versions and the correlation was 1). The CAIN and its French translation are presented in Appendix B.

A final instrument was used to measure the differences between the groups in relation to time dedicated and resources consulted. I constructed that instrument for the purpose of this study by incorporating suggestions from researchers in the area of constructivism. The instrument consists of a review sheet, organized like a survey of activities with seven questions related to each assignment done and a telephone interview with four questions structured like a casual conversation. The division by assignments was used to help the students respond correctly for it is often hard for somebody to recall the activities for a whole semester. The instrument was validated by my colleague Marcel Perason and reliability was checked by a stability (test-retest) method with 34 students the following term. After an interval of four weeks, a stability coefficient of 0.91 was found for the questions asking for time dedicated and of 0.96 for the questions related to resources consulted. No reliability check was performed for the interview.

Procedures

Both the control and treatment groups attended 13 periods of laboratories (3 consecutive hours per period) using Macintosh LCII computers connected in a network. The software packages taught were SuperPaint, Excel, Microsoft Word, ACCPAC (an accounting program) and the Macintosh operating system. Students were grouped in a lab setting, twenty-one at a time, and each one had his/her own machine. The software packages were taught in a lecture-like manner, in the lab, using a projection device, while the students followed the steps with their own computer. The training of one hour per week (the first hour of the period) was supervised by the instructor (the language of instruction was French).

During the remaining two hours of the period, the students worked on their assignments, generally related to the software taught during the first hour. It is in those two hours each week that the treatment took place. The students were required to do three assignments on SuperPaint, Word and Excel (Appendix A). The instructor and two teaching assistants were available for the whole session in the role of traditional teaching aides. They provided information as requested by students and the instructor gave demonstrations when necessary. In the matter of instruction, there was no difference between the control group and the treatment group. The role of the teaching aides was the same for both groups. The fact that they were the same individuals controlled for any differences in teaching styles. The program of instruction and assignment schedule for both the control and treatment groups are detailed in Appendix C.

Treatment Group Assignments

The role of the teacher in constructivist interventions is something that is very difficult to pinpoint (Clement, 1991). Most agree, nevertheless, that some form of teacher action is appropriate (Perkins, 1991a) in the form of scaffolding or coaching. Perkins (1991b) adds that "it is the job of the constructivist teacher (or interactive technologies) to hold learners in their zone of proximal development by providing just enough help and guidance, but not too much" (p. 20). The activities are then stimulus materials selected for their relevance and their qualities in generating natural knowledge constructions (Cobb, 1990). The bottom line of constructivism is authentic or realistic tasks. Realistic tasks take their roots in the real world.

Students must feel that they are doing an assignment that is similar to a real project of the professional world. It means also that there is no simplification of the task for didactic purposes. Tasks like these result in motivating the student to use his/her own knowledge and abilities to perform the task in his/her own way and own pace. The learner is then self-regulated and organizes the relevant information by building connections with his/her previous knowledge (Mayer, 1992).

In the treatment group, the assignments were based on the constructivist learning theory. They were created to foster self-reliance, autonomy, individual task management and creativity. They took place in a flexible personalized context as each student shaped his/her own vision of the finished product. The treatment group assignments reflected the nature of constructivist instructional strategies. Four important characteristics (Duffy & Jonassen, 1991b) of constructivism required tailored assignments to each learner: flexibility of knowledge, consideration of different entry skills, specific conditions of learning and an openness to multiple perspectives.

Other requirements of constructivism were met by the nature of the assignments themselves. They were complex enough (Duffy & Jonassen, 1991b) to emphasize the fact that the real world is complex. CTGV (1991) found in developing the constructivistic *Jasper* math problems that because they were more complex, they were judged by the students as being more fun and more meaningful. The treatment assignments were also realistic enough to provide authentic tasks (Jonassen, 1991b), an important criterion for constructivists. The students had access to a well-equipped lab with freedom to use all its software and hardware capabilities. The students also had access to construction kits (series of prefabricated parts like graphics, drawings and sounds) on the network. The latitude in using different parts on a project is an important aspect of constructivism (Perkins, 1991a). The nature of the treatment was the assignments alone. Both series of assignments (treatment and control) led to a similar outcome. However, in the treatment group they were personalized to each person and many examples of finished products were presented to the students to help them design their own product. The information put into the projects came from the students. The treatment group assignment sheets are presented in Appendix A.

Control Group Assignments

The control group lab assignments were objectivist in nature, conceived to be more generic and less personal than the treatment group assignments. The information put into the projects was imposed by the instructor instead of chosen by the students Each student was provided with a blueprint of the finished product and all the data pertaining to the project. However, in the control group, the specific assignment instructions involved detailed presentation formats and precise data to be either reproduced or manipulated. The students were also provided with a precise template of what was expected of them in each assignment. Table 4 presents a summary of the activities in both groups. The control group assignment sheets are presented in Appendix A.

TABLE 4 - SUMMARY OF ACTIVITIES IN CONTROL AND TREATMENT GROUPS

Activity/Context	Groups	
Theoretical class (6 hours per week)	TREATMENT	CONTROL
Macintosh computers	TREATMENT	CONTROL
One hour of software instruction per period	TREATMENT	CONTROL
Two hours of assignment work per period	TREATMENT	CONTROL
One instructor + two TA's (traditional role)	TREATMENT	CONTROL
Freedom to use hardware and software	TREATMENT	CONTROL
Precise template (format) imposed		CONTROL
Many examples of finished products given	TREATMENT	
Assignments on Word, Excel and SuperPaint	TREATMENT	CONTROL
Assignment format predetermined		CONTROL
Assignment format personalized	TREATMENT	
Data (information) furnished by instructor		CONTROL
Data (information) furnished by student	TREATMENT	
Tests, observations and interviews	TREATMENT	CONTROL

The two sets of assignments (for the control and treatment groups) were purposively developed for their similarities yet one set was personalized to the students' experiences and the other set was not. In Table 5, I present my interpretation of the assignments qualities in relation to the assumptions of constructivism and objectivism. Table 6 presents the interpretation of the assignments qualities by an independent professor. Both interpretations show the distinct constructivist and objectivist characteristics of both sets.

TABLE 5 - CONSTRUCTIVIST AND OBJECTIVIST QUALITIES OF ASSIGNMENTS

ASSUMPTIONS OF OBJECTIVISM (Jonassen, 1991a)	1T	2T	3T	1C	2C	3C
Reality external to the knower				X	X	X
Structure can be modeled	X		X	X	X	X
Mind is processor of symbols				X	X	X
Mind is mirror of nature				X	X	X
Thought disembodied: independent of human experience				X	X	X
Thought governed by external reality				X	X	X
Thought reflects external reality				X	X	X
Thought represents (mirrors) reality				X	X	X
Thought manipulates abstract symbols				X	X	X
Thought is atomistic			X	X	X	X
Thought is algorithmic			X	X	X	X
Meaning corresponds to entities and categories in the world	X		X	X	X	X
Meaning is external to the understander				X	X	X
Symbols represent reality				X	X	X
Symbols are internal representations of external reality				X	X	X
ASSUMPTIONS OF CONSTRUCTIVISM (Jonassen, 1991a)						
Reality determined by the knower	X	X	X			
Structure relies on experiences/interpretations	X	X				
Mind is builder of symbols	X	X	X			
Mind is perceiver/interpreter of nature	X	X	X			
Thought embodied: grows out of bodily experience	X	X	X			
Thought grounded in perception/construction	X	X	X			
Thought grows out of physical and social experience	X	X	X			
Thought more than represents (mirrors) reality	X	X	X			
Thought is imaginative: enables abstract thought	X	X	X			
Thought has gestalt properties	X	X	X			
Thought relies on ecological structure of conceptual system	X	X	X			
Meaning does not rely on correspondence to world		X				
Meaning is determined by the understander	X	X	X			
Symbols are tools for constructing reality	X	X	X		X	
Symbols are representations of internal reality	X	X	X			
OTHER ASSUMPTIONS OF CONSTRUCTIVISM						
Adapted to each learner's experiences (Jonassen, 1991b)	X	X	X			
Adjustment of activities to each student (Koehler & Grouws, 1992)	X	X	X			
Students conceptualize their activities (Cobb et al, 1991)	X	X	X			
Tasks are relevant to their experiences (Perkins, 1991a)	X	X	X			
Students have potent role in task management (Perkins, 1991b)	X	X	X			
Flexibility of knowledge (Duffy & Jonassen, 1991b)	X	X	X			
Consideration of different entry skills (Duffy & Jonassen, 1991b)	X	X	X			
Specific conditions of learning (Duffy & Jonassen, 1991b)	X	X	X			
Openness to multiple perspectives (Duffy & Jonassen, 1991b)	X	X	X			

*1T, 2T, 3T: Treatment group assignments
*1C, 2C, 3C: Control group assignments

TABLE 6 - ALTERNATE INTERPRETATION OF ASSIGNMENT QUALITIES

ASSUMPTIONS OF OBJECTIVISM (Jonassen, 1991a)	1T	2T	3T	1C	2C	3C
Reality external to the knower			X	X	X	X
Structure can be modeled	X		X	X	X	X
Mind is processor of symbols			X	X	X	X
Mind is mirror of nature				X	X	X
Thought disembodied: independent of human experience				X	X	X
Thought governed by external reality				X	X	X
Thought reflects external reality				X	X	X
Thought represents (mirrors) reality				X	X	X
Thought manipulates abstract symbols				X	X	X
Thought is atomistic				X	X	X
Thought is algorithmic				X	X	X
Meaning corresponds to entities and categories in the world				X	X	X
Meaning is external to the understander				X	X	X
Symbols represent reality				X	X	X
Symbols are internal representations of external reality			X	X	X	X
ASSUMPTIONS OF CONSTRUCTIVISM (Jonassen, 1991a)						
Reality determined by the knower	X	X	X			
Structure relies on experiences/interpretations	X	X				
Mind is builder of symbols	X	X	X			
Mind is perceiver/interpreter of nature	X	X	X			
Thought embodied: grows out of bodily experience	X	X	X			
Thought grounded in perception/construction	X	X				
Thought grows out of physical and social experience	X	X	X			
Thought more than represents (mirrors) reality	X	X	X			
Thought is imaginative: enables abstract thought	X	X	X			
Thought has gestalt properties	X	X	X			
Thought relies on ecological structure of conceptual system	X	X	X			
Meaning does not rely on correspondence to world	X	X	X			
Meaning is determined by the understander	X	X	X			
Symbols are tools for constructing reality	X	X	X			
Symbols are representations of internal reality	X	X	X			
OTHER ASSUMPTIONS OF CONSTRUCTIVISM						
Adapted to each learner's experiences (Jonassen, 1991b)	X	X	X			
Adjustment of activities to each student (Koehler & Grouws, 1992)	X	X	X			
Students conceptualize their activities (Cobb et al, 1991)	X	X	X			
Tasks are relevant to their experiences (Perkins, 1991a)	X	X	X			
Students have potent role in task management (Perkins, 1991b)	X	X	X			
Flexibility of knowledge (Duffy & Jonassen, 1991b)	X	X	X			
Consideration of different entry skills (Duffy & Jonassen, 1991b)	X	X	X			
Specific conditions of learning (Duffy & Jonassen, 1991b)	X	X	X			
Openness to multiple perspectives (Duffy & Jonassen, 1991b)	X	X	X			

*1T, 2T, 3T: Treatment group assignments
*1C, 2C, 3C: Control group assignments

Research Design

This study used a true experimental design involving random assignment to treatment and control groups. The design chosen was the Randomized Posttest-Only Control Group Design. This design is quite reliable and minimized any kind of testing validity threat. Fraenkel and Wallen (1990) said that "this is perhaps the best of all designs to use in an experimental study, provided there are at least forty subjects in each group" (p. 237). Fraenkel & Wallen (1990) said also that "the use of the pretest raises the possibility of an interaction of testing and treatment threat, since it may alert the members of the experimental group" (p. 238).

The experiment was implemented by Professor Marcel Pearson, who was in charge of the computer literacy course. He also did all the classroom teaching. Professor Pearson had 15 years of experience in teaching computer science and computer literacy, including 6 years teaching that particular course. He holds an M.B.A. in Management and he also spent many years as an executive in a credit union and in a large aluminum producing complex. In the laboratories Mr. Pearson was assisted by two graduate students in the information systems master's program.

The CAIN test as well as the survey were submitted at the end of the 13 periods of labs. They were mailed to me for analysis. The computer literacy and software proficiency tests took place at the same time and the results were mailed to me as well.

Qualitative Data Collection

A review sheet (Appendix B) was used to gather data on the differences between the groups on time dedicated and resources consulted. The questionnaire was designed with elements of constructivist instruction in mind. Jonassen (1991b) mentioned that constructivist learning motivates students to seek alternative sources of knowledge. The students were hence asked about their use of external references, other pieces of software and consultation with other faculty members. Cobb (1990) emphasized the social interaction aspects of constructivism. Hence the students were asked if they consulted with other faculty members and teaching assistants as well as whether they collaborated with other students on their assignments. Finally, I asked the students to estimate the amount of time taken to complete each assignment as well as the number of extra hours spent in the lab as the amount of time devoted to work is said to be increased by constructivism (Dougherty, 1989). The review sheet was completed at the time of the posttest.

Furthermore, five students were randomly chosen in each group for a short telephone interview. They were asked to give general comments about the lab as well as describe the skills they had learned in those lab periods. Also, since constructivist instruction is believed to increase students' motivation in seeking involvement from the community in their academic projects (Cobb, 1990), I asked them if they involved people outside the school in their assignment work (family, friends, community). Finally, I asked them about the steps they took to produce the completed finish product of each assignment as suggested by Jonassen (1991b). The review sheet and interview plan are presented in Appendix B.

Internal Validity

This design controlled the testing threat but mortality did occur. A total of 128 students registered for the course initially. They were randomly assigned to 64 in each group. However, 20 students dropped after one week of classes, 12 in the treatment group and 8 in the control group. The following information about those students was retrieved using their student number: 13 males and 7 females; 13 traditional students and 7 nontraditional. Every year at that time, some students drop their registration to get summer employment. It is possible that these 20 students left for the same reason. Every one of the 108 remaining students completed the course. Missing data were treated according to the procedures outlined in Cohen & Cohen (1983). Missing subjects were dropped from the analysis since none of the dependent variables were available for them.

The individual difference threat was controlled by randomization. A history threat was possible, and the implementer would have reported any special events that may have occurred. If an event would have been very disruptive, I would have cancelled the study for the semester and redone the experiment in the following term. During the course of the study, no unusual events were reported. The location was constant, and the measures were the same for both groups. The objectivity in scoring tests helped in controlling the potential data collector bias. The implementer threat was minimized by keeping the implementer unaware of my hypotheses and goals and only informed of the procedures.

The regression threat was controlled in part by randomization and by the fact that the mean score has been around 70% with an approximate standard deviation of 10 over the last seven years with that same instructor. The actual means of the tests showed that this threat did not exist. The course had the same format and content since 1990, therefore minimizing the novelty effect. Also, the students were not concerned about the differences in assignments between the groups. A contamination of the treatment group by the assignments of the control group would have been possible if the students could have used the other group's predetermined assignments as personal choices. However, since the specifications of the assignments differed enough to discourage that practice, this was not a problem. Moreover, any copying of the control group's templates would have been penalized in the grading process and the students were notified of that fact. None of the students followed the other group's assignment requirements.

Finally, the implementer collected information on the students' backgrounds and personal characteristics at the same time as the posttests using a short questionnaire I developed for this project (Table 7).

TABLE 7 - SURVEY

Please enter your student number:

Please answer all questions by circling the answer.

Sex (Female, Male)

Birthdate:

Do you own a computer at home? (Yes, No)

Is this your first course using computers? (Yes,No)

Is this your first contact with the Macintosh? (Yes, No)

First time with SuperPaint/MacPaint? (Yes, No)

First time with Microsoft Word? (Yes, No)

First time with ACCPAC? (Yes, No)

First time with Excel? (Yes, No)

Treatment Verification

Treatment verification was done by two independent observers who were graduate students. They each observed two lab sessions (one for each group) and reported the activities they saw by completing a checklist (Table 9). I personally gave precise instructions by telephone to the observers. For the four sessions observed, I had a report for 24 students in the control group and 23 students in the treatment group. Data were gathered by workstation and not by student name, therefore some students may have been observed twice (once in each period). The questions were divided in four categories as presented in Table 8.

TABLE 8 - CATEGORIES IN THE TREATMENT VERIFICATION CHECKLIST

ITEM NUMBERS	CATEGORY
1,2,3,4	Content of the lab: Discrepencies between the topic of the day expected to be higher in treatment group.
6,10,14,15,16,18,20	Control group activities: Must be present in the control group and totally absent of the treatment group.
5,7,8,9,11,13,17,19,21,22	Treatment group activities: Must be present in the treatment group and totally absent of the control group.

The results of the checklist were analyzed by a chi-square test (α=.05) and are presented in Appendix F. Moreover, I observed a few lab sessions and saw some completed assignments.

TABLE 9 - OBSERVATION CHECKLIST

Today's date:

Group observed:

Location:

Number of students:

Subject of the lab (circle one): *Macintosh* *Word* *SuperPaint* ACCPAC Excel

- -

Check all that apply to the student observed during the 2-hours assignment work time.

Student working on computer #: ____

1. Works with SuperPaint	___	14. Does a St.Peter's card	___
2. Works with Excel	___	15. Does Martha W. resume	___
3. Works with Word	___	16. Does general inventory	___
4. Works with ACCPAC	___	17. Does personal system	___
5. Works w/ another software	___	18. Looks at Price report	___
6. Does a Price annual report	___	19. Has a CD or cassette	___
7. Does a personal report	___	20. Draws or copies a boat	___
8. Does own resume	___	21. Consults annual reports	___
9. Looks at greeting cards	___	22. Looks in book on resumes	___
10. Consults Martha example	___	23. Works with macro-comm.	___
11. Consults the examples	___	24. Uses the picture bank	___
12. Shows work to instructor	___	25. Uses the sound bank	___
13. Does a birthday card	___		

Analysis of Data

The descriptive statistics computed were the mean and the standard deviation of the control group and the mean and the standard deviation of the treatment group, on both the final exam and the CAIN. These measures are the basis for any statistical analysis of data. These same measures were computed also for female students, male students, traditional students, nontraditional students, students that had a computer, students that did not have a computer, students that were previously enrolled in other courses using computers and students that were in their first course using computers. A correlation matrix was also created for all variables.

The inferential technique chosen was multiple regression and correlation analysis (MRC). The data were analyzed with the aid of the StatView computer software and a Macintosh computer. MRC is very versatile and powerful and can be used in a case like mine with one independent variable (treatment vs. control) and one dependent variable in each case (computer literacy, software proficiency and attitude). MRC also made it easy to add the other variables and their interactions with the treatment in the model. All 9 independent variables were nominal in nature and consequently were dummy coded prior to the analysis. The population was assumed to be normal. The dependent variables were interval in nature. The alpha level for significance was 0.05.

Analysis was performed hierarchically by first entering the covariates consisting of the subjects' attributes (set A) and then the variables related to computer experience (set B). If they did not account for a significant portion of the variance, they were withdrawn from the model. Next, the treatment variable was entered (X5) and then the two interaction variables between computer experience and treatment (set C: X6, X7) and finally the interaction between the attributes variables and the treatment (set D: X8, X9). This order was determined based on the potential importance of each set to the achievement and attitudes scores. The variables related to computer experience were in my judgement important because they can affect instructional techniques in the near future. In fact, more and more people have computers at home and/or have prior computer instruction before college. The interactions related to personal characteristics, however, such as gender and age were entered last, not because they are unimportant or uninteresting, but because most comprehensive universities do not have the power to divide groups according to age or gender. Therefore, results related to these variables were less likely than the other variables to be educationally significant or practical. The variables are presented in Table 2.

The analysis of quantitative data related to the review sheet (Appendix B) was done by a series of simple regressions (α=.05). The analysis of the interview part of the study was done by amalgamating the data by categories related to the activities and then reporting the results of chi-sqauare tests between treatment and control groups.

External Validity

The results of this study could be generalized to any college-level computer literacy class in the target population, since the accessible population and the sample were representative of similar environments in other colleges (Martin & Martin, 1988). The gender ratio was slightly in favor of females but was not too lopsided to affect the generalizability. I would be able to generalize the results to other coeducational colleges.

However, to be valid, those generalizations must be done using a similar treatment involving a personalized (constructivist) treatment and a control totally absent of any kind of personalization (objectivist). A similar computing environment like the Macintosh computer or a comparable visual icon and mouse system would be also in order to extend the generalization. The results of this study are not extendible to programming classes and courses using main-frame computers or traditional operating systems. Finally, as is often the case with qualitative methodology, the results of the students' review sheets and interviews have a limited generalizability beyond the accessible population.

CHAPTER 4

RESULTS

Descriptive Statistics

Table 10 shows the general descriptive statistics for both the dependent and independent variables.

TABLE 10 - DESCRIPTIVE STATISTICS OF STUDY VARIABLES

Dependent Variables	Mean	SD	Min	Max
Software Proficiency	56.94	8.02	37	71
Computer Literacy	18.94	6.67	4	38
Attitude	127.39	16.88	64	155
Independent Variables		n1	n2	
Group Membership		52 Treatment	56 Control	
Gender		44 Male	64 Female	
Age		42 Traditional	66 Nontrad.	
Computer Ownership		54 Yes	54 No	
First Course		30 Yes	78 No	

Note. n=108.

Table 11 presents the descriptive statistics for the control and treatment groups on attitude and achievement posttests. The achievement score was broken down to reveal the computer literacy part and the software proficiency part. The treatment group means were higher for attitude and computer literacy but the control group mean was higher for software proficiency.

TABLE 11 - POSTTESTS DESCRIPTIVE STATISTICS BY GROUP

	Group Membership	
	Treatment (n=52)	Control (n=56)
Software Proficiency		
Mean	56.17	57.64
SD	9.95	5.68
Computer Literacy		
Mean	20.25	17.71
SD	7.68	5.35
Attitude		
Mean	129.40	125.52
SD	16.81	16.88

Table 12 shows the attitudes and achievement statistics for personal attributes (age and gender). The means for females were higher for all three tests. Traditional students obtained better scores on attitude and software proficiency and nontraditional students were better on computer literacy scores.

TABLE 12 - POSTTESTS DESCRIPTIVE STATISTICS BY GENDER AND AGE

	Gender		Age	
	Female (n=64)	Male (n=44)	Traditional (n=42)	Nontraditional (n=66)
Software Proficiency				
Mean	59.19	53.66	58.45	55.97
SD	6.77	8.63	8.53	7.58
Computer Literacy				
Mean	20.09	17.25	18.17	19.42
SD	6.81	6.15	4.37	7.78
Attitude				
Mean	128.16	126.27	128.50	126.68
SD	16.84	17.07	17.60	16.50

In Table 13, the posttests scores are presented in relation to computer experience (computer ownership and previous computer instruction). In all three scores, the means of students that owned computers were higher than the means of students that did not own a computer. Means were higher in all three tests for students that had received previous computer instruction before the beginning of the study.

TABLE 13 - DESCRIPTIVE STATISTICS BY COMPUTER EXPERIENCE

	Computer Ownership		Previous Instruction	
	Own (n=54)	Don't Own (n=54)	Had (n=78)	Had not (n=30)
Software Proficiency				
Mean	57.11	56.76	58.29	53.40
SD	8.12	7.99	7.67	7.96
Computer Literacy				
Mean	19.28	18.59	19.22	18.20
SD	6.09	7.24	6.51	7.12
Attitude				
Mean	129.43	125.35	128.41	124.73
SD	16.16	17.48	16.93	16.74

Table 14 is a presentation of descriptive statistics on other information collected. The majority of students were not familiar with either the Macintosh computer or any of the software.

TABLE 14 - ACQUAINTANCE WITH COMPUTER OR SOFTWARE (SURVEY)

QUESTIONS	# Yes	% Yes	# No	% No
First contact Mac	73	68%	35	32%
First contact Paint	92	85%	16	15%
First contact Word	79	73%	29	27%
First contact Excel	96	89%	12	11%

Note. n=108.

Table 15 presents a correlation matrix between all study variables. No correlation was higher than 0.5. The highest correlations found were 0.42 between computer literacy scores and software proficiency scores, and -0.41 between age and previous instruction, meaning that nontraditional students were more likely to be novice with computers than traditional students.

TABLE 15 - CORRELATION MATRIX FOR ALL STUDY VARIABLES

	Group	Gender	Age	Own	Prev.	Attitude	Literacy	Software
Group	1	-	-	-	-	-	-	-
Gender	0.14	1	-	-	-	-	-	-
Age	0.14	-0.12	1	-	-	-	-	-
Own	-0.19	-0.04	-0.04	1	-	-	-	-
Prev.	-0.06	0.12	-0.41	-0.08	1	-	-	-
Attitude	-0.12	0.06	-0.05	-0.12	0.10	1	-	-
Literacy	-0.19	0.21	0.09	-0.05	0.07	0.26	1	-
Software	0.09	0.34	-0.15	-0.02	0.27	0.15	0.42	1

Note. n=108.

Table 16 presents the descriptive statistics for the control and treatment groups on variables related to time dedicated and resources consulted.

TABLE 16 - DESCRIPTIVE STATISTICS FOR THE STUDENT REVIEW SHEET

	Treatment Group[a]		Control Group[b]	
	Mean	SD	Mean	SD
Number of references	2.37	3.17	2.05	1.73
Number of software	3.40	2.38	2.54	1.65
Number of faculty	0.65	1.48	0.29	0.62
Number of students	1.75	1.96	1.38	1.15
Number of assistants	7.04	7.49	4.79	5.30
Time in hours	24.04	18.22	16.46	14.41
Extra lab hours	10.94	12.38	8.16	12.71

Note. n=108.
[a]n = 52. [b]n = 56.

Inferential Statistics

Software Proficiency

Table 17 presents the hierarchical analysis of the independent variables in relation to the software proficiency scores. The significance computations were done using model I error (Cohen & Cohen, 1983). All covariates together accounted for a significant 17% of the variance in the software proficiency scores. Set A (personal characteristics) accounted for a significant 13% of the variance of which 12% came from the variance in the gender variable. The age factor was not significant nor was set B containing the computer experience variables. Consequently, the gender variable was kept for inclusion in the complete multiple regression model for software proficiency.

Group membership accounted for none of the variance in software proficiency scores when gender information was present. Therefore I failed to reject Ho1. Set C (interactions between group membership and computer experience) was found significant, accounting for 6% of the variance in software proficiency scores when the other variables were present. From that set, I found that the interaction between group membership and previous instruction was significant, accounting for 5% of the variance in scores. As a consequence, Ho16a was rejected. The other interaction between computer ownership and group membership was not significant and Ho15a was not rejected. Finally, set D (interactions between group membership and personal characteristics) was not found significant. Consequently

Ho13a and Ho14a were not rejected. In summary, for software proficiency, I was able to reject Ho16a but failed to reject Ho1, Ho13a, Ho14a and Ho15a.

TABLE 17 - HIERARCHICAL MRC ANALYSIS OF VARIABLES ON SOFTWARE PROFICIENCY

VARIABLES	DF	R^2 (sr^2)	F	p
All covariates	4,103	0.17	5.35	< .05
SET A	2,105	0.13	7.72	< .05
x1: Gender	1,106	0.12	3.73	< .05
x2: Age*	1,105	0.01	1.20	> .05
SET B*†	2,103	0.04	2.48	> .05
Simultaneous	6,101	0.20	4.24	< .05
Gender (x1)	1,106	0.12	13.89	< .05
Group (x5)	1,105	0.00	0.00	> .05
SET C	2,103	0.06	3.77	< .05
Grp x Prev (x9)	1,104	0.05	6.27	< .05
Grp x Home (x8)	1,103	0.01	1.26	> .05
SET D†	2,101	0.02	1.26	> .05

* Covariates dropped from the model.

† Nonsignificant set contribution, no further analysis required.

Note. n=108.

Computer Literacy

Table 18 presents the hierarchical analysis of the independent variables in relation to the computer literacy scores. All covariates together accounted for a small 7% of the variance in the computer literacy scores. They were not significant and were dropped from further analyses.

Group membership accounted for a significant 4% of the variance in software proficiency scores. Therefore I rejected the null hypothesis Ho2 on treatment effect. The interactions between group membership and computer experience (Set C) were not found significant, accounting for none of the variance in computer literacy scores when group membership was present, therefore Ho15b and Ho16b were not rejected. Set D (interactions between group membership and personal characteristics) was found significant, accounting for 16% of the variance of computer literacy scores in the presence of the other variables. From that set, I found that the interaction between group membership and age was significant, accounting for 5% of the variance in scores, therefore rejecting Ho14b. The interaction between group membership and gender was also found significant, accounting for 11% of the variance and permitting the rejection of Ho13b. In summary, for computer literacy, I was able to reject Ho2, Ho13b and Ho14b but failed to reject Ho15b and Ho16b.

TABLE 18 - HIERARCHICAL MRC ANALYSIS OF VARIABLES ON COMPUTER LITERACY

VARIABLES	DF	R^2 (sr^2)	F	p
All covariates*†	4,103	0.07	1.92	> .05
Simultaneous	5,102	0.20	5.14	< .05
Group (x5)	1,106	0.04	4.01	< .05
SET C†	2,104	0.00	0.00	> .05
SET D	2,102	0.16	10.20	< .05
Grp x Age (x7)	1,103	0.05	5.66	< .05
Grp x Sex (x6)	1,101	0.11	14.02	< .05

* Covariates dropped from the model.

† Nonsignificant set contribution, no further analysis required.

Note. n=108.

Attitude

Table 19 presents the hierarchical analysis of the independent variables in relation to the attitude scores. All covariates together accounted for a small 2% of the variance in attitude scores. They were not significant and were dropped from further analyses.

The whole model was insufficient to explain the variance in attitude scores. All the variables together accounted for a nonsignificant 4% of the variance in attitude scores. Therefore, I failed to reject null hypotheses Ho3, Ho13c, Ho14c, Ho15c and Ho16c. None of the null hypotheses were rejected in relation to attitude scores.

TABLE 19 - HIERARCHICAL MRC ANALYSIS OF VARIABLES ON ATTITUDE

VARIABLES	DF	R^2 (sr^2)	F	p
All covariates*†	4,103	0.02	0.65	> .05
Simultaneous†	5,102	0.04	0.79	> .05

*Covariates dropped from the model.

† Nonsignificant set contribution, no further analysis required.

Note. n=108.

Resources Consulted and Time Spent

Table 20 refers to the testing of null hypotheses Ho4 to Ho10. The table displays the differences between the control and treatment groups with regards to each question asked. Data were collected for each assignment and the results were summed for the analysis. I found significant differences on the number of pieces of software used and the amount of time devoted to projects. I was able to reject Ho5 and Ho8 but failed to reject Ho4, Ho6, Ho7, Ho9 and Ho10.

TABLE 20 - REVIEW SHEET RESULTS FOR TREATMENT AND CONTROL GROUPS

VARIABLES	Mean (Treatment[a])	Mean (Control[b])	F
Number of references	2.37	2.05	0.41
Number of software	3.40	2.54	4.91*
Number of faculty	0.65	0.29	2.91
Number of students	1.75	1.38	1.49
Number of assistants	7.04	4.79	3.29
Time in hours	24.04	16.46	5.78*
Extra lab hours	10.94	8.16	1.32

Note. n=108.

[a]$\underline{n}$ = 52. [b]$\underline{n}$ = 56.

*$\underline{p}$ < .05

Interview Results

Ten students were interviewed using the format presented in Appendix B. Five students were selected at random from the treatment group, four females and one male with ages between 20 and 22. Five students were selected at random from the control group, four females and one male with ages between 21 and 39. Table 21 presents a summary of the results.

No significant difference between the control and treatment groups was found for any of the questions. Consequently Ho11a, Ho11b, Ho12a, Ho12b and Ho12c were not rejected.

TABLE 21 - INTERVIEW RESULTS BROKEN DOWN BY GROUP

Questions	Total (Treatment) (n=5)	Total (Control) (n=5)	$\chi 2$
Number of positive comments	10	9	4.13
Number of negative comments	5	7	6.80
Number of skills mentioned	14	12	3.00
Number of skills mentioned as useful	6	7	8.00
Number of outside people involved	1	0	1.11
Number of steps taken	29	23	3.20

*p < .05

Treatment Verification Results

A total of 47 students were observed (23 in treatment, 24 in control) during period 4 (SuperPaint) and then period 9 (Excel). Treatment group activities were reported significantly higher in the treatment group and totally absent in the control group. Conversely, control group activities were reported significantly higher in the control group and totally absent in the treatment group. Results and tables are presented in Appendix F.

Summary of Results

1. Ho1 was not rejected because I failed to find any difference in software proficiency scores between the treatment and control groups.

2. Ho2 was rejected because treatment group students had higher computer literacy scores than control group students.

3. Ho3 was not rejected as I failed to find any difference in attitude scores between the treatment and control groups

4. Ho4 was not rejected because no difference in references consulted was found between the groups.

5. Ho5 was rejected as the number of pieces of software used was higher in the treatment group than in the control group.

6. Ho6 was not rejected because no difference in faculty members consulted was found between the groups.

7. Ho7 was not rejected because no difference in student collaborations was detected between the groups.

8. Ho8 was rejected as the amount of time taken to complete the projects was higher in the treatment group than in the control group.

9. Ho9 was not rejected because no difference in teaching asistant consultations was found between the groups.

10. Ho10 was not rejected because no difference in extra hous spent in the lab was detected between the groups.

11. Ho11a was not rejected because students interviewed in the treatment group did not mention more skills learned than in the control group.

12. Ho11b was not rejected because students interviewed in the treatment group did not identify more skills as useful than in the control group.

13. Ho12a was not rejected as students interviewed in the treatment group did not have more positive comments than those interviewed in the control group.

14. Hol2b was not rejected as students interviewed in the treatment group did not have less negative comments than those interviewed in the control group.

15. Hol2c was not rejected as students interviewed in the treatment group did not declare more intermediate steps than those interviewed in the control group.

16. Hol3a was not rejected as the interaction between gender and group membership was not found significant for software proficiency.

17. Hol3b was rejected as the interaction between gender and group membership was found significant for computer literacy.

18. Hol3c was not rejected as the interaction between gender and group membership was not found significant for attitude.

19. Hol4a was not rejected as the interaction between age and group membership was not found significant for software proficiency.

20. Hol4b was rejected as the interaction between age and group membership was found significant for computer literacy.

21. Hol4c was not rejected as the interaction between age and group membership was not found significant for attitude.

22. Hol5a was not rejected as the interaction between computer ownership and group membership was not found significant for software proficiency.

23. Ho15b was not rejected as the interaction between computer ownership and group membership was not found significant for computer literacy.

24. Ho15c was not rejected as the interaction between computer ownership and group membership was not found significant for attitude.

25. Ho16a was rejected as the interaction between previous instruction and group membership was found significant for software proficiency.

26. Ho16b was not rejected as the interaction between previous instruction and group membership was not found significant for computer literacy.

27. Ho16c was not rejected as the interaction between previous instruction and group membership was not found significant for attitude.

28. The treatment and control activities took place exactly as planned and no contamination of either group by the other was noticed.

29. The interviews showed that students were appreciative of the textbook, assistants and the Word and Excel software but were critical of the network, SuperPaint and the number of computers available.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Principal Findings and Conclusions

Main Effects

In this experiment I failed to demonstrate a link between group membership and software proficiency scores. None of the variance in scores can be explained by group membership. It means that either the personalization was ineffective to increase software knowledge or the assignments themselves were equally effective (or ineffective) in modifying software proficiency scores. With a power of 0.87, there is a 13% chance that I missed any effect. The control group had a slightly higher mean but that was due to chance alone.

On the software proficiency part of the achievement test, females obtained significantly higher scores than males, independently of group membership. That result may be accounted by the fact that according to Moses (1993), female students may be more dedicated to their work than their male counterparts. I have observed that phenomenon several times in the past and it is my belief that the same thing happened during the experiment. Age was not a factor, nor was computer ownership and previous instruction. This is normal since only

32% of the students were acquainted with the Macintosh before the experiment.

On the computer literacy test the covariates had no effect on computer literacy scores. Group membership, however, had a significant effect on computer literacy scores. The effect was, as expected, in favor of the treatment group. For the following reasons, the effect is most likely due to the personalization of the assignments.

1. The personalized assignments permitted the students to explore more facets of the computer they were working on.

2. The assignments having more flexible requirements, the students presumably consulted their books and explored the apparatus instead of merely following instructions.

3. Students were probably more motivated to produce a quality personal product they could show to other people.

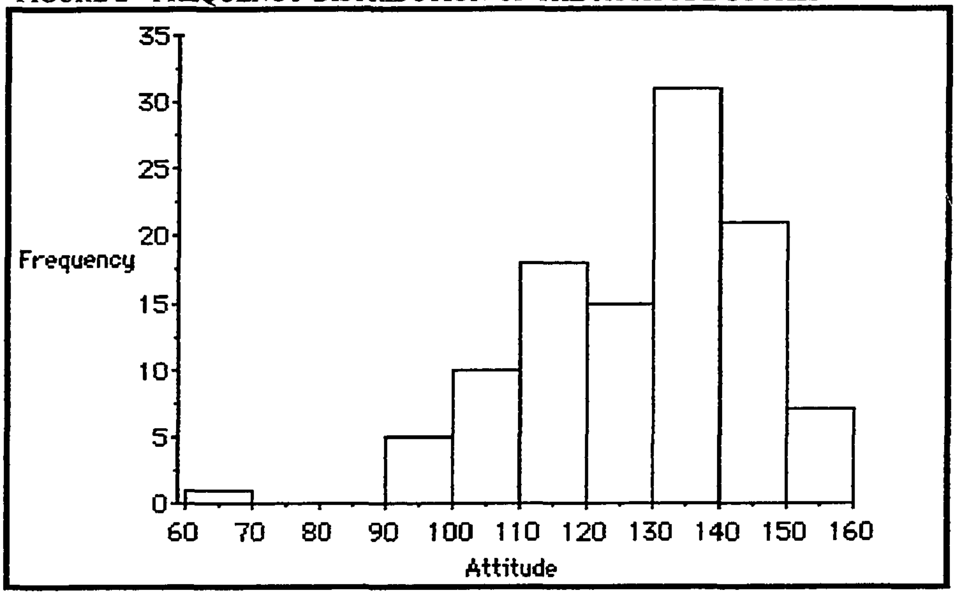
For attitude scores, none of the variables nor the whole model was found significant. It appears that the treatment was ineffective in modifying the attitudes toward computers. With a power of 0.88, there is of course a 12% chance that I missed the effect on attitudes. A number of factors may explain this finding.

1. The challenge in the treatment assignments was possibly cancelled by the frustration of working toward a less determined final product. It is also possible that some students preferred the personalized format and others preferred to follow instructions, hence canceling each other scores. These possible explanantions may be visualized by a slight bimodal tendency in the attitude

scores shown in Figure 2. The frequency distribution shows the same bimodal form when divided into control and treatment groups (not shown).

A slight skewness of the distribution is also perceptible, but I had no reason to doubt a violation of the assumption of normality because the sample size was large enough (Gravetter & Wallnau, 1988).

FIGURE 2 - FREQUENCY DISTRIBUTION OF THE ATTITUDE SCORES



Note. n=108.

2. The two sets of assignments may have failed to generate any changes in attitudes at all.

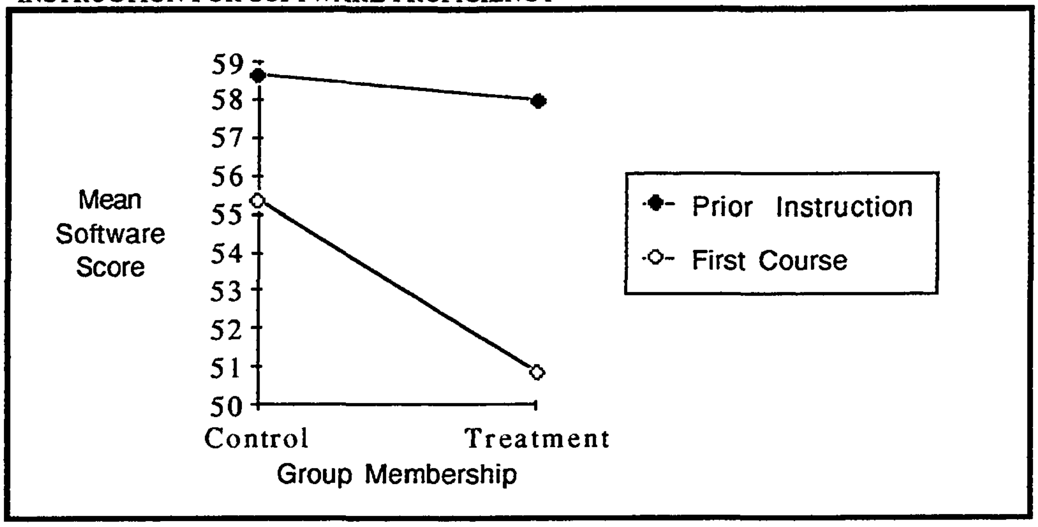
3. The students attitudes toward computers might already have been high enough before the experiment, like in the Martin & Martin (1986, 1988) studies.

4. The attitude test might have been inadequate. It is possible that attitudes toward computers encompass more than the anxiety factor measured by the test.

Interactions

The interaction between group membership and prior instruction was found significant for software proficiency scores. Figure 3 shows that the students without prior instruction did significantly better in the control group than in the treatment group (see values in Table 13). My interpretation is that students who were totally novice in the matter of instruction most likely lacked the comforting structured environment provided by the non-personalized assignments. As a result, those students without prior instruction had lower software proficiency scores and may have been too busy learning new computer skills. This hypothesis was rejected with a power of only 38%. Therefore either the effect size found was larger than the effect size projected or there has been a type I error.

FIGURE 3 - INTERACTION BETWEEN GROUP MEMBERSHIP AND PRIOR INSTRUCTION FOR SOFTWARE PROFICIENCY



Two interactions were found significant for computer literacy. Figure 4 shows the interaction between group membership and age. The figure clearly displays the score increase for nontraditional students and the lack of difference for traditional students (see values in Table 12 or 22). A possible explanation is that nontraditional students (age 22 and older) are generally more mature and experienced, therefore presumably more eager to profit from the personalization by engaging in activities beyond the minimum requirements, therefore expanding the knowledge of the machine they were working on. As for traditional students, I suspect they chose more to do as they were told. Since the two sets of assignments were designed to contain the same material, traditional students most likely learned what was programmed hence the lack of treatment effect.

FIGURE 4 - INTERACTION BETWEEN GROUP MEMBERSHIP AND AGE ON COMPUTER LITERACY SCORES

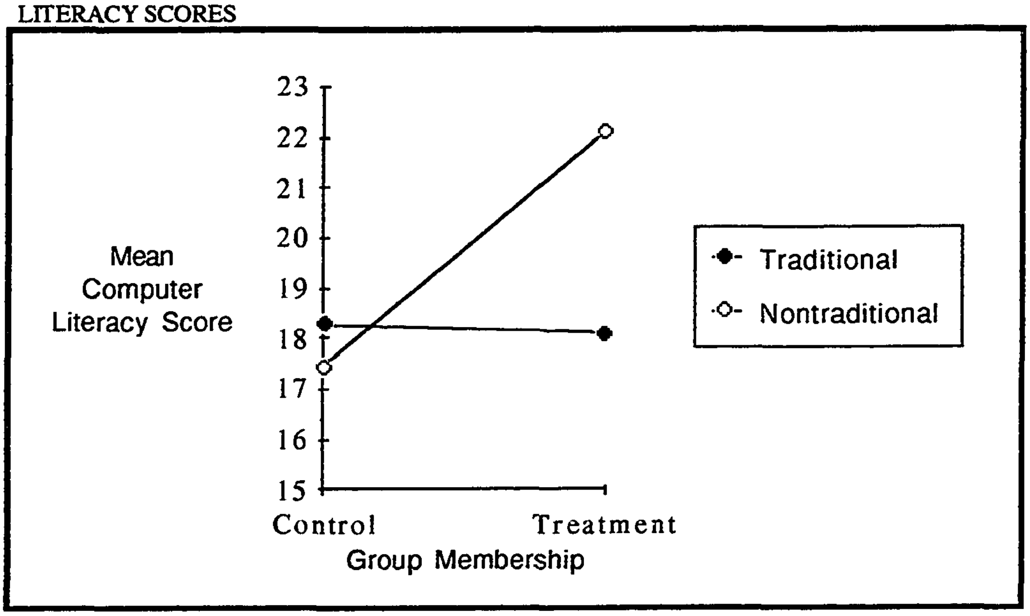


Figure 5 presents the interaction between group membership and gender on computer literacy scores. The figure clearly shows the score increase for female students (see Table

12 or 22). This result goes in the same direction as Edmonson (1989). She found that females were mainly meaningful learners compared with males that were mainly rote learners. She suggested that constructivism could be most beneficial to females and could close the gender gap caused by the males being particularly at ease with the positivist and objectivist view of science and technology. My results suggest that females benefited more than males (in relation to computer literacy scores) when involved in a personalized (constructivist) environment. Those two latter hypotheses were rejected even with a power of only 17%, suggesting an effect size larger than expected. However, that result might also be explained by a type I error.

FIGURE 5 - INTERACTION BETWEEN GROUP MEMBERSHIP AND GENDER ON COMPUTER LITERACY SCORES

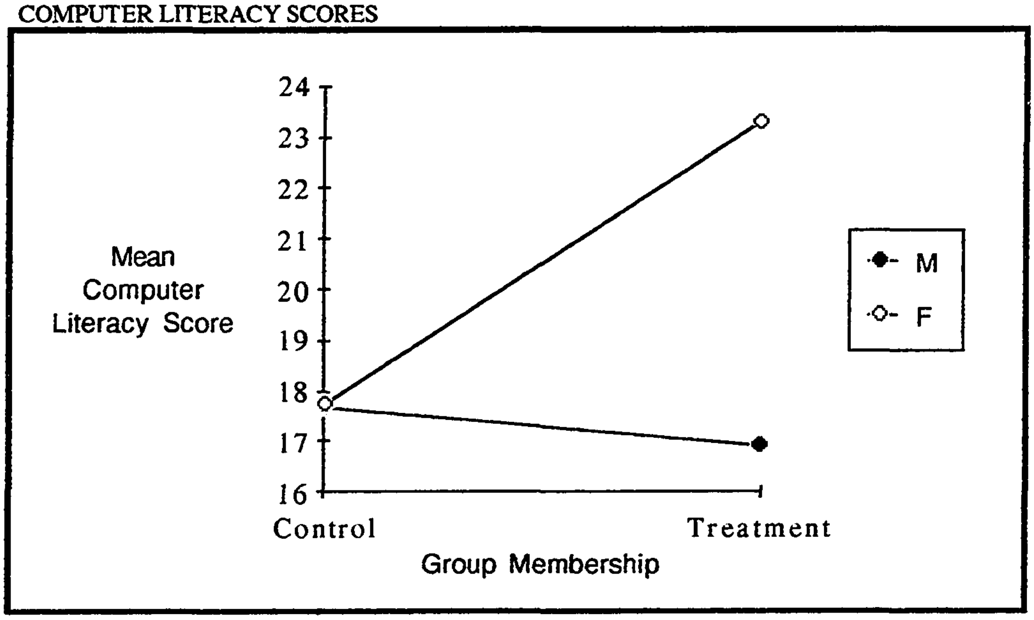


Table 22 shows the independence of the gender and age variables in relation to the significant interactions on computer literacy. Females and males were well balanced within the age groups, confirming the independence of the two interaction results.

TABLE 22 - MEANS AND NUMBER OF SUBJECTS IN RELATION TO AGE, GENDER AND COMPUTER LITERACY SCORES

		Traditional	Nontraditional	TOTAL
Male	n	14	30	44
	mean	16.36	17.67	17.25
Female	n	28	36	64
	mean	19.07	20.89	20.09
TOTAL	n	42	66	108
	mean	18.17	19.42	18.94

The treatment verification confirmed that the activities and the treatment took place as planned. The specific activities were oberved in the group where there were supposed to happen and there was no contamination between the two groups. A report is presented in Appendix F.

Time and Resources Variables

The number of pieces of software used was significantly greater in the treatment group than in the control group. This may be explained by the personalization of the assignments in the treatment group. In having the freedom to choose their layouts, the students were possibly more motivated to include some other material from another software source, including their own. In the control group, since the format was predetermined, the same applications were probably used.

The amount of time dedicated to the assignments was also greater in the treatment group than in the control group. Personalization probably permitted the students more liberty to take more time to enhance their projects in different manners as the control group students were mainly following models and instruction therefore consuming less time.

No differences were found between the groups for the number of references consulted, the number of faculty members and assistants consulted, the number of fellow students involved and the amount of extra hours in the lab. These measures were probably more robust to change than the other two, so they remained untouched by the treatment probably because some assignments were quite short and easy (4-5 hours in average to complete them), therefore minimizing the chance for a strong difference.

Students' Comments

Based on the interviews, I am able to draw the following conclusions. However these are weak conclusions since no statistical difference was found between the two groups due to the very limited sample.

1. Students in both groups had positive comments about the labs. There was no significant difference in the number of positive comments between the groups.

2. There was no significant difference in the number of negative comments between the groups. Most comments related to computer or network problems.

3. There was no significant difference in the number of skills or useful skills between the groups The particular skills identified were comparable in both groups meaning that the assignments were probably judged equivalent in terms of usefulness.

4. The treatment group students interviewed took more steps (though not significantly more) to complete their projects.

Implications of Study Results

1. Because of a significant main effect, treatment group students had higher computer literacy scores than control group students. More personalization of computing assignments may increase general knowledge about computers.

2. Because the interaction between gender and group membership was found significant for computer literacy, more personalization in computing assignments or projects may benefit female students.

3. Because of a significant interaction between previous instruction and group membership, more personalization of computing assignments may increase software proficiency for students that already received previous computer instruction.

4. Because of a significant interaction between age and group membership for computer literacy, nontraditional students (22 and older) might benefit more from personalization.

5. Results suggest that personalization may have been less effective for software proficiency scores of student populations without prior instruction (students that never had another computer course before the study). For that population segment, the objectivist approach may be better.

6. Results suggest that personalization seems to have no effect at all on attitudes toward computers.

7. Results suggest that it is possible to adapt the course assignments and prescribe projects to specific subgroups and individuals.

Limitations

1. It was impossible to see the within group effectiveness of the treatment without a pretest.

2. Power numbers for the interaction hypotheses were low (17% and 38%), minimizing the strength of the results obtained.

3. The power for the main hypotheses (Ho1 to Ho3) was not 0.99 or 1 but rather 0.87, leaving a possibility for a missed effect.

4. The effect size estimated was an approximation since no similar research has been done before.

5. The effects reported (or lack of them) might have been generated by the instructor instead of the treatment since only

one was used. It is possible that the personal style of the instructor matched one approach better than the other.

6. It is possible that the only instructor was a factor for the higher scores obtained by females students because of his particular teaching style.

7. Only 10 students were interviewed and the results are in my judgment valid only for the subjects interviewed.

8. The actual treatment time may have been insufficient (20 hours) to generate effects on more robust variables (like attitude). Moreover, many aspects of the assignments were similar, so the "real" treatment time might have been much lower.

9. Treatment time was probably different for every student since it involved projects and not formal teaching.

10. No special characterictics were found for students that achieved the higher or the lowest scores of the range because none of those students were interviewed.

11. There could have been inadequacies in the attitude test. Another general attitude test would have been valuable to validate the attitude results.

12. The age variable was divided in two categories (traditional and nontraditional) lacking the versatility of the actual ages.

13. The results from the review sheet were self-reported by the students at the end of the experiment at the time of the postests. Therefore those particular results lacked verification.

14. The posttests were of multiple-choice format and were also strongly objectivist-oriented. The tests may have been inadequate in measuring progress in a constructivist manner.

15. The analysis of data for the three dependent variables was done using three separate MRC analyses instead of an integrated canonical analysis. However, the correlation matrix shows almost nonexistent correlations between the variables, hence justifying the adequacy of the MRC choice. Nevertheless, since there was a small correlation between the two achievement scores there was probably a slight increase in the experiment-wise error.

Suggestions for Future Research

1. Replicate the study with a larger sample in order to increase statistical power for the interaction hypotheses.

2. Redesign the study in order to find the causes of the gender differences found in this study. One avenue may be to have more than one instructor to control the instructor effect versus gender. It would also be interesting to conduct the same experiment in an all-female college.

3. Replicate the study with additional variables to find the factors related to the 80% unexplained variance in computer literacy and software proficiency scores. More or different variables may be added in the model to account for the unexplained variance. These variables may include socio-economic status, ethnic origin, time and day of instruction and previous use of computers in other courses and major.

4. Replicate the study to determine the factors related to the 96% unexplained variance in attitude scores. This means that almost certainly there are many other factors that were not explored. Aside from the variables aforementioned, the preference for team or individual work, the need for structure or for rigid framing, or other traits may be explored in a future study.

An exploratory investigation of the attitude scores shows that 41% of the variance in attitude scores may be explained by the four covariates if only the 16 subjects with lower attitudes scores (less than 110) are included. For those, 28% of the variance came from computer ownership. Also, for students with high attitudes (131 and more), group membership explained 8% of the variance in attitude (significant). Here, a pretest would have provided valuable information.

By breaking-up attitudes scores by categories, I have found that the time dedicated to complete the assignments could be an avenue of future investigation. A longer time of completion seems to be associated with high and low attitudes. However, since the students reported those values themselves, they are no more than clues to future research. Table 23 presents the time spent on assignments for each category of attitude scores.

TABLE 23 - TIME SPENT ON ASSIGNMENTS AND ATTITUDE SCORES

Attitude Scores Range	n	Mean Time (Hrs)
Less than 100	7	14.6
101-110	9	24.7
111-120	20	16.8
121-130	15	14.7
131-140	33	17.2
141-150	20	32.5
151 and more	4	45.0

Note. n=108.

Table 24 was constructed by dividing the sample into three subgroups classified by attitude score. I performed a separate hierarchical MRC analysis for each subgroup. The group membership sr^2 and their statistical significance (or not) are reported. Table 24 shows that group membership explains a significant part of the variance for high scorers. Also it is possible that a larger sample would provide the same conclusion for low scorers. An attitude pretest (and maybe other variables) may help in selecting the proper prescription for each student in the class (personalized or not).

TABLE 24 - GROUP MEMBERSHIP EFFECT FOR STUDENTS WITH LOW, MEDIUM AND HIGH ATTITUDE SCORES

Attitude scores	n	Mean treatment	Mean control	Grp membership sr^2
Less than 110	16	120.56	94.00	0.17
111-130	35	120.07	118.76	0.01
131 and more	57	142.24	138.46	0.08*

* $p < .05$

5. It would be useful to replicate the experiment with a pretest-posttest design in order to see the within group effectiveness of the treatment.

6. It would be useful to replicate the experiment with more than one instructor in order to see the effect generated by a particular instructor.

7. Final course grades and grade point averages could serve as predictors In this study, the correlations between the final grades and the dependent variables were $r=0.20$ for attitude, $r=0.20$ for computer literacy and $r=0.67$ for software proficiency.

8. Replicate the study with a larger number number of students interviewed.

9. Replicate the study with the actual ages or birthdates instead of age categories.

10. Investigate further the age and gender factors by designing an experiment on personalization centered on one or the other variable. This could be achieved by a counterbalanced design with treatment and control activities balanced with the age or gender variable. A more circumscribed result would provide a more precise prescription for the practitioner.

11. Find a more reliable measure for the time and resources information. An observation would probably be more precise than the post-hoc self-reported review sheet used in this study. Also, by verifying treatment by student name instead of computer workstation, another source of time and resources data gathering would be provided.

12. Elaborate a posttest including constructivist tasks instead of objectivist multiple-choice exams.

13. Do a correlational study between attitude scores and variables related to personal characteristics and experience.

14. Develop a new attitudes toward computers test.

15. Try to analyze the results with canonical analysis, in the likely event that the correlation between some variables might be high (especially if there is more than one achievement or attitude score).

16. Try to establish a-priori effect sizes as precisely as possible, using this study's results as a guide. Some effect sizes were in these cases underestimated and others overestimated. This is particularly obvious in the interactions. Three were found significant with power ranging from 17% to 38%, meaning that either the actual effect sizes were larger than the projected effect sizes or type I errors may have occurred.

17. Do a complete qualitative (longitudinal) study on the subject of personalization with videos and extensive interviews.

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APPENDIX A

ASSIGNMENTS

TREATMENT GROUP ASSIGNMENTS

Assignment #1 (Treatment Group)

You are in search of permanent employment. You are now required to write your own resume using the Microsoft Word program. Your resume is your passport to employment therefore creativeness and originality count. Make a good impression by expressing yourself!

General Requirements:

The format is letter: 11 inches X 81/2 inches.

You may create any layout you want and any number of pages you want.

You may use other pieces of software to make up your own resume but the final document must be on Word.

You must show your work to your instructor one week prior to final delivery.

This assignment counts for 20% of your final grade.

A few copies of a book on resumes showing several examples will be available during the lab. Feel free to use it as a guide to your project.

Note: This is your project. All the assistance you need is available from 9:00 AM to 9:00 PM during weekdays at the TA's office.

Assignment #2 (Treatment Group)

You wish to create a birthday greeting card for a person special to you using the SuperPaint drawing program on the Macintosh. It may be your girlfriend, boyfriend, husband, wife, mother, father, etc. You may put any picture your want on the cover and any greeting you wish inside.

Ten card models will be on display during the lab period. You may use one of these examples to inspire you or make up your own from scratch.

General Requirements:

The card must follow the following specifications:

The card must be printed on one of the lab's laser printers using 11X17 paper.
You are free to use any card design you want.

You must show your work to your instructor one week prior to final delivery.

This assignment counts for 10% of your final grade.

Note: This is your project. All the assistance you need is available from 9:00 AM to 9:00 PM during weekdays at the TA's office.

Assignment #3 (Treatment Group)

You wish to produce your personal wealth report in the form of your personal annual report. To do this, you may inspire your design from one of the five annual reports that will be on display in the lab. Instead of the corporation's data, you substitute your own (personal property, bank accounts, investments, real estate, loans, etc.). Try to be as accurate as possible. Remember to include as much information as possible to produce *an elaborate document of approximately 10 pages. The charts and graphs* must contain a legend, and one graph must be of the superimposed type.

You can use any other piece of software you judge interesting for your project, but all tables and graphs must be done on Excel.

As a complement, you must develop a small interactive inventory software system using the Excel macro capabilities. Its use is to monitor the inventory of any <u>one</u> collection important to you (it may be books, records, videos, motorcycle parts or any other).
You must develop 3 modules to manage data. The information must be manipulated using dialogs. Do not enter or modify data directly on the spreadsheet.

1. Adding new information
2. Updating/Deleting existing information
3. Display the information

<u>General Requirements:</u>

•The format is letter: 11 inches X 81/2 inches.
•An example of the work will be on display in the lab.
•You must show your work to your instructor one week prior to final delivery.
•This assignment counts for 30% of your final grade.

<u>Note:</u> This is your project. All the assistance you need is available from 9:00 AM to 9:00 PM during weekdays at the TA's office.

A version of a small inventory system was developed using another programming language. It is available on the network in executable form, therefore you may see how it looks and play with it but you can't see how it was done. That example is generic, you must personalize it as presented above. Also, the visual aspect of your system may be quite different.

CONTROL GROUP ASSIGNMENTS

Assignment #1 (Control Group)

You are a resume consultant and must write a resume for Ms. Martha Washington who is looking for an executive position for an important hotel firm. You are required to use the Microsoft Word program. It is important that you comply with the rigid standards of the business world. Ms. Washington furnished the following data over the phone in order to make her resume:

Her address is 2900, Fallside Road, Dundee, Florida 33838.
Her telephone number is (813) 439-1234.
She is married and was born in Miami, Florida.
She had a MBA from Yale University in New Haven CT in 1990.
She had a bachelors degree in Business Administration from the University of Central Florida in Orlando in 1985.
She went to Palm High School in Miami.
She is now the manager of the Dundee Holiday Inn since 1991.
She was the assistant manager of the New Haven Holiday Inn from 1988-1990.
She was the assistant manager of the Melbourne, Florida Days Inn from 1986-1990.
She was a desk clerk at the Orlando East Ramada Inn from 1981-1985.
She was a desk clerk at the Fontainbleau Hilton in Miami Beach from 1979-1981.
She likes gardening, piano and movies.
She mentions the regional managers of Holiday Inn, Days Inn and Ramada Inn as references.

General Requirements:

The format is letter: 11 inches X 81/2 inches.

The standard layout presented in the lab must be used for this project.

An example with required steps will be provided in the lab.

You must show your work to your instructor one week prior to final delivery.

This assignment counts for 20% of your final grade.

<u>Note:</u> This is your project. All the assistance you need is available from 9:00 AM to 9:00 PM during weekdays at the TA's office.

Assignment #2 (Control Group)

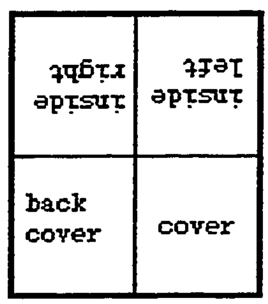
You are hired by Hallmark cards to produce a greeting card for St. Peter's Day, the fisherman's holiday using the SuperPaint drawing program on the Macintosh. The message inside the card will say: "Happy St. Peter's Day! May God bring many fishes and a long and happy life."

A model of the card will be on display during the lab period. The cover of the card represents a fishing boat. Your boat must resemble the boat on the model card. You are also encouraged to add fish pictures on the greeting page.

General Requirements:

The card must follow the following specifications:

The card must be printed on one of the lab's laser printers using 11X17 paper. The page must divided in four parts to produce a 51/2 X 81/2 greeting card. Here is a plan of the layout:



You must show your work to your instructor one week prior to final delivery.

This assignment counts for 10% of your final grade.

Note: This is your project. All the assistance you need is available from 9:00 AM to 9:00 PM during weekdays at the TA's office.

Assignment #3 (Control Group)

You are a designer for a major advertising firm. You are required to produce a high quality annual report for a major corporation. In this assignment you must produce an elaborate document. Using the annual report available in the lab (Price Corporation), you must reproduce exactly the same thing using the Macintosh. When a photograph is present, you may substitute a picture from the picture bank of approximately the same size.

You can use any other piece of software you judge interesting for your project, but all tables and graphs must be done on Excel.

As a complement, you must develop a small business-aid software using the Excel macro capabilities. It will be used to monitor general inventory. It will be made to contain the following data: Identification Number, Description, Quantity, Price.
You must develop 3 modules:

1. Adding new information
2. Updating/Deleting existing information
3. Display the information

General Requirements:

The format is letter: 11 inches X 81/2 inches.

An example of the work will be on display in the lab.

You must show your work to your instructor one week prior to final delivery.

This assignment counts for 30% of your final grade.

Note: This is your project. All the assistance you need is available from 9:00 AM to 9:00 PM during weekdays at the TA's office.

A version of the small system was developed using another programming language. It is available on the network in executable form, therefore you may see how it looks and play with it but you can't see how it was done. You must reproduce the same using Excel macro commands.

FRENCH VERSIONS OF ASSIGNMENTS
TREATMENT GROUP

Travail 1 (Word)
Vous recherchez un emploi permanent. Ecrivez votre propre curriculum-vitae sur Microsoft Word. C'est une étape importante pour obtenir un emploi, la créativité et l'origialité compte. Exprimez-vous et faites une bonne impression!

Spécifications:

Imprimez sur format lettre 21.5 x 28 cm.

Vous êtes libre de choisir la présentation de votre choix.

Vous pouvez vous aider d'un autre logiciel mais le produit fini doit être rendu sur Word.

Vous devez montrer votre travail au professeur une semaine avant la remise finale.

Ce travail compte pour 20% de la note finale.

Quelques copies de livres sur les curriculum-vitae contenant des exemples seront disponibles dans le lab.

** Ce projet est votre responsabilité, Une assistance est disponible de 9:00 à 21:00 du lundi au vendredi au local 3-520.

Travail 2 (SuperPaint)
Vous désirez créer une carte de fête pour une personne spéciale avec SuperPaint. Ce peut étre votre petit(e) ami(e), mari, épouse mère, père, etc. Vous étes entièrement libres quant à la présentation.

Dix modèles de cartes seront en démonstration durant le lab. Vous êtes libres de vous inspirer ou non de ces modèles.

Spécifications:

Imprimez sur format poster 28 x 35 cm.

Vous êtes libre de choisir la présentation de votre choix.

Vous devez montrer votre travail au professeur une semaine avant la remise finale.

Ce travail compte pour 10% de la note finale.

Quelques copies de livres sur les curriculum-vitae contenant des exemples seront disponibles dans le lab.

** Ce projet est votre responsabilité, Une assistance est disponible de 9:00 à 21:00 du lundi au vendredi au local 3-520.

Travail 3 (Excel)
Vous désirez produire votre bilan personnel. Pour cela, vous pouvez vous inspirer d'un des cinq rapports annuels en montre dans le lab. Substituez vos données à celles de la compagnie (biens personnels, comptes de banque, investissements, immeubles, prêts, etc.). Essayez d'être aussi précis que possible. Rappelez-vous d'inclure le plus d'information possible pour produire un document d'environ dix pages. Les graphiques doivent contenir une légende et un graphique doit être surimposé.

Vous pouvez vous aider d'autres logiciels mais tous les tableaux et graphiques doivent être faits sur Excel.

De plus, vous devez développer un programme en langage macro. Faites un petit système d'inventaire pour une collection qui vous intéresse (livres disques, pièces de moto, etc.). Le système contiendra trois modules. L'information doit être entrée par dialogue, n'entrez pas les données directement sur le tableur. Voici les trois modules:
1. Ajout d'information
2. Mise à jour de l'information
3. Présentation de l'information

Spécifications:

Imprimez sur format lettre 21.5 x 28 cm.

Un exemple sera en montre dans le lab.

Vous devez montrer votre travail au professeur une semaine avant la remise finale.

Ce travail compte pour 30% de la note finale.

** Ce projet est votre responsabilité, Une assistance est disponible de 9:00 à 21:00 du lundi au vendredi au local 3-520.

Une version du programme est disponible sur le réseau. Ce programme est barré, vous pouvez voir comment il fonctionne mais comment il a été fait. Vous devez personnaliser votre système, de plus votre système peut être différent.

CONTROL GROUP

Travail 1A (Word)

Vous travaillez pour un service de curriculum-vitae et Madame Martha Washington vient vous voir. Elle recherche un position dans la gestion hôtelière. Avec Word, faites son curriculum-vitae en utilisant les standards du monde des affaires. Voici les informations qu'elle vous a communiqué au téléphone:

Son adresse est 2900, Fallside Road, Dundee, Floride 33838.
Son téléphone est (813) 439-1234.
Elle est mariée et native de Miami, Floride.
Elle a obtenu un MBA de l'Université Yale à New Haven Connecticut en 1990.
Elle a obtenu un baccalauréat en Administration de l'Université de Floride Centrale à Orlando in 1985.
Elle est graduée de l'école secondaire Palm High à Miami.
Elle est actuellement gérante du Dundee Holiday Inn depuis1991.
Elle fut assistante gérante du New Haven Holiday Inn de 1988-1990.
Elle fut assistante gérante du Melbourne, Florida Days Inn de 1986-1990.
Elle fut réceptioniste au Orlando East Ramada Inn de 1981-1985.
Elle fut réceptionniste au Fontainbleau Hilton à Miami Beach de 1979-1981.
Elle aime le jardinage, le piano et le cinéma.
Elle montionne comme références les administrateurs régionaux des chaînes Holiday Inn, Days Inn et Ramada Inn.

Spécifications:

Imprimez sur format lettre 21.5 x 28 cm.

La présentation exigée est en montre dans le lab.

Un exemple avec les étapes sera présenté dans le lab.

Vous devez montrer votre travail au professeur une semaine avant la remise finale.

Ce travail compte pour 20% de la note finale.

Quelques copies de livres sur les curriculum-vitae contenant des exemples seront disponibles dans le lab.

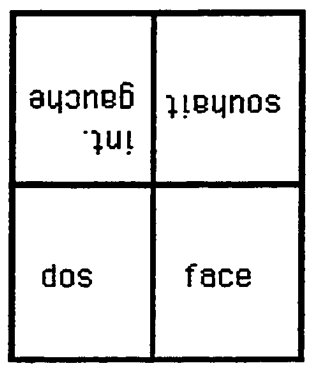
** Ce projet est votre responsabilité, Une assistance est disponible de 9:00 à 21:00 du lundi au vendredi au local 3-520.

Travail 2A (SuperPaint)
Vous êtes engagés par Hallmark pour concevoir une carte de souhaits pour la fête de St-Pierre patron des pêcheurs. Le message de la carte sera: "Joyeuse Saint-Pierre! Que Dieu vous apporte poissons à volonté et une vie longue et heureuse."

Un modèle de la carte sera en démonstration durant le lab. Le dessus de la carte représente un bateau de pêche. Votre bateau doit ressembler au bateau du modèle. Vous êtes encouragés à ajouter des poissons à la page du souhait.

Spécifications:

Imprimez sur format poster 28 x 35 cm. Vous diviserez la page en quatre parties que vous plierez pour faire une carte de 14 x 22 cm.
Voici le plan:



Vous devez montrer votre travail au professeur une semaine avant la remise finale.

Ce travail compte pour 10% de la note finale.

Quelques copies de livres sur les curriculum-vitae contenant des exemples seront disponibles dans le lab.

** Ce projet est votre responsabilité, Une assistance est disponible de 9:00 à 21:00 du lundi au vendredi au local 3-520.

Travail 3A (Excel)
Vous travaillez pour une agence de publicité. On vous demande de produire un rapport annuel de haute qualité pour une grande compagnie. Prenant comme modèle le rapport de la compagnie Price en montre dans le lab, reproduisez-le utilisant le Macintosh. Vous pouvez remplacer les photos par des dessins de même taille.

Vous pouvez vous aider d'autres logiciels mais tous les tableaux et graphiques doivent être faits sur Excel.

De plus, vous devez développer un programme en langage macro. Faites un petit système d'inventaire général. Votre système doit contenir quatre champs (Numéro d'identification, Description, Quantité et Prix). Le système contiendra trois modules. L'information doit être entrée par dialogue, n'entrez pas les données directement sur le tableur. Voici les trois modules:

1. Ajout d'information
2. Mise à jour de l'information
3. Présentation de l'information

Spécifications:

Imprimez sur format lettre 21.5 x 28 cm.

Un exemple sera en montre dans le lab.

Vous devez montrer votre travail au professeur une semaine avant la remise finale.

Ce travail compte pour 30% de la note finale.

** Ce projet est votre responsabilité, Une assistance est disponible de 9:00 à 21:00 du lundi au vendredi au local 3-520.

Une version du programme est disponible sur le réseau. Ce programme est barré, vous pouvez voir comment il fonctionne mais comment il a été fait. Vous devez reproduire la même chose avec Excel.

APPENDIX B

INSTRUMENTS

STUDENT REVIEW SHEET AND INTERVIEW PLAN

Name: ________________ Student #: ________ Group: ______

The following questions relate to your assignment work only.

Review Sheet

Did you use references other than the course text ?

For Assignment #1 (SuperPaint)	How Many?	__________
For Assignment #2 (Word)	How Many?	__________
For Assignment #3 (Excel)	How Many?	__________

Did you use other pieces of software for your assignments?

For Assignment #1 (SuperPaint)	How Many?	__________
For Assignment #2 (Word)	How Many?	__________
For Assignment #3 (Excel)	How Many?	__________

Did you consult other faculty members for your assignments?

For Assignment #1 (SuperPaint)	How Many?	__________
For Assignment #2 (Word)	How Many?	__________
For Assignment #3 (Excel)	How Many?	__________

Did you collaborate with other students for your assignments?

For Assignment #1 (SuperPaint)	How Many?	__________
For Assignment #2 (Word)	How Many?	__________
For Assignment #3 (Excel)	How Many?	__________

How much time did you devote to your work on the assignments (estimate in hours)?

For Assignment #1 (SuperPaint)	__________	Hrs
For Assignment #2 (Word)	__________	Hrs
For Assignment #3 (Excel)	__________	Hrs

Did you consult the teaching assistants?

For Assignment #1 (SuperPaint)	#Times?	__________
For Assignment #2 (Word)	#Times?	__________
For Assignment #3 (Excel)	#Times?	__________

How many extra hours did you spend in the lab?

For Assignment #1 (SuperPaint)	__________	Hrs
For Assignment #2 (Word)	__________	Hrs
For Assignment #3 (Excel)	__________	Hrs

Interview Plan

The interview is conducted by telephone.

1. Open comments about the lab.

For this question you ask the student general comments about their experience in the lab. You must check if the student give a comment identical or similar of one of those mentioned below. Otherwise, you enter the comment in a short sentence form in the "other" section (positive or negative comment). You do not ask for specific comments!

POSITIVE		NEGATIVE	
Likes Macintosh:	___	Would have preferred IBM:	___
Likes computers:	___	Does not like computers:	___
Useful for other courses:	___	Too difficult:	___
Very easy:	___	Too Easy:	___
Lab personnel competent:	___	Lab personnel not competent:	___
Useful in business career:	___	I already know all that stuff:	___
The lab is the best part:	___	Room too hot/crowded:	___
Other: ____________________		Other: ____________________	
____________________		____________________	
____________________		____________________	
____________________		____________________	

2. List the skills you have learned in the lab?

* Which ones do you feel are or will be useful in your life?

Again, you ask the question as is, you do not probe for specific answers. List the skills below.

SKILLS	Useful?
______________________________	___
______________________________	___
______________________________	___
______________________________	___
______________________________	___
______________________________	___

3. Did you involve people outside the school in your project (relatives, friends, others in the community)?

Again, you ask the question as is, you do not probe for specific answers. Check below if the answer is similar otherwise enter in "other" section.

Parents:	___	Local ad agency:	___
Brothers/Sisters:	___	Local business person:	___
Friends/Neighbors:	___	Local bank manager:	___
Other: ____________________		Data processing consultant:	___
____________________			
____________________			

4. Explain the steps taken for each assignment.

For this question, you ask the student if they have taken each step. You check below for a yes answer.

SUPERPAINT:

Looked at greeting card: ___
Drafted on paper before: ___
Used another software: ___
Other steps? ______________________
____

WORD:

Used his/her own old resume: ___
Used a book on resumes: ___
Did a paper draft before: ___
Other steps? ______________________
____

EXCEL:

Did a flowchart: ___
Did an algorithm: ___
Used a corporate annual report: ___
Used another software: ___
Other steps? ______________________
____

REVIEW SHEET (FRENCH TRANSLATION)

Nom:__________________________
Code Permanent:____________
Groupe Cours:______

Avez-vous utilisé des livres de référence pour vos travaux? Si Oui Combien?
Pour travail-1:__ Pour travail-2:__ Pour travail-3:__

Avez vous combiné différents logiciels?
Pour travail-1:__ Pour travail-2:__ Pour travail-3:__

Avez vous consulté d'autres professeurs?
Pour travail-1:__ Pour travail-2:__ Pour travail-3:__

Avez-vous collaboré avec d'autres étudiants?
Pour travail-1:__ Pour travail-2:__ Pour travail-3:__

Combien d'heures approximativement pour réaliser chaque travail?
Pour travail-1:__ Pour travail-2:__ Pour travail-3:__

Avez vous consulté les dépanneurs (nombre de fois)?
Pour travail-1:__ Pour travail-2:__ Pour travail-3:__

Combeien d'heures supplémentaires passées dans le lab?
Pour travail-1:__ Pour travail-2:__ Pour travail-3:__

Merci.

CAIN

COMPUTER OPINION SURVEY

INSTRUCTIONS: PLEASE INDICATE HOW YOU FEEL ABOUT THE FOLLWING STATEMENTS. USE THE SCALE BELOW TO INDICATE YOUR FEELINGS. MARK THE APPROPRIATE CIRCLE ON THE ANSWER SHEET.

1 = Strongly Agree	4 = Slightly Disagree
2 = Agree	5 = Disagree
3 = Slightly Agree	6 = Strongly Disagree

1. Having a computer avialble to me would improve my productivity.	1 2 3 4 5 6
2. If I had to use a computer for some reason, it would probably save me some time and work.	1 2 3 4 5 6
3. If I use a computer, I could get a better picture of the facts and figures.	1 2 3 4 5 6
4. Having a computer available would improve my general satisfaction.	1 2 3 4 5 6
5. Having to use a computer could make my life less enjoyable.	1 2 3 4 5 6
6. Having a computer available to me could make things easier to me.	1 2 3 4 5 6
7. I feel very negative about computers in general.	1 2 3 4 5 6
8. Having a computer available to me could make things more fun to me.	1 2 3 4 5 6
9. If I had a computer at my disposal, I would try to get rid of it.	1 2 3 4 5 6
10. I look forward to a time when computers are more widely used.	1 2 3 4 5 6
11. I doubt if I would ever use computers very much.	1 2 3 4 5 6
12. I avoid using computers whenever I can.	1 2 3 4 5 6
13. I enjoy using computers.	1 2 3 4 5 6
14. I feel that there are too many computers around now.	1 2 3 4 5 6
15. Computers are probably going to be an important part of my life.	1 2 3 4 5 6
16. A computer could make learning fun.	1 2 3 4 5 6
17 If I were to use a computer, I could get a lot of satisfaction from it.	1 2 3 4 5 6
18. If I had to use a computer, it would probably be more trouble than it was worth.	1 2 3 4 5 6
19. I am usually uncomfortable when I have to use computers.	1 2 3 4 5 6
20. I sometimes get nervous just thinking about computers.	1 2 3 4 5 6
21. I will probably never learn to use a computer.	1 2 3 4 5 6
22. Computers are too complicated to be of much use to me.	1 2 3 4 5 6
23. If I had to use a computer all the time, I would probably be very unhappy.	1 2 3 4 5 6
24. I sometimes feel intimidated when I have to use a computer.	1 2 3 4 5 6
25. I sometimes feel that computers are smarter than I am.	1 2 3 4 5 6
26. I can think of many ways that I could use a computer.	1 2 3 4 5 6

CAIN (FRENCH VERSION)

CODE PERMANENT: ________________

GROUPE DE LAB: ___

SONDAGE D'OPINION INFORMATIQUE

Instructions: Encerclez la réponse qui correspond le mieux à votre réaction aux phrases suivantes concernant les ordinateurs.

1= Tout à fait d'accord	4= Légèrement en désaccord
2= D'accord	5= En Désaccord
3= Légèrement d'accord	6= Tout à fait en désaccord

1. Avoir un ordinateur augmenterait ma productivité	1 2 3 4 5 6
2. Avec un ordinateur, je sauve du temps et du travail	1 2 3 4 5 6
3. Avec un ordinateur la présentation est meilleure	1 2 3 4 5 6
4. Avoir un ordinateur augmenterait ma satisfaction	1 2 3 4 5 6
5. Avoir un ordinateur rendrait la vie moins agréable	1 2 3 4 5 6
6. La vie serait plus facile avec un ordinateur	1 2 3 4 5 6
7. Je suis négatif envers les ordinateurs en général	1 2 3 4 5 6
8. Un ordinateur rend les tâches plus agréables	1 2 3 4 5 6
9. Si j'avais un ordinateur, je le jetterais aux poubelles	1 2 3 4 5 6
10. J'aimerais que les ordinateurs soient plus répendus	1 2 3 4 5 6
11. Je ne crois pas que je serai un gros utilisateur	1 2 3 4 5 6
12. J'évite les ordinateurs quand je peux	1 2 3 4 5 6
13. J'aime utiliser les ordinateurs	1 2 3 4 5 6
14. Je crois qu'il y a trop d'ordinateurs	1 2 3 4 5 6
15. Les ordinateurs seront une part importante de ma vie	1 2 3 4 5 6
16. Un ordinateur rend l'apprentissage agréable	1 2 3 4 5 6
17. J'ai de la satisfaction quand j'utilise un ordinateur	1 2 3 4 5 6
18. Les ordinateurs causent plus d'ennuis que de solutions	1 2 3 4 5 6
19. Je suis plutôt inconfortable avec les ordinateurs	1 2 3 4 5 6
20. Je suis nerveux juste à penser aux ordinateurs	1 2 3 4 5 6
21. Je n'apprendrai jamais l'informatique	1 2 3 4 5 6
22. Les ordinateurs sont trop compliqués	1 2 3 4 5 6
23. Je serais très malheureux si je travaillais avec un ord.	1 2 3 4 5 6
24. Je suis intimidé par les ordinateurs	1 2 3 4 5 6
25. Les ordinateurs sont plus intelligents que moi	1 2 3 4 5 6
26. J'ai plein d'idées pour un projet informatique	1 2 3 4 5 6

COMPUTER LITERACY TEST

QUESTIONNAIRE GENERAL D'INFORMATIQUE

Répondez à toutes les questions. Si vous ignorez la réponse, répondez au hasard.

IMPORTANT: Utilisez la feuille-réponse, indiquez votre code permanent et votre groupe de lab.

1. Indiquez la principale raison pourquoi les ordinateurs fonctionnent en binaire.
   a. la valeur prend moins d'espace
   b. les valeurs sont plus facile à entrer
   c. simplifie les circuits logiques
   d. rend les opéretions plus précises
   e. c'est une relique du passé

2. Décrivez le traitement de données en informatique
   a. analyser critiquement des données
   b. entrer les données
   c. possible seulement avec un gros ordinateur
   d. la gestion de l'information comme trier, cacluler, ...
   e. faire des opérations en base deux

3. Ordonnez chronologiquement les opérations suivantes
   1- imprimer le rapport
   2- entrer les données dans l'ordinateur
   3- developper le programme et l'algorithme
   4- calculer les résultats
   5- coder les données pour les entrer
   a. 1,2,3,4,5
   b. 3,2,5,4,1
   c. 3,5,2,4,1
   d. 5,4,3,2,1
   e. 3,5,1,2,4

4. La raison-d'être du logiciel est:
   a. donner des instructions à l'ordinateur
   b. convertir les instructions pour la CPU (UCT)
   c. developper un algortithme
   d. concevoir les données
   e. présenter les résultats d'une opération

5. Le matériel n'est qu'une petite portion du coût informatique parce que:
   a. les périphériques sont dispendieux
   b. une ordinateur a besoin de cartes d'interface
   c. ce n'est pas sûr que l'on sauvera de l'argent avec
   d. le ROM n'est pas compris dans le prix
   e. le logiciel est essentiel et très dispendieux

6. Les composantes informatiques peuvent être digitales (numériques) ou analogiques. Indiquez les composantes matérielles digitales:

a. CPU, RAM, palette de jeux
b. ROM, interface série, microprocesseur
c. CPU, compilateur, traitement de texte
d. RAM, ROM, système d'exploitation
e. BASIC, circuit intégré, interpréteur

7. Un réseau informatique couvrant un bureau ou un édifice est appelé:

a. réseau étoile
b. réseau en anneau
c. réseau téléphonique
d. réseau local
e. réseau série

8. Indiquez la liste qui contient un intrus (pas matériel-hardware)

a. CRT, CPU, RAM
b. synthétiseur de voix, disk drive, digitaliseur
c. imprimante, ROM, connecteur entrée/sortie
d. circuit intégré, BASIC, disquette, power supply
e. clavier, disk drive, moniteur

9. Identifiez un ordinateur spécialisé

a. microordinateurs en réseau dans une classe
b. un gros ordinateur avec des terminaux
c. un PC avec un traitement de texte et imprimante
d. une contrôle climatique d'édifice informatisé
e. un miniordinateur avec des terminaux

10. Quand plusieurs usagers se servent du même CPU en même temps cela s'appelle:

a. système à temps partagé
b. mémoire multiple
c. système multi-fonction
d. réseau en anneau
e. réseau en étoile

11. Identifiez la caractéristique du microordinateur

a. pas capable de faire des tâches complexes
b. généralement simple tâche - simple usager
c. mémoire plus lente
d. ne peut partager l'information
e. toute la mémoire n'est pas accessible

12. Que donne plusieurs microordinateurs connectés ensemble?

a. temps-partagé
b. multiple processeur
c. réseau
d. interaction d'interface
e. modulation-démodulation

13. Qu'est la communication en série?
   a. transfert d'information 8 bits à la fois
   b. transfert d'information un bit à la fois
   c. interactions bit-byte
   d. par instructions programmées
   e. transfert programme-CPU

14. Indiquez la fonction du système d'exploitation
   a. ordonne les entrées/sorties
   b. permet la compatibilité entre ordinateurs
   c. permet la connection en réseau
   d. détermine la longueur du mot mémoire
   e. procure une liste de commandes facile à utiliser

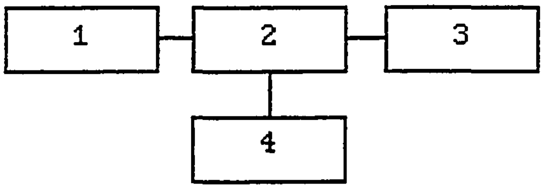
15. Votre disque est proprement inséré, la commande est correcte mais les données ne sont pas sauvegardées. Toutes les raisins indiquées sont bonnes sauf une, laquelle?
   a. le disque n'est pas initialisé
   b. le disque est verrouillé
   c. le disque est plein
   d. l'unité ne fonctionne pas
   e. le disque n'est pas verrouillé

16. Une des opérations ci-dessous n'est <u>pas</u> nécessaire pour maintenir un système informatique.
   a. controler le voltage menant à l'ordinateur
   b. contrôler l'électricité statique
   c. faire une circulation d'air
   d. contrôler les poussières
   e. maintenir la pièce à au moins 68 (20) degrés

17. Un microordinateur est limité dans le traitement de grands ensembles de données parce que:
   a. le moniteur est trop petit
   b. manque de mémoire
   c. cartes insuffisantes
   d. pas d'unités de disque
   e. impossible tout court

18. Quelle est la fonction principale de la CPU?
   a. storer
   b. entrer
   c. processer
   d. entrée/sortie
   e. analyser/manipuler

19. Identifiez les composantes:



- a. 1-entrée, 2-CPU, 3-sortie, 4-mémoire
- b. 1-E/S, 2-CPU, 3-RAM, 4-ROM
- c. 1-moniteur, 2-clavier, 3-disk drive, 4-imprimante
- d. 1-processur, 2-entrée, 3-mémoire, 4-sortie
- e. 1-mémoire, 2-contrôleur, 3-DOS, 4-E/S

20. Identifiez la fausseté concernant RAM et ROM

- a. RAM peut être changé, pas ROM
- b. RAM et ROM sont vidés lors d'une panne de courant
- c. ROM garde les programmes de contrôle
- d. Le RAM détermine la mémoire de l'ordinateur
- e. RAM est volatile et ROM ne l'est pas

21. Quelle mémoire est la plus important pour un acheteur de microordinateur?

- a. EPROM
- b. PROM
- c. ROM
- d. RAM
- e. String-Floppy

22. Identifiez le logiciel d'application

- a. système d'exploitation
- b. manager de base de données
- c. ROM
- d. langage machine
- e. serveur de fichiers

23. Indiquez la fausseté concernant les logiciels

- a. programmes qui contrôlent les opérations du matériel
- b. ils contiennent des utilitaires
- c. le ROM contient du logiciel
- d. c'est une liste d'instructions
- e. ce sont des périphériques

24. Ce fut la première machine à utiliser des perforations pour transmettre des instructions

- a. Mark I
- b. Machine analytique
- c. ENIAC
- d. Machine tabulatrice de Hollerith
- e. Métier de Jacquard

25. Ce fut le premier ordinateur électronique, mais ne fut reconnu comme tel que plus tard

a. UNIVAC
b. ABC (Atanasoff-Berry)
c. EDVAC
d. Moteur Analytique
e. Machine de Pascal

26. Quels mots identifient le mieux les 4 générations d'ordinateurs?

a. cartes perforées, lignes imprimées, contrôleurs, disques
b. tables, moteurs, machines analytiques, calculatrices
c. lampes, transistors, circuits intégrés, microprocesseurs
d. Aiken, Mauchly, Eckert, Jobs
e. relais, electromécanique, lampes, transistors

27. Formatter une disquette est:

a. déterminer les marges d'impression
b. placer un programme sur disque dur
c. copier un logiciel sur disquette
d. organiser un disque en pistes et secteurs
e. insérer le disque

28. Que se passe t-il quand vous sauvegardez?

a. le ROM est transféré sur disque
b. le document est protégé
c. le document est dans le RAM
d. un fichier sur disque est créé pour contenir le document
e. le disque est initialisé en pistes et secteurs

29. Que pouvez-vous faire avec un disque verrouillé?

a. sauvegarder de nouveaux documents
b. ouvrir et imprimer les documents du disque
c. changer le nom des documents
d. déplacer les documents
e. editer les documents

30. Quelle tâche est la plus difficile pour un ordinateur?

a. traitement rapide
b. opérations répétitives
c. traitement de gros ensembles de données
d. interactions constantes avec l'usager
e. storage des sonnées

31. Identifiez le facteur <u>sans</u> importance dans l'attribution d'une tâche à un ordinateur

a. matériel adéquat?
b. utilitaires présents?
c. programme compatible?
d. difficile à utiliser?
e. claculs complexes?

32. Vous utilisez un logiciel de gestion de chèques. Il y a une erreur de calcul. Quelle est la cause probable?

a. version du logiciel désuète
b. ordinateur pas fait pour gérer les décimales
c. RAM est pleine
d. vous avez fait une erreur en entrant les données
e. un virus est présent dans votre ordinateur

33. Quelle phrase ne montre pas un crime informatique?

a. copier un logiciel commercial sans autorisation
b. utiliser le mot de passe de l'ordinateur d'un autre
c. créer des permis de conduire et les vendre après
d. créer des comptes d'investissement fictifs
e. créer un logiciel et le copier pour ses amis

34. Quel poste convient le mieux à la description suivante:

-démarre l'ordinateur
-monte les disques et les rubans
-charge les programmes
-fait marcher les programmes
-fournit les rubans et papiers d'impression

a. programmeur d'application
b. analyste
c. programmeur de système
d. informaticien
e. opérateur

35. Quel poste convient le mieux à la description suivante:

-connaît un ou lusieurs langages
-écrit des algortihmes
-écrit les programmes
-explique aux usagers et documente

a. programmeur d'application
b. analyste
c. programmeur de système
d. informaticien
e. opérateur

36. Identifiez l'avantage principal du traitement de texte sur la machine à écrire durant les opérations de correction

a. la qualité d'impression est meilleure
b. les traits-d'union sont automatiques
c. les parties correctes n'ont pas à être retouchées
d. on peut chager la présentation
e. dictionnaire intégré

37. Quand vous créez un texte, où est-il gardé lors de sa manipulation?

a. disquette
b. ROM
c. RAM
d. bureau
e. disque dur

38. Quelle fonction ne correspond pas aux bases de données

a. créer un fichier
b. changer des données
c. traiter des textes
d. trier des fichiers
e. chercher des dossiers

39. Quelle caractéristique décrit le mieux un système de gestion de bases de données?

a. analyses statistiques
b. organisation efficace
c. gestion de textes
d. didacticiels interactifs
e. résolution de problèmes

40. Quel logiciel conviendrait le mieux à un fermier voulant gérer ses coûts de production?

a. tableur
b. base de données
c. traitement de texte
d. statistique
e. graphique

SOFTWARE PROFICIENCY TEST

---

1. À l'opposé de Supprimer, la commande Insérer sert à introduire une cellule ou plage de cellules vides dans la feuille, en décalant les cellules sélectionnées. La mise à jour des formules est effectuée automatiquement. L'insertion d'une colonne s'effectue à gauche de la sélection, l'insertion d'une ligne s'effectue au-dessous de la sélection. (Excel)

a) vrai

b) faux.

---

2. ARRONDI() est une fonction permettant d'arrondir un nombre.
ARRONDI(3,08;1) égale

a) 3,1

b) 3,00

c) 3

d) 3,2

---

3. Au préalable, la sélection d'une cellule dans une feuille de calcul Excel oblige parfois une opération de:

a) sauvegarde

b) défilement

c) collage

d) suppression.

4. Avant d'exécuter la macro Échange seulement les données en B4:B5 de Passerelle n'étaient pas affichées.

Quel est le contenu numérique de A7 de la feuille macro une fois la macro exécutée?

M_Passerelle

	A
1	**Échange (e)**
2	=ACTIVER("Passerelle")
3	=SELECTION.ATTEINDRE("Départ")
4	=CELLULE.ACTIVE()
5	=SELECTIONNER("L(1)C")
6	=CELLULE.ACTIVE()
7	=-A6*Timpôt
8	=SELECTIONNER("L(1)C")
9	=FORMULE(A7)
10	=POSER.NOM("Bnet";A6+A7)
11	=SELECTIONNER("L(1)C")
12	=FORMULE(Bnet)
13	=RETOUR()

Passerelle

	A	B
1		
2	Taux d'imposition	20%
3	Bénéfice imposable	50000
4	Impôt	-10000
5	Bénéfice net	40000
6		
7		
8		
9		
10		
11		
12		

a) -10000

b) 50000

c) 40000

d) 10000

5. Avec Excel il est possible de nommer une constante ou une formule sans les entrer dans les cellules.

a) vrai

b) faux.

6. Avec Excel, il ne faut pas confondre l'option Décimale fixe et la mise en forme (commande Nombre du menu Format). En entrant 1379 dans une cellule mise en forme pour afficher deux décimales, les valeurs stockées (S) et affichées (A) sont

a) S: 1379 A: 1379

b) S: 1379 A: 13,79

c) S: 13,79 A: 1379,00

d) S: 1379 A: 1379,00

---

7. Avec le format 0 de la commande Nombre du menu Format, le nombre entré 0,8 est affiché sous la forme

a) 0,8

b) ,8

c) 1

d) 0.

---

8. Avec le tableur Excel, lorsque la commande Recopier vers la droite (ou avec la poignée de recopie) est choisie, les données situées dans la colonne de gauche de la sélection sont copiées sur chacune des autres colonnes.

a) vrai

b) faux.

---

9. Avec un ordinateur muni de 4 Mo de mémoire, il est possible de remplir toutes les cellules d'une feuille de calcul Excel.

a) vrai

b) faux

---

10. En utilisant le format commercial # ##0,00 $;-# ##0,00$ le nombre 23312,706 est affiché de cette manière

a) 23 312,71 $

b) (23 312,706 $)

c) (23 312,71 $)

d) 23 312,706 $.

---

11. ENT() est une fonction permettant d'arrondir au nombre entier le plus proche. ENT(19,9) égale

a) 19

b) 20

c) 19,0

d) -20

---

12. ET() est une fonction de Excel.

ET(3=3;12<17;VRAI;27=-27) égale

a) vrai

b) faux.

---

13. Excel insère automatiquement des sauts de page pour partitionner le document en pages. À cette fin, il utilise les paramètres de mise en page notamment la dimension de la feuille et les marges. Si les sauts de page automatiques ne vous conviennent pas, vous pouvez définir manuellement des sauts de page.

a) vrai

b) faux.

---

14. Excel offre une fonction couramment utilisée pour évaluer la rentabilité d'un investissement. Cette fonction est

a) VA()

b) VPM()

c) NPM()

d) VAN()

---

15. Excel permet de nommer une cellule ou une plage de cellules. De plus il permet de nommer les constantes ou les formules sans les entrer dans les cellules. Taux_de.dividende est un exemple de nom.

a) vrai

b) faux.

---

16. Excel permet de restreindre l'impression à une partie de la feuille de calcul, grâce à la commande

a) Impression des titres

b) Zone d'impression

c) Aperçu avant impression

d) Mise en page.

---

17. Excel permet l'utilisation d'un nom permettant de désigner notamment une plage entière de cellules. Le nom Bénéfice Net
est un bon exemple.

a) vrai

b) faux.

---

18. Excel propose deux manières pour créer un graphique. Il peut être créé directement dans une feuille de calcul (appelé graphique incorporé) ou dans un document séparé

a) vrai

b) faux.

19. Excel propose la fonction SI().

Si la cellule G2 contient 13, G3 contient 0 et H13 contient 38

SI(OU(MOYENNE(G2:G3)>7;G3>-1);H13-13;H13+13) égale

a) 38

b) 25

c) 26

d) 51

---

20. Exel conserve en mémoire les valeurs

a) stockées

b) numériques seulement

c) affichées

d) textuelles seulement.

---

21. GAUCHE() est une fonction de Excel.

Si la cellule F2 contient International, la cellule F3 contient Business et la cellule F4 contient Machine

Si H4 a exactement le contenu suivant:

GAUCHE(F2;1)&GAUCHE(F3;1)&GAUCHE(F4;1)

H4 contient

a) MacIntosh

b) IBM

c) Int

d) GAUCHE(F2;1)&GAUCHE(F3;1)&GAUCHE(F4;1)

---

22. Il est possible de créer une référence externe avec Excel.

='Feuille de calcul1'&$E$4

peut être le contenu d'une cellule indiquant une référence externe

a) vrai

b) faux.

---

23. L'option décimale fixe permet d'éviter d'entrer à chaque fois la virgule (ou le point). Si vous fixez l'option Décimale fixe/Places sur 2 le nombre stocké, lorsque vous entrez le chiffre 1347 est

a) 13,47

b) 1347

c) ,1345

d) 13

---

24. La charte structurée est un outil de documentation permettant d'avoir un aperçu général de la structure interne du logiciel notamment les liens modulaires. La charte est améliorer progressivement au cours du développement.

a) vrai

b) faux

---

25. La commande Nommer lignes et colonnes permet la création rapide de plusieurs noms à la fois. Tous les noms créés doivent se trouver dans une seule ligne ou une seule colonne de la feuille, et les valeurs qui y sont reliés doivent se situer en-dessous ou à droite des cellules contenant les noms.

a) vrai

b) faux.

---

26. La commande Supprimer permet d'éliminer des cellules, lignes ou colonnes entières de la feuille de calcul. Excel décale les autres cellules afin d'occuper l'espace vide généré par les cellules supprimées. Comme la commande Supprimer, la commande Effacer élimine définitivement les cellules de la feuille.

a) vrai

b) faux.

27. *La fenêtre graphique de Excel peut contenir du texte dépendant et du texte indépendant.*

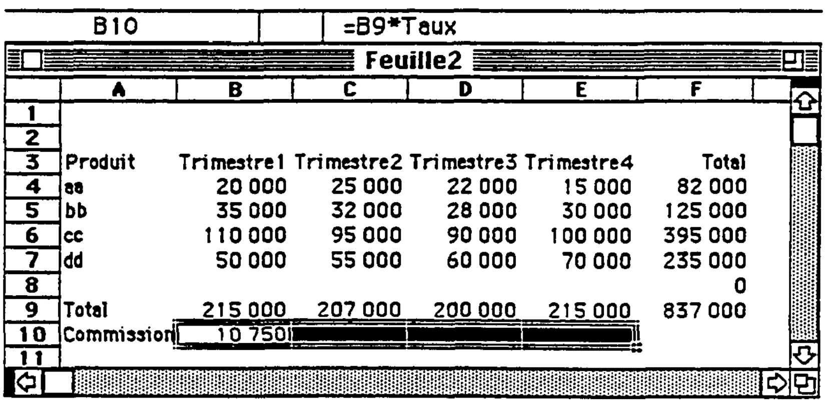
Le texte dépendant est lié à un élément particulier du graphique: tel le libellé d'une colonne ou un axe. Le déplacement d'un élément du graphique entraîne avec lui le texte qui en dépend.

Le texte indépendant peut être placé n'importe où.

a) vrai

b) faux.

28. *La plage B10:E10 étant sélectionnée, en utilisant la commande Recopier à droite du menu Edition (ou en utilisant la poignée de recopie de B10 à E10), le contenu de D10 est*



a) 10 750

b) 12 000

c) 10 350

d) 10 000.

29. *La position par défaut de Excel est l'alignement standard, c'est-à-dire le texte est justifié à droite et les nombres à gauche.*

a) vrai

b) faux.

30. Laquelle des fonctions suivantes de Excel donne le versement périodique pour calculer un emprunt?

a) VA()

b) VPM()

c) NPM()

d) VC()

31. Le bouton  *permet*

a) d'enregistrer un document

b) d'appeler au secours

c) de générer un graphique incorporé

d) de supprimer la barre d'outils

32. Le format d'une cellule affecte

a) la valeur stockée seulement

b) la valeur affichée seulement

c) la valeur stockée et affichée

d) aucune valeur entrée.

33. Le logiciel Exel permet de générer trois types de fenêtres ou de documents: la fenêtre de la feuille de calcul, la fenêtre graphique et la fenêtre macro.

a) vrai

b) faux.

---

34. Le tableur Excel permet de créer vos propres formats en plus de ceux prédéfinis. Ainsi, pour entrer le numéro de téléphone des clients (exemple 418-545-4300) il ne suffit d'entrer que les chiffres, sans les tirets, et utiliser le format personnalisé

a) 000-0000

b) 000,000,0000

c) 000@000@0000

d) 000-000-0000.

---

35. Lequel des formats suivants, obtenus de la rubrique Enregistrer du menu Fichier de Excel, permet de ne conserver que le texte et les valeurs entrées dans la feuille permettant le transfert de fichiers vers (ou en provenance de) d'un traitement de texte

a) SPV

b) Texte

c) WKS

d) Normal.

---

36. Les dates étant mémorisées sous forme de numéro de série, ceci s'avère très avantageux. Il est possible de les utiliser dans les calculs comme tout autre nombre.

a) vrai

b) faux.

---

37. Les encadrements et les contrastes permettent de mettre en valeur des informations clés de la feuille de calcul et d'assurer une présentation soignée du document. Avant d'utiliser la commande Encadrement, vous devez sélectionner la cellule ou la plage sur laquelle doit s'opérer la mise en valeur.

a) vrai

b) faux.

38. Les lignes de code de cette macro furent créées avec l'enregistreur de macros (enregistreur automatique).

À partir de quelle ligne le mode relatif est-il utilisé (à ce moment le mode absolu est affiché dans le menu)?

	A
3	=SELECTIONNER("L1:L16384")
4	=EFFACER(1)
5	=SELECTIONNER("L2C2")
6	=FORMULE("01/01/94")
7	=SELECTIONNER("LC:L(11)C")
8	=DONNEES.SERIE(2;3;3;1;;FAUX)
9	=FORMAT.NOMBRE("jj-mmm")
10	=FORMAT.POLICE("New York";10;FAUX;FAUX;F
11	=AFFICHAGE(FAUX;FAUX;VRAI;VRAI;0;;VRAI;FA
12	=SELECTIONNER("L(4)C:L(5)C")
13	=FORMAT.POLICE(;;VRAI)

a) A5

b) A12

c) A3

d) A7

---

39. Les séries servent de base pour construire le graphique Excel.

Si la plage contient plus de lignes que de colonnes (plage horizontale), Excel organise les séries en colonne. La disposition en colonne sur le graphique s'effectue sur la base des colonnes de la feuille.

a) vrai

b) faux.

---

40. Lors de l'utilisation de la commande Imprimer, Excel imprime toute la feuille active. Il procède au découpage automatique de la feuille tenant compte de plusieurs facteurs notamment des caractéristiques de mise en page, pour fixer le contenu d'une page.

a) vrai

b) faux.

41. Lorsqu'Excel ne peut calculer correctement une formule dans une cellule, il affiche un message d'erreur sous forme de code. Ainsi, #N/A apparaît lorsque vous utilisez un nom qu'Excel ne reconnaît pas.

a) vrai

b) faux.

42. Lorsque plusieurs opérateurs sont utilisées dans une formule, Excel assigne une priorité d'exécution selon un certain ordre. Quel est le résultat de la formule =(3(10-5)^3)-11*7*

a) 3298

b) 298

c) 23548

d) aucune de ces réponses.

43. MIN() est une fonction qui renvoie la valeur minimale d'une liste de nombres. Si la plage C1:C4 contient les nombres 7, 12,27,8

MIN(C2:C4;9) égale

a) 7

b) 8

c) 9

d) 27

44. MOYENNE() est une fonction de Excel qui calcule la moyenne arithmétique d'une liste de nombres.

Si la plage B2:B7 contient les nombres 29, 4,33,80,100,0

MOYENNE(14;B5:B7;7;B2) égale

a) 29,286

b) 30,111

c) 41

d) 38,333

45. MOYENNE() est une fonction qui calcule la moyenne arithmétique.

Si la plage D2:D4 contient les nombres 11, 17,23

MOYENNE(10;D4) égale

a) 16,5

b) 11

c) 18,333

d) 15,25

46. NB() est une fonction de Excel.

Si la plage C1:C4 contient les nombres 10, -78,44,259

NB(C1:C3;10;0;soleil;C1) égale

a) 7

b) 6

c) 8

d) 5

47. NON() est une fonction de Excel.

NON(3<2) égale

a) vrai

b) faux.

48. OU() est une fonction de Excel.

OU(12<8;22+11=34;10=10) égale

a) vrai

b) faux.

49. *Pour obtenir de l'aide électronique il suffit de cliquer sur le bouton*

a) 

b) 

c) 

d) 

50. *Quel est le résultat généré par Excel avec la formule =12-3*7+9:*

a) 144

b) 0

c) 72

d) 24

51. *Quelle fonction macro permet de transporter le contenu d'une cellule de la feuille de calcul vers la feuille macro*

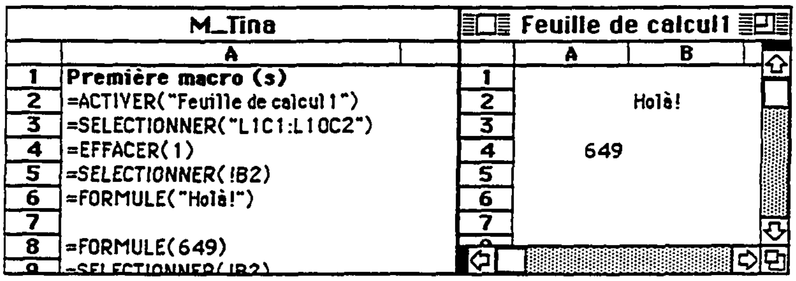
a) POSER.VALEUR

b) FORMULE

c) POSER.NOM

d) CELLULE.ACTIVE

52. *Quelle instruction sous forme relative manque-t-il en A7?*



a) =SELECTIONNER("L1C4")

b) =SELECTIONNER("A7")

c) =SELECTIONNER("L(2)C(-1)")

d) =SELECTIONNER(!A4)

53. *Si la cellule C1 contient EXAMEN, la cellule C3 contient FINAL et si en D8 vous entrez la formule =C3&"$"&C1 alors la cellule D8 contient la valeur:*

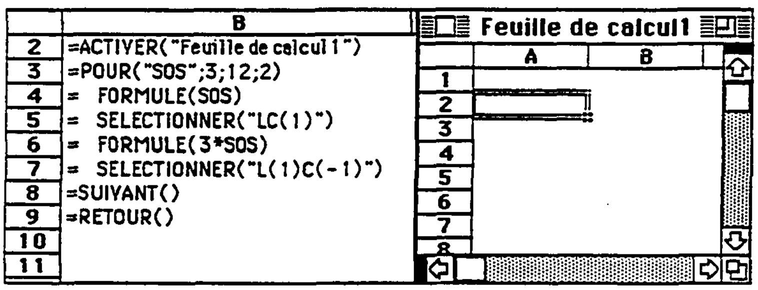
a) FINALEXAMEN

b) FINAL$EXAMEN

c) FINAL EXAMEN

d) EXAMEN FINAL

54. *Si vous exécutez cette macro, quel est le contenu de B6 de la feuille de calcul?*



a) 33

b) rien

c) 27

d) 11

---

55. *SI() est une fonction de Excel.*

Si la cellule B3 contient 4, B7 contient 6 et F2 contient 10

*SI(B3>B7;F2-3;F2*3) égale*

a) 30

b) 3

c) 7

d) 18

---

56. *SI() est une fonction indispensable.*

Si la cellule I5 contient 7 et I6 contient 4

SI(I5<I6;"m";SI(I6>4;"w";"p")) égale

a) w

b) m

c) p

d) Nul

---

57. SIGNE() est une fonction permettant d'obtenir le signe du nombre. SIGNE(-378) égale

a) 1

b) 0

c) -1

d) 2

---

58. SOMME() est une fonction de Excel qui calcule la somme des nombres d'une liste, incluant toute valeur logique ou textuelle comprise dans la liste.

a) vrai

b) faux.

---

59. Sous le format 0% de la commande Nombre du menu Format, le nombre entré ,32 est affiché sous la forme

a) 32%

b) 3,2%

c) 0,32%

d) 0,32.

---

60. Supposons que la formule apparaissant dans la cellule A6 est =$A1+A2+A3+$A$5. En copiant la formule apparaissant en A6 dans la cellule C10, la formule qui est stockée en C10 est:

a) $A1+C6+C7+$A$5

b) $A5+C2+C3+$A$5

c) A1+C2+C3+A5

d) $A5+C6+C7+$A$5

61. Une fois cette macro exécutée,

Macro1

	A	B	C
1	**Examen**		
2	=SELECTIONNER("L5C2")		
3	=FORMULE("Holà!")		
4	=SELECTIONNER("L(2)C(-1)")		
5	=FORMULE("Jupiter")		
6	=RETOUR()		
7			
8			

dans quelle cellule le mot Jupiter est-il affiché?

a) A7

b) C7

c) B7

d) Aucune des réponses précédentes

---

62. Une référence circulaire intervient lorsqu'une formule dépend directement ou indirectement de sa propre cellule.

a) vrai

b) faux.

---

63. Une référence relative fait référence à l'emplacement d'une cellule sur la feuille Excel. Elle a une position fixe par rapport à la cellule contenant la formule.

a) vrai

b) faux.

64. Voici le contenu de différentes cellules Excel: A1 contient 400, A2 contient 300, A3 contient la formule =A1+A2, B1 contient 100 et B2 contient 80. Une fois la plage A3:B3 sélectionnée en utilisant la commande Recopier à droite (ou avec la poignée de recopie utilisée de A3 à B3), la cellule B3 contient:

a) 700

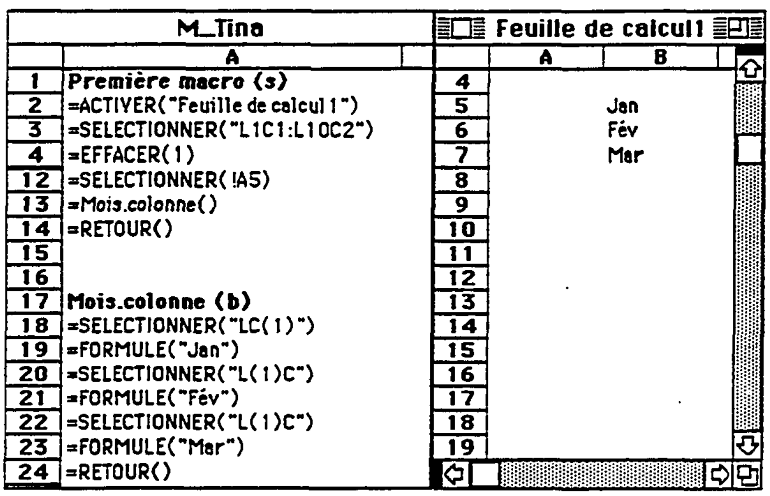
b) 880

c) 20

d) 180

---

65. Vous exécutez la macro « Première_macro ». Ce qui est affiché dans la feuille de calcul est-il exact?



a) vrai

b) faux

---

66. Vous ne pouvez exécuter une macro que si la feuille macro où elle est stockée est ouverte. La macro doit résider en mémoire vive.

a) vrai

b) faux

---

67. Comment faire pour déplacer une icone sur l'écran du Macintosh ?

a) Cliquer 2 fois dessus

b) Cliquer une fois dessus

c) Cliquer puis maintenir la pression

d) Utiliser les flèches du clavier

---

68. Sous quel menu trouve t-on l'accès à MacJanet ?

a) Le menu pomme

b) Le menu Fichier

c) Le menu Edition

d) Le menu Rangement

---

69. Quel outil de SuperPaint permet de sélectionner uniquement l'objet qui nous intéresse (avec des formes très irrégulières) ?

a) Le rectangle

b) Le rectangle pointillé

c) Le lasso

d) La main

---

70. Quel outil de Word parmet d'aligner les colonnes d'un texte ?

a) Le petit triangle noir de la règle

b) Le petit triangle blanc de la règle

c) Le menu Section

d) Les flèches de défilement

71. Où peut-on changer la justification (droite ou gauche) d'un texte ?

a) Dans la règle

b) Dans le menu

c) Aux deux endroits

d) On la choisit au début, on ne peut la changer

72. Si je sélectionnne un texte dans Word et que je fais la commande Couper où se trouve maintenant ce texte ?

a) Il est perdu

b) Dans le presse-papiers

c) Dans l'album

d) Toujours dans le document

73. Comment fait-on pour ouvrir un document Word?

a) Cliquer 2 fois sur l'icone

b) Cliquer 1 fois sur l'icone

c) Choisir le menu "Document"

d) Déplacer l'icone dans le dossier système

74. Si je sélectionnne un texte dans Word et que je fais la commande Coller où se trouve maintenant ce texte ?

a) Il est perdu

b) Dans le presse-papiers

c) Dans l'album

d) Il est remplacé par le contenu du presse-papiers

75. Peut-on changer la taille d'un dessin une fois qu'il est rendu dans le texte Word?

a) Oui

b) Non

76. Si je veux avoir 5 copies d'un dessin dans MacDraw, la façon la plus rapide est:

a) Copier-Coller

b) Dupliquer

c) Passer par l'album

d) Refaire le dessin 5 autres fois

APPENDIX C

COMMON LAB SCHEDULE

COMMON LAB SCHEDULE (TREATMENT AND CONTROL)

Period 1: Macintosh System

*Mouse use
*Cut/Paste/Copy
*Menus
*Network Access
*Windows
*Icons
*Disk Formatting

Period 2: Word (4.0) Basics

*Activating Word
*Modify a text
*Fonts
*Paragraphs
*Creating a text
*Printing
*Margins

ASSIGNMENT #1 - Word

Period 3: Advanced Word

*Writing in the margins
*Change page numbering
*Page making techniques
*Frames and special effects
*Picture insertion
*Multiple windows
*Headers and Footers
*Document partition
*Long document management

Period 4: SuperPaint (2.0)

*Document management
*Tools
*Menus and facilities
*Exercises

ASSIGNMENT #2 - SuperPaint

Period 5: Excel (3.0) Basics

*Command activation
*Selection
*Formulas
*Saving
*Error values
*Printing
*Cell management
*Enter mode
*Relative and absolute references
*Names and labels
*Formatting

Period 6: Excel Functions and Calculations

*Formula constructions
*Pre-defined functions
*Calculation mode
*Exercises

ASSIGNMENTS #1, #2 DUE

Period 7: Excel References and Models

*External references
*Document models
*Vectorized pictures

ASSIGNMENT #3 - Excel

Period 8: Graphics with Excel

*Graphic creation
*Text edition
*Graphic types
*Title edition
*Refinements
*Serial formulas

Periods 9,10: Macro-command Programming (Excel)

- *Macro sheet
- *Macro language
- *External reference
- *Simultaneous display
- *Deleting a macro
- *Auto-save
- *Independence of data
- *Loops
- *Macro documentation
- *Basic principles
- *Basic syntax
- *Step by step debugging
- *Subroutines
- *Macro-function
- *Dialog boxes
- *Branching
- *Interactive macros

Period 11: Excel Macros and Examples

- *Case study

Period 12: ACCPAC

- *Naturex case
- *Account chart
- *Account integration
- *Enterprise creation
- *Auxiliary registries
- *Ledger entries

Period 13: ACCPAC Exercises

ASSIGNMENT #3 DUE

APPENDIX D

DATA

COVARIATES AND DEPENDENT VARIABLES

Student	*Grp*	*Sex*	*Age*	*Own*	*Course*	*Mac*	*Paint*	*Word*	*Excel*	*Attitude*	*Literacy*	*Software*
101	T	M	TRAD	N	N	Y	Y	Y	Y	123	15	68
102	T	M	TRAD	N	N	Y	Y	Y	Y	145	10	49
103	T	F	N.T.	N	Y	Y	Y	Y	Y	141	37	59
104	T	M	TRAD	N	Y	N	Y	N	Y	128	18	48
105	C	F	N.T.	N	Y	Y	Y	Y	Y	113	17	62
106	T	M	N.T.	N	N	Y	Y	Y	Y	136	37	68
107	C	F	TRAD	Y	N	N	Y	N	Y	127	18	62
108	T	F	N.T.	Y	N	Y	Y	N	Y	142	18	55
109	C	F	TRAD	Y	N	N	Y	N	Y	148	16	65
110	C	M	N.T.	N	Y	Y	Y	Y	Y	107	11	53
111	C	M	N.T.	Y	N	N	N	N	Y	111	23	61
112	T	F	N.T.	Y	Y	Y	Y	Y	Y	145	19	49
113	C	M	N.T.	N	N	Y	Y	Y	Y	90	12	47
114	C	F	N.T.	Y	Y	N	N	N	Y	136	22	63
115	C	F	N.T.	N	Y	Y	Y	Y	Y	115	21	57
116	T	F	TRAD	N	N	Y	Y	Y	Y	135	20	64
117	T	M	N.T.	N	Y	Y	Y	Y	Y	107	17	50
118	T	M	N.T.	Y	Y	N	N	Y	Y	121	16	40
119	C	F	N.T.	Y	Y	N	Y	N	N	134	13	62
120	C	F	TRAD	N	N	Y	Y	N	Y	129	9	63
121	C	F	N.T.	N	Y	N	N	N	N	149	14	61
122	T	M	N.T.	N	N	N	N	Y	N	100	8	46
123	T	M	TRAD	Y	N	Y	Y	Y	Y	98	14	37
124	T	F	N.T.	Y	N	Y	Y	Y	Y	107	34	68
125	T	F	N.T.	N	Y	Y	Y	Y	Y	111	17	64
126	T	F	TRAD	Y	N	Y	Y	Y	Y	106	22	63
127	C	F	N.T.	N	N	Y	Y	Y	Y	139	13	61
128	C	F	N.T.	N	N	N	N	N	Y	111	26	62
129	T	F	TRAD	N	N	N	Y	N	Y	122	28	68
130	C	F	N.T.	N	N	Y	Y	Y	Y	138	19	55
131	C	M	N.T.	N	N	N	N	N	Y	139	13	50
132	C	M	N.T.	Y	Y	Y	Y	Y	Y	106	4	49
133	T	F	TRAD	N	N	Y	Y	Y	Y	140	17	58
134	T	F	N.T.	N	Y	Y	Y	Y	Y	154	38	68
135	T	F	N.T.	Y	N	Y	Y	Y	Y	119	14	55
136	C	F	N.T.	N	Y	Y	Y	Y	Y	118	20	51
137	T	M	TRAD	N	N	Y	Y	Y	Y	114	17	55
138	T	F	N.T.	N	N	N	Y	N	N	127	20	40
139	C	F	N.T.	Y	Y	Y	Y	Y	Y	117	16	49
140	C	M	N.T.	Y	N	Y	Y	Y	Y	131	12	57
141	C	M	TRAD	N	N	Y	N	N	N	131	20	65
142	T	F	TRAD	Y	N	N	N	N	Y	140	21	62
143	C	M	N.T.	Y	N	Y	Y	Y	Y	143	16	59
144	T	F	TRAD	N	N	N	Y	N	Y	131	23	58
145	C	F	N.T.	Y	N	Y	Y	Y	Y	97	18	58
146	T	M	TRAD	N	Y	Y	Y	Y	Y	103	17	43
147	C	F	TRAD	Y	N	N	N	N	N	131	24	63
148	C	F	N.T.	N	N	Y	Y	Y	Y	131	24	58
149	T	M	N.T.	Y	N	N	Y	Y	Y	134	19	66
150	C	F	N.T.	Y	N	Y	Y	Y	Y	120	20	67
151	C	F	TRAD	N	N	N	N	Y	Y	131	19	65
152	T	F	N.T.	Y	N	Y	Y	Y	Y	148	35	71
153	T	M	TRAD	N	N	Y	Y	Y	Y	151	18	66
154	T	M	TRAD	Y	N	N	N	N	Y	151	19	39
155	C	F	TRAD	N	N	Y	Y	Y	Y	125	19	54
156	T	F	TRAD	N	N	Y	Y	Y	Y	117	12	67
157	C	F	N.T.	Y	Y	Y	Y	Y	Y	149	17	62
158	C	F	N.T.	Y	N	N	Y	N	Y	137	32	60
159	C	F	TRAD	Y	N	Y	Y	Y	Y	137	28	58
160	C	F	N.T.	N	N	Y	Y	Y	Y	111	18	49

161	T	F	TRAD	Y	N	Y	Y	Y	Y	117	28	63
162	C	M	N.T.	Y	N	N	Y	N	N	140	24	53
163	C	M	N.T.	Y	Y	N	Y	Y	Y	124	19	61
164	T	F	TRAD	Y	N	Y	Y	Y	Y	135	23	67
165	T	F	TRAD	Y	N	Y	Y	Y	Y	103	21	66
166	C	F	TRAD	N	N	N	N	N	Y	142	19	63
167	C	M	N.T.	Y	Y	Y	Y	Y	Y	150	26	58
168	C	F	TRAD	N	N	Y	Y	Y	Y	64	14	62
169	C	M	N.T.	N	Y	N	Y	Y	Y	122	21	57
170	C	F	N.T.	Y	N	Y	Y	Y	Y	130	15	48
171	T	M	TRAD	Y	N	Y	Y	Y	Y	142	14	38
172	C	F	TRAD	Y	N	Y	Y	Y	Y	101	17	65
173	C	F	TRAD	Y	N	N	Y	N	Y	139	19	62
174	C	F	N.T.	N	N	N	Y	Y	N	115	15	60
175	T	M	N.T.	N	N	N	Y	N	Y	95	15	56
176	T	F	TRAD	N	N	N	Y	Y	Y	145	15	65
177	T	M	N.T.	Y	Y	N	Y	N	Y	134	27	58
178	C	F	TRAD	Y	N	Y	Y	Y	Y	111	14	66
179	T	M	N.T.	Y	N	Y	Y	Y	Y	150	16	56
180	T	F	N.T.	N	N	Y	Y	Y	Y	146	38	65
181	T	F	N.T.	N	N	Y	Y	Y	Y	139	19	45
182	T	F	TRAD	Y	N	Y	Y	Y	Y	148	15	43
183	C	M	N.T.	Y	N	Y	Y	Y	Y	124	7	50
184	T	M	N.T.	N	N	Y	Y	Y	Y	134	19	65
185	T	F	N.T.	Y	N	N	N	N	N	139	22	61
186	T	M	N.T.	Y	N	N	N	N	N	133	22	63
187	T	M	N.T.	Y	N	N	Y	N	N	155	24	55
188	C	M	N.T.	N	N	Y	Y	Y	Y	120	20	61
189	C	F	TRAD	Y	N	Y	Y	Y	Y	135	17	60
190	T	F	N.T.	N	N	N	N	N	Y	148	34	62
191	C	F	TRAD	Y	N	N	Y	Y	N	149	19	53
192	T	M	TRAD	N	N	Y	Y	Y	Y	134	11	59
193	T	M	N.T.	N	Y	Y	Y	Y	Y	117	14	38
194	C	M	N.T.	Y	Y	Y	Y	Y	Y	115	19	55
195	C	M	N.T.	Y	N	Y	Y	Y	Y	115	28	57
196	C	F	N.T.	Y	N	Y	Y	Y	Y	121	10	58
197	T	M	N.T.	N	Y	Y	Y	Y	Y	150	9	51
198	C	M	N.T.	Y	Y	Y	Y	Y	Y	133	21	48
199	C	F	N.T.	Y	N	Y	Y	Y	Y	135	12	55
200	T	F	TRAD	N	N	Y	Y	Y	Y	130	20	57
201	C	F	TRAD	Y	N	Y	Y	Y	Y	143	17	59
202	C	M	TRAD	Y	N	Y	Y	Y	Y	140	21	62
203	C	M	TRAD	N	N	Y	Y	Y	Y	135	19	54
204	T	M	N.T.	N	Y	Y	Y	Y	Y	104	11	39
205	T	M	TRAD	N	N	N	Y	N	Y	121	16	51
206	T	F	N.T.	N	Y	Y	Y	Y	Y	114	20	54
207	C	F	N.T.	Y	Y	Y	Y	Y	Y	93	14	44
208	C	F	N.T.	N	Y	Y	Y	Y	Y	132	11	49

DUMMY CODED MRC VARIABLES

Student	Attitude	Literacy	Software	Grp	Sex	Age	Home	Course	G x C	G x H	G x A	G x S
101	123	15	68	1	1	1	0	0	0	0	1	1
102	145	10	49	1	1	1	0	0	0	0	1	1
103	141	37	59	1	0	0	0	1	1	0	0	0
104	128	18	48	1	1	1	0	1	1	0	1	1
105	113	17	62	0	0	0	0	1	0	0	0	0
106	136	37	68	1	1	0	0	0	0	0	0	1
107	127	18	62	0	0	1	1	0	0	0	0	0
108	142	18	55	1	0	0	1	0	0	1	0	0
109	148	16	65	0	0	1	1	0	0	0	0	0
110	107	11	53	0	1	0	0	1	0	0	0	0
111	111	23	61	0	1	0	1	0	0	0	0	0
112	145	19	49	1	0	0	1	1	1	1	0	0
113	90	12	47	0	1	0	0	0	0	0	0	0
114	136	22	63	0	0	0	1	1	0	0	0	0
115	115	21	57	0	0	0	0	1	0	0	0	0
116	135	20	64	1	0	1	0	0	0	0	1	0
117	107	17	50	1	1	0	0	1	1	0	0	1
118	121	16	40	1	1	0	1	1	1	1	0	1
119	134	13	62	0	0	0	1	1	0	0	0	0
120	129	9	63	0	0	1	0	0	0	0	0	0
121	149	14	61	0	0	0	0	1	0	0	0	0
122	100	8	46	1	1	0	0	0	0	0	0	1
123	98	14	37	1	1	1	1	0	0	1	1	1
124	107	34	68	1	0	0	1	0	0	1	0	0
125	111	17	64	1	0	0	0	1	1	0	0	0
126	106	22	63	1	0	1	1	0	0	1	1	0
127	139	13	61	0	0	0	0	0	0	0	0	0
128	111	26	62	0	0	0	0	0	0	0	0	0
129	122	28	68	1	0	1	0	0	0	0	1	0
130	138	19	55	0	0	0	0	0	0	0	0	0
131	139	13	50	0	1	0	0	0	0	0	0	0
132	106	4	49	0	1	0	1	1	0	0	0	0
133	140	17	58	1	0	1	0	0	0	0	1	0
134	154	38	68	1	0	0	0	1	1	0	0	0
135	119	14	55	1	0	0	1	0	0	1	0	0
136	118	20	51	0	0	0	0	1	0	0	0	0
137	114	17	55	1	1	1	0	0	0	0	1	1
138	127	20	40	1	0	0	0	0	0	0	0	0
139	117	16	49	0	0	0	1	1	0	0	0	0
140	131	12	57	0	1	0	1	0	0	0	0	0
141	131	20	65	0	1	1	0	0	0	0	0	0
142	140	21	62	1	0	1	1	0	0	1	1	0
143	143	16	59	0	1	0	1	0	0	0	0	0
144	131	23	58	1	0	1	0	0	0	0	1	0
145	97	18	58	0	0	0	1	0	0	0	0	0
146	103	17	43	1	1	1	0	1	1	0	1	1
147	131	24	63	0	0	1	1	0	0	0	0	0
148	131	24	58	0	0	0	0	0	0	0	0	0
149	134	19	66	1	1	0	1	0	0	1	0	1
150	120	20	67	0	0	0	1	0	0	0	0	0
151	131	19	65	0	0	1	0	0	0	0	0	0
152	148	35	71	1	0	0	1	0	0	1	0	0
153	151	18	66	1	1	1	0	0	0	0	1	1
154	151	19	39	1	1	1	1	0	0	1	1	1
155	125	19	54	0	0	1	0	0	0	0	0	0
156	117	12	67	1	0	1	0	0	0	0	1	0
157	149	17	62	0	0	0	1	1	0	0	0	0
158	137	32	60	0	0	0	1	0	0	0	0	0
159	137	28	58	0	0	1	1	0	0	0	0	0
160	111	18	49	0	0	0	0	0	0	0	0	0

161	117	28	63	1	0	1	1	0	0	1	1	0
162	140	24	53	0	1	0	1	0	0	0	0	0
163	124	19	61	0	1	0	1	1	0	0	0	0
164	135	23	67	1	0	1	1	0	0	1	1	0
165	103	21	66	1	0	1	1	0	0	1	1	0
166	142	19	63	0	0	1	0	0	0	0	0	0
167	150	26	58	0	1	0	1	1	0	0	0	0
168	64	14	62	0	0	1	0	0	0	0	0	0
169	122	21	57	0	1	0	0	1	0	0	0	0
170	130	15	48	0	0	0	1	0	0	0	0	0
171	142	14	38	1	1	1	1	0	0	1	1	1
172	101	17	65	0	0	1	1	0	0	0	0	0
173	139	19	62	0	0	1	1	0	0	0	0	0
174	115	15	60	0	0	0	0	0	0	0	0	0
175	95	15	56	1	1	0	0	0	0	0	0	1
176	145	15	65	1	0	1	0	0	0	0	1	0
177	134	27	58	1	1	0	1	1	1	1	0	1
178	111	14	66	0	0	1	1	0	0	0	0	0
179	150	16	56	1	1	0	1	0	0	1	0	1
180	146	38	65	1	0	0	0	0	0	0	0	0
181	139	19	45	1	0	0	0	0	0	0	0	0
182	148	15	43	1	0	1	1	0	0	1	1	0
183	124	7	50	0	1	0	1	0	0	0	0	0
184	134	19	65	1	1	0	0	0	0	0	0	1
185	139	22	61	1	0	0	1	0	0	1	0	0
186	133	22	63	1	1	0	1	0	0	1	0	1
187	155	24	55	1	1	0	1	0	0	1	0	1
188	120	20	61	0	1	0	0	0	0	0	0	0
189	135	17	60	0	0	1	1	0	0	0	0	0
190	148	34	62	1	0	0	0	0	0	0	0	0
191	149	19	53	0	0	1	1	0	0	0	0	0
192	134	11	59	1	1	1	0	0	0	0	1	1
193	117	14	38	1	1	0	0	1	1	0	0	1
194	115	19	55	0	1	0	1	1	0	0	0	0
195	115	28	57	0	1	0	1	0	0	0	0	0
196	121	10	58	0	0	0	1	0	0	0	0	0
197	150	9	51	1	1	0	0	1	1	0	0	1
198	133	21	48	0	1	0	1	1	0	0	0	0
199	135	12	55	0	0	0	1	0	0	0	0	0
200	130	20	57	1	0	1	0	0	0	0	1	0
201	143	17	59	0	0	1	1	0	0	0	0	0
202	140	21	62	0	1	1	1	0	0	0	0	0
203	135	19	54	0	1	1	0	0	0	0	0	0
204	104	11	39	1	1	0	0	1	1	0	0	1
205	121	16	51	1	1	1	0	0	0	0	1	1
206	114	20	54	1	0	0	0	1	1	0	0	0
207	93	14	44	0	0	0	1	1	0	0	0	0
208	132	11	49	0	0	0	0	1	0	0	0	0

REVIEW SHEET DATA

Student	Grp	Ref1	Ref2	Ref3	So1	So2	So3	Fac1	Fac2	Fac3	Stu1	Stu2	Stu3	Time1	Time2	Time3	TA1	TA2	TA3	Extra1	Extra2	Extra3	Ref	Soft	Fac	Stu	Time	TA	Extra
101	T	0	0	0	0	0	1	0	0	0	0	0	0	5	8	11	0	1	0	2	5	7	0	1	0	0	24	1	14
102	T	0	0	0	0	1	1	0	0	0	0	0	0	2	3	3	0	0	1	3	3	0	0	2	0	0	8	1	6
103	T	1	1	3	0	1	1	0	0	0	1	1	1	3	12	40	0	3	5	0	2	2	5	2	0	3	55	8	4
104	T	0	0	0	1	0	1	0	0	0	2	1	1	2	5	3	1	0	2	1	3	2	0	2	0	4	10	3	6
105	C	1	2	1	1	2	2	0	0	0	0	1	1	3	5	4	0	0	0	0	0	0	4	5	0	2	12	0	0
106	T	1	1	1	0	2	5	0	0	0	0	0	0	10	20	24	0	0	0	0	20	40	3	7	0	0	54	0	60
107	C	2	2	1	1	2	2	0	0	0	0	0	1	2	2	2	0	0	2	0	0	0	5	5	0	1	6	2	0
108	T	1	1	1	0	2	1	0	0	0	0	1	0	1	10	13	0	10	0	0	10	15	3	3	0	1	24	10	25
109	C	0	0	0	0	1	1	0	0	0	1	1	1	4	3	3	0	0	1	0	0	0	0	2	0	3	10	1	0
110	C	0	0	0	0	1	1	0	0	0	1	0	0	3	2	2	0	1	0	2	2	0	0	2	0	1	7	1	4
111	C	0	0	0	0	0	1	0	1	0	0	0	0	3	8	12	0	0	0	0	0	6	0	1	1	0	23	0	6
112	T	0	0	0	0	0	1	0	0	0	0	0	0	2	3	6	0	0	0	0	0	0	0	1	0	0	11	0	0
113	C	1	1	1	0	0	1	0	0	0	0	1	1	2	4	7	0	2	4	0	0	0	3	1	0	2	13	6	0
114	C	2	2	1	0	1	1	1	0	1	0	0	1	3	5	10	1	0	10	0	2	7	5	2	2	1	18	11	9
115	C	1	1	1	1	1	3	0	0	0	0	0	1	3	2	6	3	4	2	3	2	6	3	5	0	1	11	9	11
116	T	0	0	0	0	2	3	0	0	1	0	0	1	1	8	16	0	0	10	1	8	10	0	5	1	1	25	10	19
117	T	2	2	1	1	1	2	2	2	2	2	1	1	15	5	12	10	3	10	6	1	4	5	4	6	4	32	23	11
118	T	1	1	1	1	0	1	0	0	0	0	0	0	3	2	6	0	0	0	2	2	6	3	2	0	0	11	0	10
119	C	0	0	0	0	1	1	0	0	0	0	0	0	1	1	2	0	1	1	0	0	0	0	2	0	0	4	2	0
120	C	1	1	1	0	1	1	0	0	1	1	1	1	8	3	7	2	3	5	5	1	4	3	2	1	3	18	10	10
121	C	1	1	1	2	2	2	0	0	0	0	0	1	6	3	8	0	0	2	0	0	6	3	6	0	1	17	2	6
122	T	0	0	1	1	1	2	0	0	0	1	1	1	5	2	10	1	0	6	4	4	15	1	4	0	3	17	7	23
123	T	1	1	1	0	0	1	0	0	0	0	0	0	2	6	10	3	5	6	0	0	4	3	1	0	0	18	14	4
124	T	1	1	1	1	2	3	0	0	0	0	0	0	5	10	20	0	2	5	0	0	10	3	6	0	0	35	7	10
125	T	0	0	0	0	2	1	0	0	1	0	0	0	2	4	5	3	5	10	0	0	4	0	3	1	0	11	18	4
126	T	1	1	1	1	0	1	0	0	0	1	1	1	4	3	10	3	0	5	4	3	10	3	2	0	3	17	8	17
127	C	1	1	1	0	0	1	0	0	0	0	0	0	6	8	10	5	3	4	3	5	7	3	1	0	0	24	12	15
128	C	1	1	1	0	1	1	0	1	1	1	1	1	1	1	10	0	1	1	0	0	4	3	2	2	3	12	2	4
129	T	0	0	0	1	1	2	0	0	0	1	1	0	5	5	10	3	10	5	0	0	1	0	4	0	2	20	18	1
130	C	0	0	0	0	1	1	0	0	0	1	1	1	6	6	6	0	0	0	6	6	6	0	2	0	3	18	0	18
131	C	1	1	1	1	1	2	0	0	0	1	1	1	2	2	2	1	1	1	0	0	0	3	4	0	3	6	3	0
132	C	1	1	1	0	0	1	0	0	0	1	1	1	30	10	45	15	10	7	30	10	45	3	1	0	3	85	32	85
133	T	1	1	1	1	0	1	0	0	0	1	0	1	4	3	14	0	1	1	4	1	11	3	2	0	2	21	2	16
134	T	0	0	0	0	1	1	0	0	0	1	1	1	6	6	6	0	0	0	6	6	6	0	2	0	3	18	0	18
135	T	0	0	0	0	0	1	0	0	0	0	0	0	1	4	10	0	0	0	0	0	6	0	1	0	0	15	0	6
136	C	0	0	0	0	0	1	0	0	0	0	1	1	1	9	2	2	3	3	0	3	2	0	1	0	2	12	8	5
137	T	1	1	1	2	1	2	0	0	0	1	0	1	2	3	3	4	0	2	1	0	2	3	5	0	2	8	6	3
138	T	4	7	10	0	1	1	0	0	0	1	1	1	1	4	10	3	4	6	0	1	0	21	2	0	3	15	13	1
139	C	2	2	1	2	2	3	0	0	0	0	0	0	5	10	10	2	2	3	2	4	4	5	7	0	0	25	7	10
140	C	1	1	1	0	0	1	0	0	0	1	0	0	4	10	12	0	0	1	6	9	13	3	1	0	1	26	1	28
141	C	1	1	1	0	1	1	0	0	0	0	1	1	1	3	4	0	1	3	0	1	2	3	2	0	2	8	4	3
142	T	0	0	0	0	2	3	1	1	1	0	0	1	3	6	16	0	0	10	0	0	10	0	5	3	1	25	10	10
143	C	0	0	1	0	0	1	0	0	0	0	0	0	4	6	8	0	0	0	2	4	8	1	1	0	0	18	0	14

144	T	0	0	0	1	0	1	0	0	0	0	0	0	7	5	12	0	0	0	4	2	6	0	2	0	0	24	0	12
145	C	0	0	0	0	1	1	0	0	0	0	0	0	2	3	7	2	5	2	2	3	7	0	2	0	0	12	9	12
146	T	0	1	0	0	0	1	0	0	0	0	1	1	2	3	4	0	1	0	0	0	0	1	1	0	2	9	1	0
147	C	0	0	0	0	1	1	0	0	0	1	1	1	4	3	3	0	0	1	0	0	0	0	2	0	3	10	1	0
148	C	0	1	0	1	1	1	0	0	0	0	0	1	3	6	9	1	0	2	0	2	2	1	3	0	1	18	3	4
149	T	1	1	1	0	0	1	0	0	0	1	1	1	1	5	5	2	3	0	0	5	0	3	1	0	3	11	5	5
150	C	0	0	0	0	1	1	0	0	0	0	0	0	3	4	7	2	5	2	3	4	7	0	2	0	0	14	9	14
151	C	1	1	1	1	2	2	0	0	1	0	0	1	3	3	6	0	0	2	2	3	6	3	5	1	1	12	2	11
152	T	1	1	1	0	2	5	0	0	0	0	0	0	20	20	24	0	0	0	0	20	40	3	7	0	0	64	0	60
153	T	1	1	1	1	2	2	0	0	1	0	1	0	6	10	13	6	6	6	3	0	0	3	5	1	1	29	18	3
154	T	2	2	1	1	1	1	0	0	0	0	0	0	4	3	10	4	3	6	0	0	0	5	3	0	0	17	13	0
155	C	0	0	0	0	0	1	0	0	0	0	0	1	1	5	2	0	5	2	0	3	0	0	1	0	1	8	7	3
156	T	1	1	1	1	0	1	0	0	0	1	0	1	4	2	14	0	0	1	4	1	11	3	2	0	2	20	1	16
157	C	1	1	1	0	1	2	0	0	0	0	0	0	3	6	4	0	0	0	1	3	3	3	3	0	0	13	0	7
158	C	1	1	1	0	0	2	1	0	0	0	0	0	5	5	5	3	3	4	2	2	2	3	2	1	0	15	10	6
159	C	1	1	1	0	1	1	0	0	0	0	1	1	3	5	4	0	3	4	0	2	0	3	2	0	2	12	7	2
160	C	1	0	1	0	0	1	0	0	0	1	0	1	5	2	6	2	0	2	0	0	3	2	1	0	2	13	4	3
161	T	2	2	1	1	1	2	0	0	0	0	1	1	6	7	8	3	7	5	0	0	0	5	4	0	2	21	15	0
162	C	1	1	1	0	1	1	0	0	0	0	1	1	2	5	4	0	3	4	0	2	0	3	2	0	2	11	7	2
163	C	2	2	1	0	1	1	0	0	0	0	1	0	4	8	10	0	0	0	0	4	10	5	2	0	1	22	0	14
164	T	0	0	0	0	2	1	0	0	1	0	0	0	1	9	9	2	2	5	3	5	10	0	3	1	0	19	9	18
165	T	1	1	1	1	0	1	0	0	0	1	1	1	4	2	10	3	0	7	3	2	10	3	2	0	3	16	10	15
166	C	1	1	1	1	2	2	0	0	1	0	0	1	2	3	6	0	0	2	2	3	6	3	5	1	1	11	2	11
167	C	2	2	1	1	2	3	0	0	0	0	0	0	10	35	40	0	0	0	0	0	0	5	6	0	0	85	0	0
168	C	2	2	1	2	2	1	0	0	0	0	0	0	1	1	8	0	0	0	0	0	4	5	5	0	0	10	0	4
169	C	0	0	0	0	0	1	0	0	0	0	1	1	1	9	2	1	1	6	0	6	0	0	1	0	2	12	8	6
170	C	0	0	0	0	1	1	0	0	0	1	1	1	6	6	6	0	0	0	6	6	6	0	2	0	3	18	0	18
171	T	1	1	1	1	2	2	0	0	0	0	3	2	1	10	12	1	5	1	0	7	9	3	5	0	5	23	7	16
172	C	0	0	0	0	0	1	0	0	0	0	0	1	1	5	2	0	5	2	0	3	0	0	1	0	1	8	7	3
173	C	0	0	0	0	1	1	0	0	0	0	1	1	3	6	3	0	2	4	0	1	0	0	2	0	2	12	6	1
174	C	0	0	0	0	0	1	0	0	0	0	1	1	3	5	4	0	0	0	0	0	0	0	1	0	2	12	0	0
175	T	1	1	1	2	2	2	0	0	0	1	1	1	3	5	10	1	0	1	1	0	5	3	6	0	3	18	2	6
176	T	0	0	0	0	0	1	0	0	0	0	1	1	3	6	12	0	0	6	0	0	0	0	1	0	2	21	6	0
177	T	1	1	1	2	2	3	0	0	1	0	0	0	3	5	10	0	0	1	0	0	3	3	7	1	0	18	1	3
178	C	1	1	1	2	1	2	0	0	0	0	0	0	6	3	15	5	0	5	3	3	5	3	5	0	0	24	10	11
179	T	0	0	1	0	2	1	0	0	2	0	5	5	9	10	14	5	0	5	3	3	6	1	3	2	10	33	10	12
180	T	1	1	1	1	1	2	0	0	0	0	0	1	5	3	20	0	1	2	2	0	0	3	4	0	1	28	3	2
181	T	1	1	1	0	2	1	0	0	0	0	1	0	1	10	10	0	10	0	0	0	0	3	3	0	1	21	10	0
182	T	0	1	1	0	2	4	0	0	1	0	1	2	3	6	12	0	2	2	0	3	6	2	6	1	3	21	4	9
183	C	1	0	0	0	0	1	0	1	0	0	0	1	2	2	2	0	0	1	0	0	0	1	1	1	1	6	1	0
184	T	1	1	1	2	2	3	0	0	1	0	0	0	3	5	15	0	0	2	0	0	5	3	7	1	0	23	2	5
185	T	1	1	1	0	1	2	0	0	1	0	0	0	1	2	10	0	2	8	0	0	3	3	3	1	0	13	10	3
186	T	0	0	0	3	3	2	2	2	2	2	2	2	4	4	4	2	3	2	3	12	3	0	8	6	6	12	7	18
187	T	1	1	2	0	0	1	0	0	0	0	0	0	4	3	6	1	1	0	0	0	0	4	1	0	0	13	2	0

188	C	0	0	0	0	1	1	0	0	0	1	1	1	3	10	4	3	3	3	0	0	0	0	2	0	3	17	9	0
189	C	1	1	1	0	1	1	1	1	1	0	0	0	3	6	3	3	2	3	2	4	3	3	2	3	0	12	8	9
190	T	0	0	0	0	1	1	0	0	0	1	1	1	3	12	40	0	2	4	0	1	10	0	2	0	3	55	6	11
191	C	1	1	1	0	1	1	0	0	1	1	1	1	8	3	7	2	3	3	8	3	7	3	2	1	3	18	8	18
192	T	0	0	0	0	1	1	1	1	0	1	1	1	5	5	15	2	3	5	3	3	5	0	2	2	3	25	10	11
193	T	0	0	0	0	0	1	0	0	0	1	0	1	6	3	7	0	0	0	3	4	9	0	1	0	2	16	0	16
194	C	1	2	1	1	2	2	0	0	0	1	1	2	6	6	4	0	0	0	3	3	3	4	5	0	4	16	0	9
195	C	1	1	1	0	1	1	0	0	0	0	0	0	3	10	5	2	5	3	0	5	0	3	2	0	0	18	10	5
196	C	0	0	0	0	0	1	0	1	0	0	1	1	3	5	4	1	1	1	0	0	0	0	1	1	2	12	3	0
197	T	1	2	2	2	3	8	0	0	1	0	0	4	28	20	72	8	13	20	8	10	14	5	13	1	4	120	41	32
198	C	1	1	1	1	1	2	0	0	1	1	1	1	3	8	12	0	0	1	6	9	18	3	4	1	3	23	1	33
199	C	1	1	1	0	0	1	0	0	0	1	0	1	6	4	15	1	0	2	0	2	15	3	1	0	2	25	3	17
200	T	0	0	0	0	0	1	0	0	0	0	0	0	3	6	12	0	0	6	0	0	0	0	1	0	0	21	6	0
201	C	0	0	0	1	2	2	0	0	0	0	0	1	2	10	2	0	2	0	0	0	0	0	5	0	1	14	2	0
202	C	0	0	0	0	0	1	0	0	0	0	0	0	1	2	3	0	0	2	0	0	0	0	1	0	0	6	2	0
203	C	1	1	1	0	1	1	0	0	0	0	1	0	2	4	4	0	1	3	0	1	3	3	2	0	1	10	4	4
204	T	1	1	1	0	1	1	0	0	0	0	0	0	4	4	5	3	3	2	2	2	2	3	2	0	0	13	8	6
205	T	0	0	0	0	1	1	0	0	0	0	0	0	2	5	10	0	0	0	0	0	12	0	2	0	0	17	0	12
206	T	2	2	1	1	1	2	2	2	2	1	1	1	15	5	15	0	0	0	0	0	10	5	4	6	3	35	0	10
207	C	1	1	0	0	1	2	0	0	0	0	0	0	4	2	8	2	3	6	0	0	2	2	3	0	0	14	11	2
208	C	0	0	1	0	0	1	0	0	0	0	0	1	2	2	2	0	0	1	0	0	0	1	1	0	1	6	1	0

INTERVIEW DATA

Student	*Grp*	*Pos*	*Neg*	*Skills*	*Useful*	*People*	*Steps*
101	T	1	0	3	3	0	4
133	T	1	0	3	3	1	6
133	C	1	1	1	0	0	4
141	C	2	3	3	1	0	4
142	T	3	2	1	3	0	4
145	C	2	1	4	2	0	6
150	C	2	1	2	2	0	4
159	C	2	1	2	2	0	5
161	T	3	1	3	1	0	7
165	T	2	2	4	4	0	8

RELIABILITY CHECK FOR REVIEW SHEET DATA

Student	*Time (1st)*	*Time (2nd)*	*Res (1st)*	*Res (2nd)*
101	38	30	2	2
104	16	16	10	10
105	12	13	11	11
121	23	18	11	10
129	21	20	24	20
131	6	6	13	12
133	37	35	13	12
134	36	35	5	6
137	11	10	16	17
150	28	30	11	10
155	11	10	9	11
161	21	21	26	24
162	13	20	14	14
163	36	28	10	12
169	18	10	11	12
173	13	18	9	8
178	35	40	18	16
181	21	22	17	16
187	13	12	7	10
188	17	20	14	15
207	16	10	16	19
208	6	8	3	3

APPENDIX E

INTERVIEW REPORT

INTERVIEW REPORT

TREATMENT GROUP POSITIVE COMMENTS:

-Lab staff was very kind
-Lab assistants were easy to reach (3)*
-Textbook well done
-Software well chosen
-Interesting
-Lab staff was competent (2)
-Permitted to apply our knowledge

* In parentheses: number of students that gave that same comment.

TREATMENT GROUP NEGATIVE COMMENTS

-Lab part was too important in the course
-Not enough computers (2)
-Network was unreliable
-Excel assignment was too long
-No negative comments (2)

* In parentheses: number of students that gave that same comment.

TREATMENT GROUP SKILLS REPORTED

SKILL	USEFUL?	No. of students
Excel	Yes*	5
Mac technology	Yes	1
Word	Yes	4
SuperPaint	Yes	4

* 3 students mentionned that Excel would be the most useful.

Only one student mentioned that a person outside the school was consulted in the project (friend).

TREATMENT GROUP STEPS TAKEN

Step Taken	No. of students
SUPERPAINT:	
Looked at greeting card	5
Drafted on paper before	3
Used another software	3
WORD:	
Used his/her old resume	2
Used a book on resumes	5
Did a draft on paper before	1
EXCEL:	
Did a flowchart	0
Did an algorithm	0
Used a corporate annual report	5
Used another software	5

CONTROL GROUP POSITIVE COMMENTS

-Lab assistants were easy to reach
-Textbook well done
-I liked Word and Excel
-Very easy
-Lab personnel competent
-Computers worked very well
-Learning by modules is good
-Good course
-One more piece of knowledge

CONTROL GROUP NEGATIVE COMMENTS

-SuperPaint assignment was not useful
-Students did not respect their allowed timeslots
-Network was unreliable (2)*
-Knowledge incomplete
-Hard to get help on weekends
-Not very useful because at work I use IBM

* In parentheses: number of students that gave that same comment.

CONTROL GROUP SKILLS REPORTED

SKILL	USEFUL?	No. of students
Excel	Yes*	4
Word	Yes*	3
SuperPaint	Yes	1
Mac Software	No	1
Macro programming	Yes	2
Learned to like computers	Yes	1

* 2 students mentioned that Excel and Word would be the most useful.

Nobody mentioned that a person outside the school was involved in the projects.

CONTROL GROUP STEPS TAKEN

Step Taken	No. of students
SUPERPAINT:	
Looked at greeting card	5
Drafted on paper before	2
Used another software	0
WORD:	
Used his/her old resume	0
Used a book on resumes	5
Did a draft on paper before	1
EXCEL:	
Did a flowchart	0
Did an algorithm	0
Used a corporate annual report	5
Used another software	5

APPENDIX F

TREATMENT VERIFICATION REPORT

Table F-1, shows the original data gathered by the observers. It presents the number of the computer observed, the period (see Appendix C) in which the observation took place, the group (treatment or control), the topic of the period (SuperPaint or Excel), and finally the tally of all activities recorded in relation to the checklist (Table 9). A "1" indicates that the activity or behavior was observed at least once during the period.

Table F-2 shows the results of the questions related to differences between the topic of the day and the activity observed. No significant results were found. Table F-3 presents the results for the questions related to the treatment group activities. Activities observed occurred significantly more in the treatment group for seven of the ten questions. Also, none of the treatment group activities were observed in the control group. Table F-4 presents the results for the questions related to the control group activities. These activities were observed more in the control group for five of the seven questions. None of the control group activities were observed in the treatment group. Finally Table F-5 shows the results of the remaining activities, which were expected to occur in both groups. No significant differences were found.

TABLE F-1 - TREATMENT VERIFICATION ORIGINAL DATA

Comp./Period	Group	Subj	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1/4	T	SP	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2/4	T	SP	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0
3/4	T	SP	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1
4/4	T	SP	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0
5/4	T	SP	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0
7/4	T	SP	1	0	1	0	0	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1
8/4	T	SP	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/4	T	SP	1	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/4	T	SP	1	0	1	0	1	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1
13/4	T	SP	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0
17/4	T	SP	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
20/4	T	SP	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1/4	C	SP	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0
2/4	C	SP	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0
4/4	C	SP	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0
8/4	C	SP	1	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0	0	0	1	0
9/4	C	SP	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0
10/4	C	SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/4	C	SP	1	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0	0	0	1	0
12/4	C	SP	1	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	1	0	0	0	1	1
13/4	C	SP	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0
14/4	C	SP	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
15/4	C	SP	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0
16/4	C	SP	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0
19/4	C	SP	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0
21/4	C	SP	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0
1/9	T	Excel	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0
3/9	T	Excel	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0
5/9	T	Excel	0	1	0	0	1	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	1	1	0
7/9	T	Excel	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1	1	1
9/9	T	Excel	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0
11/9	T	Excel	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0
13/9	T	Excel	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0
15/9	T	Excel	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0
17/9	T	Excel	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0
19/9	T	Excel	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1	1	0
21/9	T	Excel	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1	1	1
2/9	C	Excel	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
4/9	C	Excel	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0
6/9	C	Excel	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0
8/9	C	Excel	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1
10/9	C	Excel	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
12/9	C	Excel	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0
14/9	C	Excel	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
16/9	C	Excel	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	1	0
18/9	C	Excel	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
20/9	C	Excel	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0

TABLE F-2 - DISCREPANCIES FROM THE TOPIC OF THE DAY

QUESTIONS	% in C	% in T	χ^2	p
Question 1	7%	17%	0.57	> .05
Question 2	0%	0%	0.00	> .05

TABLE F-3 - QUESTIONS RELATED TO THE TREATMENT GROUP ACTIVITIES

QUESTIONS	% in C	% in T	χ^2	p
Question 5	0%	13%	3.34	> .05
Question 7	0%	44%	13.25	< .05
Question 8	0%	26%	7.18	< .05
Question 9	0%	35%	10.06	< .05
Question 11	0%	78%	30.44	< .05
Question 13	0%	30%	8.58	< .05
Question 17	0%	22%	5.84	< .05
Question 19	0%	9%	2.18	> .05
Question 21	0%	48%	14.99	< .05
Question 22	0%	13%	3.34	> .05

TABLE F-4 - QUESTIONS RELATED TO THE CONTROL GROUP ACTIVITIES

QUESTIONS	% in C	% in T	χ^2	p
Question 6	38%	0%	10.67	< .05
Question 10	25%	0%	6.59	< .05
Question 14	54%	0%	17.22	< .05
Question 15	25%	0%	6.59	< .05
Question 16	13%	0%	3.07	> .05
Question 18	42%	0%	12.17	< .05
Question 20	54%	0%	17.22	< .05

TABLE F-5 - QUESTIONS RELATED TO GENERAL LAB ACTIVITIES

QUESTIONS	% in C	% in T	χ^2	p
Question 12	25%	35%	0.54	> .05
Question 23	13%	22%	0.71	> .05
Question 24	88%	78%	0.71	> .05
Question 25	13%	26%	1.40	> .05