LEARNERS' PERCEPTIONS OF CREATING A COLLABORATIVE HYPERMEDIA PRODUCT: AN EXPLORATORY CASE STUDY AT MOUNT PLEASANT PRIMARY SCHOOL

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTERS IN EDUCATION

in

Information Communication Technology in Education

In the Department of Education

of

RHODES UNIVERSITY

by

ANDRÉ DU PLESSIS

JULY 2003

Supervisor: Prof. Cheryl Hodgkinson-Williams

ABSTRACT

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Department: Education

Degree: MEd (ICT)

The Ministry of Education (SICTE, 2002) states that the widespread introduction of computers in schools should support Curriculum 2005 and that computer technology is part and parcel of making schools the center of community life. The vision is to establish Smart Schools: schools that are reinvented in terms of teaching-learning practices to prepare learners for the information era (SICTE, 2002).

Kafai (1996:71) has found that conventional school assignments rarely give learners the opportunity to spend a great deal of time on complex projects. As a result, many learners have little experience in design: planning, problem solving, researching, dealing with time constraints, modifying expectations and synthesizing everything in a project. Research by Carver, Lehrer, Connell and Erickson (1992); Lehrer, (1993); Lehrer, Erickson and Connell (1994); Kafai (1996); Liu and Hsiao (2002) and Liu (2002) indicates that the design of hypermedia artefacts can assist in providing experience in design.

To date, no equivalent research has been conducted in South Africa to ascertain the perceptions of learners regarding the creation of a hypermedia artefact over an extended period of time and whether some of the critical outcomes specified in Curriculum 2005 can be addressed in such a learning-by-design hypermedia project.

This study shows that design skills and aspects related to the critical outcomes of Curriculum 2005 can be achieved. Furthermore, it indicates that this kind of project encourages interest, motivation and collaboration. In addition, it suggests that learners experience the role of the teacher as different and prefer such a learning environment. In spite of the positive results, some aspects that need attention for future implementation are suggested.

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LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
AC	Assessment Criteria
ARCS	Attention, Relevance, Confidence & Satisfaction motivational model of Keller
AVI	AVI video files (Audio Video Interleave, file format)
CBI	Computer Based Instruction
CO	Critical Outcomes
DOE	Department of Education
ICT	Information & Communication Technology
ILS	Integrated Learning Systems
IS	Internet Source: Refer to sources in Reference section that were downloaded from the Internet e.g. Reeves (1998:IS) or (Reeves, 1998:IS-2). The number next to the IS indicates the page number of the copy printed from the Internet and lodged with the supervisor.
JPEG	File format for saving images such as photos or pictures. The images file size can be compressed to make the file smaller, but some picture quality is then lost in the process.
PAQ	Project Assessment Questionnaire
PBL	Project-Based Learning
PC	Personal Computer
PI	Performance Indicator
REALs	Rich Environment for Active Learning
RTF	Rich Text Format (Format in which a text file can be saved)
SICTE	Strategy for Information and Communication Technology in Education
SO	Specific Outcomes
TEP	Task Elicitation Procedure
TRP	Task Ranking Procedure
TTCT	Torrance Test of Creativity and Thinking
ZPD	Zone of Proximal Development

ACKNOWLEDGEMENTS

To my wife, Marlene, and Elz-Mari, my daughter: You have always believed in me – you carried me.

I would like to record special thanks to the following people for their contributions towards this research project:

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- To my Creator: You have led me through deep and turbulent waters to discover myself.

"The mere possibility that thinking skills might be taught dictates that efforts to teach them should be made. If we try, and discover that it cannot be done, the cost is only a bit of wasted effort. If it can be done, but we choose not to try, the cost, in wasted intellectual potential, could be enormous."

Nickerson, Perkins and Smith (1985).

CHAPTER 5

CONCLUSION

5.1 INTRODUCTION

Curriculum 2005 has encouraged a more constructivist approach to learning (Department of Education, 2000:11). The constructivist classroom is different from the traditional classroom in many ways (Brooks & Brooks, 1993, 1999). An alternative learning strategy, using the computer as a design tool in a cooperative REALs Project-Based Learning environment underpinned by cognitive apprenticeship, was implemented in an effort to determine the perceptions of grade 6 learners about the design process in creating a hypermedia product, as well as their perceptions of collaboration, motivation and interest. The reasoning behind this was to ascertain whether implementation of the proposed constructivist learning theory in the construction of a hypermedia artifact following a Project-Based Learning approach, would assist in developing the proposed critical outcomes of Curriculum 2005 (DOE, 1997a:IS). In other words, would aspects of the critical outcomes manifest during this project?

It was expected that the new approach would indeed assist in realizing certain critical outcomes, because:

(1) A novel tool would be used during this project, the computer
(2) The authentic learning environment would be experienced as something different
(3) The role of the teacher would be different
(4) Previous research indicates positive results (Lehrer, 1993).

5.2 QUESTION 1 and 2: SUMMARY OF FINDINGS

Learners displayed various skills during the project. While busy with the project they had to implement and use existing skills and had to learn and develop new skills when necessary.

Question 1: What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia project?

5.2.1 DECISION MAKING SKILLS

Decisions for deciding on a topic were mainly based on interest in the topic. Added to interest, the following factors played also a role:

- Having some knowledge about the topic
- Interest in particular animals
- Information readily available

- Influence of friends
- Possibility of a group that will work and function well together
- Topic not difficult to understand, it is do-able
- New opportunity to learn more about something that is new to them

5.2.2 RESEARCH SKILLS

Searching for information was a priority for the majority of the learners during the first few weeks. However, searching for information was not the only task that received attention at the start of the project. It was found that tasks such as *"draft planning"*, designing and editing of screens on the computer also received attention. One learner planned at home and started to design his product from week one on the computer. These findings are in line with the findings of Lehrer (1993), Papert (1993) and Kafai (1996), who also found that not all learners approach the planning and designing of their projects in the same way.

It was found that learners used sources not only in the library, but from elsewhere to obtain information such as books, magazines that were brought from home, Microsoft Encarta Multimedia Ecyclopedia and even a video recorded from an educational television program. Some learners used the card catalogue as a tool to assist them to find information in the library. Only two learners used the interview technique to find additional information. At least 11% of the learners tried to make use of the Internet connection provided to them, by searching using the search engine http://www.google.com. However, Internet searching seems to be problematic as learners have not yet worked extensively on the Internet at school and found the process of searching for information difficult. Keywords were used during the search process, but too many results were yielded and hence learners found it difficult to filter through all the information and to select which of the Internet hits to select.

The selection and location of information was also important to the learners and they spent a considerable amount of time finding information. The majority knew where to find relevant information pertaining to their topics. However, some groups experienced problems in finding information in the library about their topic. Two girls indicated that the project was difficult and was too much for them, mainly because they did not find information initially. Not being able to find information did not deter all learners, as one group used this opportunity to explore a new technique to circumvent this problem: they went to the museum and took photographs in digital format of the inscriptions on the walls and inside the glass cases. These photos were then enlarged in photo editing software and the information summarised from the photos.

Information that was found in English sources was translated from English to Afrikaans. Hence, translation skills such as using the dictionary received attention. To summarise the located

information, learners made use of keywords and tried to write in a comprehensible way in their own words. However, not all the learners found summarization and translation easy. With reference to the work of Lehrer (1994) and Liu (2002) it becomes evident yet again that we cannot expect learners just to *"have"* the necessary skills such as using a dictionary with a view to translate from one language to another. Skills such as translating need to be taught and practised. This is indeed what should have been done to a greater extent with the participants during this study.

It was found that the majority of learners believe that information sources such as books and magazines are truthful and reliable sources, although not all such sources are always truthful and reliable. However, a few learners made use of cross-referencing by comparing information from sources covering the same topics to validate information.

5.2.3 PROJECT MANAGEMENT SKILLS

Careful planning and management of people is important, especially collective planning of projects in group context, as well as individual planning. Learners indicated that collective planning was important. Be that as it may, in practice it was found that some team-discussion had taken place, but not in much depth. Learners indicated at the end of the project that collective planning would have to receive greater attention in similar projects in future.

In contrast to collective planning, individual planning was a high priority, as learners planned every session by setting goals for the session in their journals. It was found that different goals were set for different aspects and tasks at different stages during the project. For example, during the first four weeks, goals referring to the search process seemed to be important, but as the project commenced, the search-related goals became less important. Goals related to designing on the computer, to finishing the project and to editing and rounding off the design, were not a high priority at the start, but their importance increased towards the end of the project. Learners felt that the goals that they had set, assisted them to plan (setting their goals for each session), to decide whether they had achieved their goals, to identify what they had learned and also made them aware of the problems that they experienced and whether they were solved or not, with a view to future planning. Although learners indicated that the goal setting assisted them, they did not enjoy the recording of the goals in their journals.

5.2.4 TIME MANAGEMENT

When time is a factor, the setting of deadlines and the creation of a timeline are important tools that can assist with the planning process. The findings showed that the creation of timelines was not a high priority. This could create the impression that there was not much thinking about time. Yet, an anlysis of the data showed that learners had thought about time-related aspects in spite

of not creating timelines. Strategies that they mentioned that assisted them to finish on time included the setting of goals, planning well in advance, working at other times or at other places and the limitation of off-task behaviour.

It was found that time constraints were caused by time-consuming tasks such as searching for information and illustrative material, translation of information from English to Afrikaans, scanning of visual material and insufficient computers available for all learners to work on at the same time. The findings about time constraints are in line with Liu (1998, 2002) who found that managing time well is not an easy task for learners in the middle school.

5.2.5 DESIGN SKILLS (ORGANISATION AND REPRESENTATION SKILLS)

It was found that the design process required a great deal of concentration during the segmentation and sequencing stages of the project in order that their prospective audience would easily understand their topic and the related sub-topics. Only 5% of the learners indicated that it was difficult to decide in what order they should present their ideas to make the project more understandable for their prospective audience. On the whole it seems that the learners have learned that sequencing information is an important aspect when one has to design a project.

It was found that learners did not readily mention searching for pictures, photos or AVI video clip files as goals. In spite of this, an analysis of TEP 2 and the PAQ provided evidence that learners regarded the inclusion of visual material as very important as visual material enhances understanding and promotes interest.

To be a successful designer, one needs to plan and map one's design. The findings showed that the majority of learners used storyboarding as a technique to design their screens first on cards, before they designed their screens on computer. At the same time it was noted that some learners did not make use of storyboarding on cards, but designed from the start on the computer. This finding is in line with Kafai (1996) who states that not all learners plan and design in the same manner. It was also found that the designed screen on computer did not necessarily depict the original design on paper, as many learners made alterations when they started to design on the computer with a view to improving their paper-based design.

To connect the screens together, learners need to know how to hyperlink. In addition, they also need to create an interface to assist their prospective users to navigate with ease through their presentation. It was found that many learners initially used plain text that consisted of a blue-text-only-underlined-link (Example: HABITAT) that would take the user to the linked screen. Users were then 'forced' to go back to the main screen to start the browsing from the start again.

In opposition to this method, it was found that some learners created an always-visible-hyperlink-navigation menu with hover buttons as an alternative. Those who opted not to use hover buttons for linking, opted for blue-text-only-underlined-links, but all the links were displayed on every page to assist with navigation.

The hyperlinking of screens was difficult for learners. It was found that the majority of learners finished the design of their screens and only then started with the hyperlinking process. In spite of the difficulty, learners felt that it was important for prospective users to be able to navigate with ease through their projects.

Initial analysis suggested that learners did not think much about their prospective audience; they concentrated too much on the design of the product to think about them. However, a closer inspection indicated that learners had thought about their audience, as aspects such as readability, colour usage, page layout and picture quality were important concerns during the design process. It was found that learners felt that screens need to grab attention and hence should not contain too much text; otherwise their audience might not be interested. Text used on screen should also be easily understandable to keep the user's attention and focus.

5.2.6 REFLECTION AND EVALUATION SKILLS

It was found that learners felt that it was important to test their design at regular intervals in browser software such as Microsoft Internet Explorer. However, feedback was not limited to browser software as many learners assisted one another in the feedback process to give advice with a view to improve their designs.

It was found that the testing of their designs was normaly done whenever learners thought that there could be a problem, when they completed a screen and sometimes when they entered the class to ascertain whether everything was still working.

Thinking about their designs and how they could be improved, was not limited to the time period during which the design process took place. It was found that many learners thought a lot about how they could improve their designs even after the project was completed.

Question 2: How does the creation of a hypermedia project encourage collaboration, motivation and interest?

5.2.7 COLLABORATION

The use of groups, working in a cooperative manner, provided opportunities for learners to practice social skills and people skills. It was found that conflict had emerged at some stages

between certain group members and this provided an ideal opportunity to use conflict management skills. It was evident that the majority of learners had a good understanding of the behaviour that is associated with working in groups. In spite of the conflict, it was found that learners still seemed to enjoy the project.

The cooperative environment provided the opportunity for learners to share their expertise with those who approached them for assistance and some became involved in peer-tutoring. Likewise, it created the opportunity for learners who needed assistance to approach any person for assistance, be it an expert or just someone that they felt comfortable with.

It was found that learners indicated that they had learned the following from one another:

- To support and advise each other
- To take one another's feelings into consideration
- To teach one another computer skills
- To edit content, language and spelling
- To discuss problems
- To manage conflict
- To bear with one another and to be friendly and understandable
- Not to think about themselves all the time
- To be a member of a team or to work as a team

5.2.8 INTEREST AND MOTIVATION

It was found that this project was not viewed as being boring, but that learners enjoyed working on it. It was found that the reasons for enjoyment were that they had choices in decision-making and that the project established a feeling of ownership, similar to the findings of Lehrer (1993).

The research data suggests that learners enjoyed the different classroom context as they had more freedom to move around, to choose their own topic and to plan their learning according to their goals. The traditional class was not a passive learning experience, listening to the teacher all the time.

It was particularly interesting that some learners did not experience this project as work (although they did work a lot), indicating that *"work"* had become *"play"* for them as *"play"* is a word that people use to create the impression of enjoyment (based on the 'playfulness' concept, Csikszentmihalyi, 1990 and Webster, Trevino & Ryan, 1993). Learners felt that the new medium, working on the computer, gave them an alternative opportunity: they do not have to use books, pen and paper all the time, but they can also use the computer. Thus, variety became important.

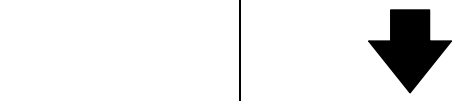
To compare this project with something else was difficult, as learners indicated that they had not done anything similar to this project before. However, it was found that three learners thought that it was similar to using multimedia encyclopedia.

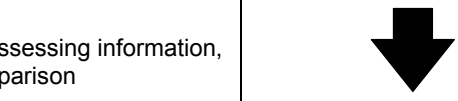
Learners felt that this way of learning would assist them as they would be able to remember more about their topic because they were engaged in the whole process, the teacher did not provide everything for them.

It was found that the learners experienced the role of the teacher as being different. To them the teacher became a helper and supporter, a person that was always available. In spite of being a helper, the teacher did not do the work for the learners or take over when problems arose, but assisted and provided verbal guidance as the learners had to solve the problems themselves. This indicates that this type of project could assist in changing the teacher-learner relationship. Furthermore, it could assist to change the role of the teacher to become more of a facilitator.

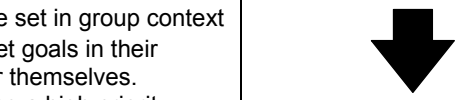
5.3 SUMMARY OF FINDINGS IN TABLE FORMAT: QUESTION 1 and 2

It becomes evident that the learners had to use and develop various skills during the project. A short summary of the skills and their relation to the research questions, follow below in Table 5.1. These skills are based on the ideas of Jonassen (1996) and Jonassen, Peck and Wilson (1999).

RESEARCH QUESTION: DESIGN SKILLS		**SKILLS DEVELOPED DURING CREATION OF HYPERMEDIA PROJECT**	**RESEARCH QUESTION: CRITICAL CROSS-FIELD OUTCOMES**
1. What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia project?		**DECISION-MAKING SKILLS** Complex Thinking Skills • Identifying problem(s) • Generating possible solutions	3. How are these skills related to the critical cross-field outcomes in the languages, science and technology curriculum statements in C2005?  Collect, analyse, organize & critically evaluate information. Identify and solve problems by means of critical and creative thinking. Employ effective learning strategies, as a critical outcome is also addressed. Work effectively with others as a member of a team, group, organization, community

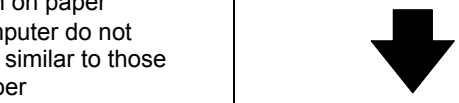
RESEARCH QUESTION: DESIGN SKILLS		SKILLS DEVELOPED DURING CREATION OF HYPERMEDIA PROJECT	RESEARCH QUESTION: CRITICAL CROSS-FIELD OUTCOMES
1. What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia project?		**RESEARCH SKILLS** Complex Thinking Skills • Problem solving: Researching the problem Critical Thinking Skills • Analyzing & Selection skills: Finding information & identification of main ideas • Evaluation skills: Assessing information, validation and comparison Creative Thinking Skills • Synthesizing skills: Summarisation & keywords • Elaborating skills by expanding information, adding own personal meaning	3. How are these skills related to the critical cross-field outcomes in the languages, science and technology curriculum statements in C2005?  Collect, analyse, organize & critically evaluate information. Identify and solve problems by means of critical and creative thinking. Employ effective learning strategies, as a critical outcome is also addressed. Work effectively with others as a member of a team, group, organization, community

RESEARCH QUESTION: DESIGN SKILLS		SKILLS DEVELOPED DURING CREATION OF HYPERMEDIA PROJECT	RESEARCH QUESTION: CRITICAL CROSS-FIELD OUTCOMES

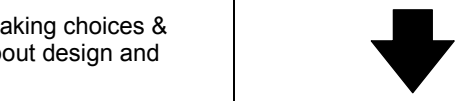
1. What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia project?		**PROJECT MANAGEMENT SKILLS**
		Complex Thinking Skills
		• Decision making: Identification of issues, generate alternatives, evaluate choice(s)
		• Designing ideas skills: Formulating goals
		  Some goals were set in group context
		  Learners have set goals in their journal writing for themselves. Individual planning a high priority.
		• Designing ideas skills: Revising product when necessary
		• Problem solving: Building acceptance of ideas between group members
		  Some collective planning occurred. Learners need more assistance with collective planning.
		Creative Thinking Skills
		• Synthesizing skills: Planning the process on paper
			3. How are these skills related to the critical cross-field outcomes in the languages, science and technology curriculum statements in C2005?
			 
			Organise and manage oneself and one's activities responsibly and effectively
			
			Work effectively with others as a member of a team, group, organization, community

RESEARCH QUESTION: DESIGN SKILLS		SKILLS DEVELOPED DURING CREATION OF HYPERMEDIA PROJECT	RESEARCH QUESTION: CRITICAL CROSS-FIELD OUTCOMES

1. What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia project?		**TIME MANAGEMENT SKILLS**
		Critical Thinking Skills
		• Prioritising skills: what to do and when (timelines & planning)
		  Learners need more assistance with timelines and time management
		  Learners did not create timelines, but thought about time and time constraints
		Creative Thinking Skills
		• Planning skills: To manage and finish on time:
		  Concentrate
		  Work as fast as possible
		  Set goals
		  Plan well in advance
		  Allocate time for each learner to work on computer
		  Work at other times
		  Work at other places
		  Limit off-task behaviour
			3. How are these skills related to the critical cross-field outcomes in the languages, science and technology curriculum statements in C2005?
			 
			Organise and manage oneself and one's activities responsibly and effectively
			
			Work effectively with others as a member of a team, group, organization, community

RESEARCH QUESTION: DESIGN SKILLS		SKILLS DEVELOPED DURING CREATION OF HYPERMEDIA PROJECT	RESEARCH QUESTION: CRITICAL CROSS-FIELD OUTCOMES
1. What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia project?		**DESIGN SKILLS** Complex Thinking Skills • Designing: Imagining & Formulating goals about process and about product Where do learners plan their design? * Storyboarding: plan and design screens in rough on paper * Screens on computer do not necessarily look similar to those designed on paper How do they plan? * One group used one learner as project manager. The other groups planned mainly individually What can be deduced from planning? * Not all learners plan in the same way as every person is unique and thinks differently. Some planned on paper before they started and others designed and planned on the computer from the start. What about the prospective audience? * Learners did not ignore their audience, but thought more about their work: they concentrated and stayed focused. * Readability, colour usage, page outlay, size of headings and fonts and picture layout are important * Designed in such a way that audience do not want to leave screens immediately by having not too much information on screens and by including visual material – attention grabbing * Used words that are easily understandable	3. How are these skills related to the critical cross-field outcomes in the languages, science and technology curriculum statements in C2005?  Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made. Work effectively with others as a member of a team, group, organisation, and community. Organise and manage oneself and one's activities responsibly and effectively Collect, analyse, organise and critically evaluate information Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation

RESEARCH QUESTION: DESIGN SKILLS		SKILLS DEVELOPED DURING CREATION OF HYPERMEDIA PROJECT	RESEARCH QUESTION: CRITICAL CROSS-FIELD OUTCOMES

1. What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia project?		**DESIGN SKILLS** (Continued)
		• Designing: Invent, assess & revise product/design on paper and computer
		• Problem solving: Sensing problems during design process, finding alternative ways, make a decision about best way
		• Decision making: Making choices & evaluate choices about design and changes to design
		  What does the segmentation and sequencing of information require?
		* Concentration
		* Thinking a great deal
		* Thinking about ideas
		* Designing of links in such a way that connections can be made, they can be easily understood and assist with making connections among ideas
		Creative Thinking Skills
		• Elaborating: Concretize, modify and extend ideas on screen during design
		  How important is visual material in their hypermedia presentation?
		* Prefer the use and inclusion of visual material instead of just plain text
		* Used AVI files, pictures already on computer and scanned images with scanner
		• Imagining: Visualize ideas on screen, intuition or hunches about best ways to present ideas (visual representation)
		  What can be deduced from the navigational structure?
		* Learners want all hyperlinks to be visible at all times
		* Hyperlinking was left to be done near to the end
		* Learners experienced difficulty with hyperlinking
			3. How are these skills related to the critical cross-field outcomes in the languages, science and technology curriculum statements in C2005?
			 
			Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made.
			
			Work effectively with others as a member of a team, group, organisation, and community.
			
			Organise and manage oneself and one's activities responsibly and effectively
			
			Collect, analyse, organise and critically evaluate information
			
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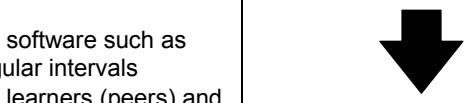
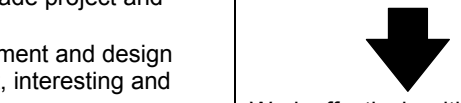
RESEARCH QUESTION: DESIGN SKILLS		SKILLS DEVELOPED DURING CREATION OF HYPERMEDIA PROJECT	RESEARCH QUESTION: CRITICAL CROSS-FIELD OUTCOMES

1. What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia project?		**REFLECTION SKILLS**
		Complex Thinking Skills
		• Decision making & Design: Identify problems in design, make choices and revise
		  What sources of feedback have been used?
		  * Feedback from software such as browsers at regular intervals
		  * Feedback from learners (peers) and teacher
		  Do learners think a lot about revising and improving the design?
		  * Some thinking about revising and improving occurred
		Creative Thinking Skills
		• Imagining: Predict changes in design
		  What is the function of this feedback?
		  * To assist with improvement of design to make the necessary revisions
		  When are revisions made?
		  * When learners thought there could be a problem
		  * When a screen was completed
		  * When they enter the class
			3. How are these skills related to the critical cross-field outcomes in the languages, science and technology curriculum statements in C2005?
			 
			Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made.
			
			Work effectively with others as a member of a team, group, organisation, community.
			
			Organise and manage oneself and one's activities responsibly and effectively
			
			Collect, analyse, organise and critically evaluate information
			
			Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation

RESEARCH QUESTION: DESIGN SKILLS		SKILLS DEVELOPED DURING CREATION OF HYPERMEDIA PROJECT	RESEARCH QUESTION: CRITICAL CROSS-FIELD OUTCOMES
2. How does the creation of a hypermedia project encourage collaboration, motivation and interest?		**MOTIVATION AND INTEREST** • Enjoyable, interesting • Hard work • Different from anything else that they have done before • Ownership • Learn more from project • Role of teacher made project and class enjoyables • Computer involvement and design made it a different, interesting and enjoyable experience	3. How are these skills related to the critical cross-field outcomes and the specific outcomes in the languages, science and technology curriculum statements in C2005?  Work effectively with others as a member of a team, group, organization, community Organise and manage oneself and one's activities responsibly and effectively Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation

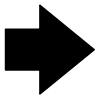
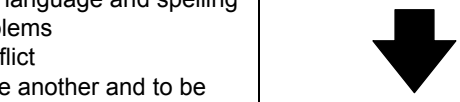
RESEARCH QUESTION: DESIGN SKILLS		SKILLS DEVELOPED DURING CREATION OF HYPERMEDIA PROJECT	RESEARCH QUESTION: CRITICAL CROSS-FIELD OUTCOMES
2. How does the creation of a hypermedia project encourage collaboration, motivation and interest?		**COLLABORATION** • To support and advise each other • To ask experts in group or class for assistance • To take one another's feelings into consideration • To teach one another computer skills • To edit content, language and spelling • To discuss problems • To manage conflict • To bear with one another and to be friendly and understandable • Not to think about yourself all the time • To be a member of a team or To work as a team	3. How are these skills related to the critical cross-field outcomes and the specific outcomes in the languages, science and technology curriculum statements in C2005?  Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made. Work effectively with others as a member of a team, group, organisation, and community. Organise and manage oneself and one's activities responsibly and effectively Collect, analyse, organise and critically evaluate information Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation

Table 5.1: Summary of findings related to research questions

5.4 QUESTION 3: RELATION OF FINDINGS TO CURRICULUM 2005: CRITICAL OUTCOMES AND SPECIFIC OUTCOMES

From the findings in chapter 4, it became evident that it is possible during the construction of a hypermedia artifact to facilitate the achievement of six of the seven critical outcomes and three of the five related issues associated with the critical outcomes[1]. The design skills model of Carver *et al.* (1992) and the hyper-composition-design-model of Lehrer (1993) provide an opportunity to realize the critical outcomes and the specific outcomes of Curriculum 2005 in Science and/or Technology as well as in the Language and Literacy learning area, therefore also making provision for a cross-curricular learning area approach. In the Science and Technology learning areas one specific outcome, Specific Outcome 1, can be addressed completely in each of the two mentioned learning areas. In the Language and Literacy learning area, Specific Outcome 1 to 7 can be addressed. The tabular form, presented after each design skills section

[1] See Chapter 2 (Literature Review) about the discrepancies in publications of Department of Education regarding the number of Critical Outcomes.

in chapter 4, indicates how the design skills in this study are related to the critical and specific outcomes. A summary of how the critical outcomes and design skills could be related follows in Table 5.2 below:

CRITICAL OUTCOMES AND RELATED ISSUES	DESIGN SKILLS ASK: WHAT ACTIONS MUST BE EVIDENT IN THE SKILLS TO INDICATE THAT THE CRITICAL OUTCOME HAS BEEN ADDRESSED?
Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made.	Research Skills Project management and Time management Reflection Skills Design Skills
Work effectively with others as a member of a team, group, organisation, community	Decision Making Skills Research Skills Project management and Time management Design Skills Reflection Skills
Organise and manage oneself and one's activities responsibly and effectively	Project management and Time management Design Skills Reflection Skills
Collect, analyse, organise and critically evaluate information	Decision Making Skills Research Skills Design Skills Reflection Skills
Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation	Design Skills Reflection Skills
Use science and technology effectively;	Research Skills Design Skills
Employ effective learning strategies;	Decision Making Skills Research Skills
Become responsible citizens;	Time management
Be culturally and aesthetically sensitive;	Project management

Table 5.2: Critical Outcomes in relation to design skills

The specific outcomes of the Technology learning area can be used as a design model, related to the design model of Carver *et al.* (1992) and Lehrer (1993). With reference to Specific Outcome 1 of the Technology learning area, the numbered phrases in Table 5.3 below, refers to the assessment criteria of Specific Outcome 1. Specific Outcome 1 in Technology can be extensively related to the design model and hypercomposition-based model.

TECHNOLOGY DESIGN OBE MODEL (SPECIFIC OUTCOME 1): SA EDUCATION DEPARTMENT	EXPLANATION	RELATED TO CRITICAL AND SPECIFIC OUTCOMES AND ASSESSMENT CRITERIA
1. Investigate	**Problems, needs and wants are identified and explained.**	The Technology Model on the left refers to Specific Outcome 1 of the Technology learning area: Understand and apply the Technological Process to solve problems and to satisfy needs and wants. The Assessment Criteria are numbered from 1 to 7. The Critical Outcomes need to be selected before the project starts. As part of integration with the Language and Literacy learning area, the following Specific Outcomes could be included as part of the design process: • Specific Outcome 1: Learners make and negotiate meaning and understanding • Specific Outcome 2: Learners show critical awareness of language usage • Specific Outcome 4: Learners access, process and use information from a variety of sources and situations (Focus on Research Skills). • Specific Outcome 5: Learners understand, know and apply language structures and conventions in context • Specific Outcome 6: Learners use language for learning • Specific Outcome 7: Learners use appropriate communication strategies for specific purposes and situations Rubrics and checklists need to be developed to assess the learners' progress in a particular project with reference to the Critical and Specific Outcomes and the related Assessment Criteria.
2. Solutions	**A range of possible and relevant solutions is considered.**	
3. Decide	**An informed choice is made.**	
4. Design	**A design is developed.**	
5. Make	**Design is realized, made or built using necessary tools and materials.**	
6. Evaluate	**Determine whether design solves the problem and meets design specifications. Suggest improvements regarding design and solutions.**	
7. Record & Communicate	**Process is recorded and communicated using a variety of methods using multi-media presentations.**	

Table 5.3: South African Technology as Design Model taken form Specific Outcome 1 of Technology (DOE, 1997b)

The specific outcomes of the Natural Science learning area can be used as a design model, related to the design model of Carver *et al.* (1992) and the framework of hypercomposition-based design model of Lehrer (1993). With reference to Specific Outcome 1 of the Natural Science learning area, the numbered phrases in Table 5.4 below, refer to the assessment criteria of Specific Outcome 1. Specific Outcome one in Science as learning area can also be extensively related to the design model and hypercomposition-based model.

SCIENCE DESIGN OBE MODEL (SPECIFIC OUTCOME 1): SA EDUCATION DEPARTMENT	RELATED TO CRITICAL AND SPECIFIC OUTCOMES AND ASSESSMENT CRITERIA
1. Problems or Phenomena are identified	The Science Model on the left refers to Specific Outcome 1 of the Natural Science learning area: Use process skills to investigate phenomena related to natural science. The Assessment Criteria are numbered from 1 to 10. The same Science Model could be used for Specific Outcome 3 of the Natural Science learning area: Apply scientific knowledge and skills to problems in innovative ways. The assessment criteria are slightly different, but very similar. The Critical Outcomes need to be selected before the project starts. As part of integration with the Language and Literacy learning area, the following Specific Outcomes could be included as part of the design process: • Specific Outcome 1: Learners make and negotiate meaning and understanding • Specific Outcome 2: Learners show critical awareness of language usage • Specific Outcome 4: Learners access, process and use information from a variety of sources and situations (Focus on Research Skills). • Specific Outcome 5: Learners understand, know and apply language structures and conventions in context • Specific Outcome 6: Learners use language for learning • Specific Outcome 7: Learners use appropriate communication strategies for specific purposes and situations Rubrics and checklists need to be developed to assess the learners' progress in a particular project with reference to the Critical and Specific Outcomes and the related Assessment Criteria.
2. Relevant information is gathered	
3. Investigative questions are posed	
4. Observations are made (if required) and/or Predictions are made	
5. Plan of action formulated	
6. Data are collected	
7. Data are analysed	
8. Data are evaluated	
9. Data are Interpreted	
10. Findings are communicated	

Table 5.4: South African Science as Design Model taken from Specific Outcome 1 and 3 of Natural Sciences (DOE, 1997b).

The relationship between the South African Technology and Natural Science models (taken from specific outcome one of the two learning areas) and the design model of Carver *et al.* (1992) and the framework for hypercomposition-based-design of Lehrer (1993) is indicated in Table 5.5.

DESIGN SKILLS Carver, Lehrer, Connell & Erikson (1992)	**FRAMEWORK FOR HYPER-COMPOSITION-BASED DESIGN** Lehrer (1993)	**TECHNOLOGY AS DESIGN OBE MODEL** (SPECIFIC OUTCOME 1) SA Education Dept (DOE, 1997b)	**SCIENCE AS DESIGN OBE MODEL** (SPECIFIC OUTCOME 1) SA Education Dept (DOE, 1997b)
Project Management Skills	Planning	• Decide / Decisions	• Problems or Phenomena are identified • Plan of action formulated
Research Skills	Transforming & Translating	• Investigate • Decide / Decisions	• Relevant information is gathered • Investigative questions are posed • Observations are made (if required) and/or Predictions are made • Data are collected • Data are analysed • Data are evaluated • Data are interpreted
Organization and Representation Skills	Transforming & Translating	• Decide / Decisions • Design • Solutions	• Findings are communicated
Presentation Skills	Transforming & Translating	• Decide / Decisions • Design • Make • Record	
Reflection Skills	Evaluating & Revising	• Evaluate	

Table 5.5: The South African models related to the Design Skills Model of Carver, Lehrer, Connell & Erikson (1992) and Framework for Hypercomposition-Based Design of Lehrer (1993):

From Table 5.5 it becomes evident that it is possible to link the design skills model of Carver et al. (1992) and the framework for hypercomposition-based design to the South African design model depicted in Specific Outcome 1 of both the Technology and Science learning areas.

There is one great concern: there are no clear performance indicators (criteria) in the primary phase from grade 4 to 6, such as standardized rubrics or checklists, available to teachers in order to establish fair assessment that would not discriminate against learners. Clearly spelled out performance indicators could not only assist teachers to be fair and consistent, but could also assist learners, as they would be able to ascertain what performance is required. It seems that teachers would have to develop these criteria themselves.

5.5 SOME NEGATIVE ASPECTS

In spite of all the positive aspects, some negative aspects have also been found. It is important to note that negative aspects do not necessarily indicate failure, but could become a positive ally as it assist one to be conscious about what happened and to make the necessary changes and/or to use them in a positive manner in the future in similar situations. The following negative aspects were found from the data:

1. Not all learners enjoyed working on computers. There were two learners who did not work on the computers, as they were afraid of them. They did not feel comfortable using them, they lacked the skills and this contributed towards a negative self-concept regarding computers.
2. Knowing about the Internet and being able to use it effectively is not necessarily the same thing, as we cannot assume that learners know how to work on the Internet. The skills needed, such as searching, using keywords and the selection of hits by the search engine, need to be taught and practised.
3. High levels of involvement in a project, does not mean that all learners are actively involved all the time. Some groups have indicated that certain members were not progressing; they were off-task, engaged in activities such as talking, playing and making jokes.
4. Learners need more assistance regarding time management, especially the construction and value of timelines. More assistance regarding project planning needs to be provided.
5. Learners need more practice and development in *"Microsoft FrontPage"*, the design software.
6. In spite of the predominantly positive attitude towards working in groups, it was found that some learners seemed to be uncertain and favoured working alone. It seems that issues such as conflict and disagreement between group members and the off-task behaviour of some learners caused this response.
7. The design process can be difficult, especially when one lacks skills pertaining to finding information. This became evident as two learners responded that it was too much for them.
8. Learners struggled with certain skills, for example research and designing on computer. More assistance should be given prior to such a project and during such a project either by the teacher or by using the *"jigsaw"* (Clark, 1994a; Johnson, Johnson & Smith, 1991) cooperative learning model.

5.6 NEW DESIGN MODEL

To ascertain whether the critical outcomes can be addressed by constructing a hypermedia artifact, the hypermedia design composition model of Carver *et al.* (1992), Lehrer (1993) and Lehrer *et al.* (1994) was used. To make the design model more flexible, the following changes are suggested when learners may decide on their own topic or when they are given a variety of topics to choose from (Figure 5.1 below):

- Two extra components are added: Decide and Investigate
- The transforming and translating part are subdivided into: Searching and research, plan design and creation on PC (personal computer).
- The arrows were inserted to indicate the flow among the phases, but also to illustrate the cyclical nature of the process.

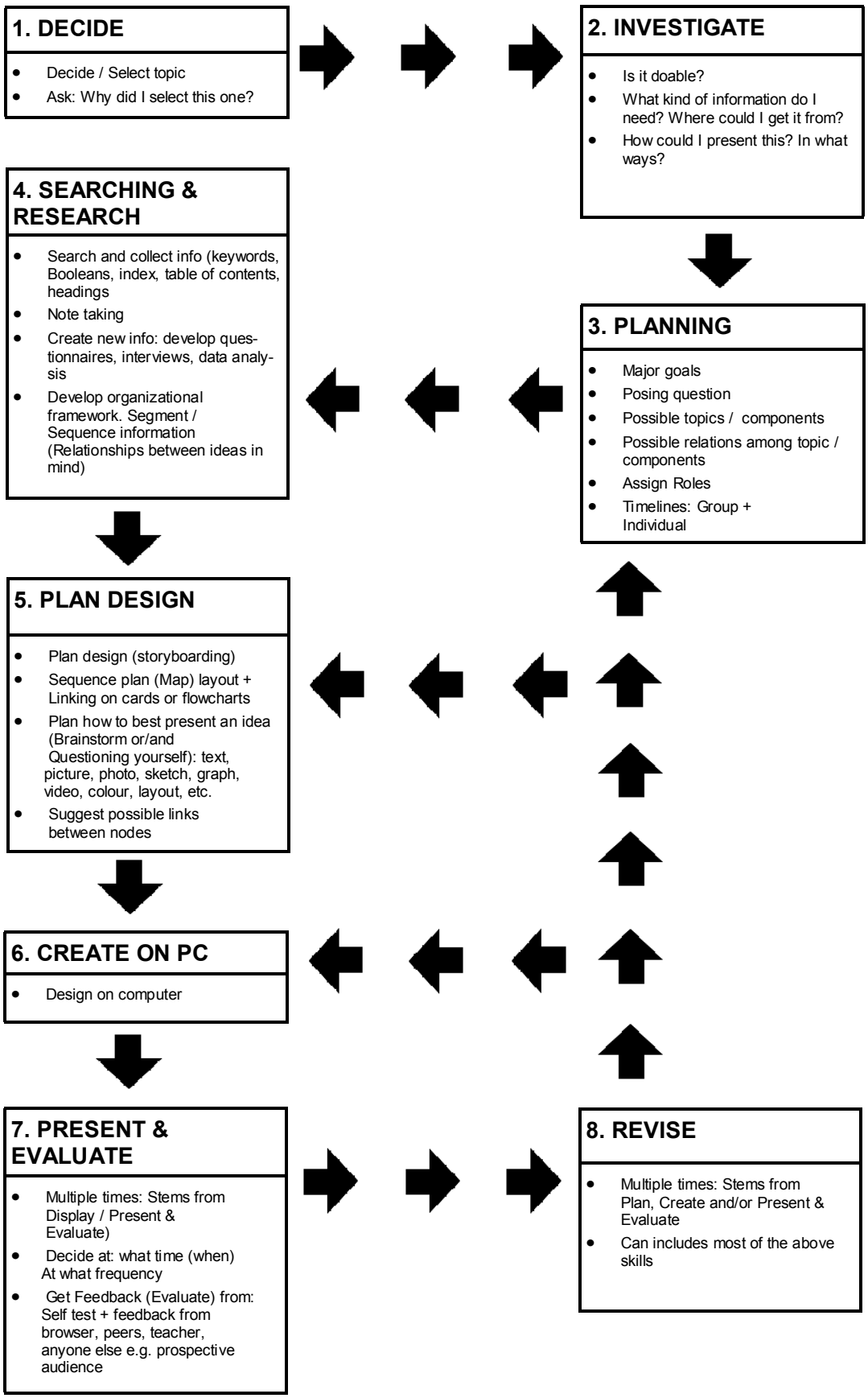


Figure 5.1: Altered Du Plessis Design Model based on the Design Model of Lehrer (1993)

5.7 RECOMMENDATIONS

Various aspects could have influenced the findings. It is quite possible that the so-called *"newness"* of computers at school, as well as collaboration, could have influenced the learners' perceptions towards motivation, interest, collaboration and design skills during this project. It is also possible that because it was difficult for learners to compare this project with anything that they have done before, that this has also influenced their motivation and interest. The project was not assessed formally and did not count towards any mark. However, the project was related to a real life situation: a museum that wanted to provide information to learners, but that cannot be visited by as many learnes as the museum would like, due to various reasons. Thus the construction of this project could benefit others by creating a resource that allows more access. This could also have had an influence.

Thus, to determine the reliability (consistency) of the tools that have been used, as well as the reliability of the findings with a view to motivating schools to implement this way of learning with technology (rather than *"from"* it), it is proposed that the same research should be conducted in various schools: (1) schools in which learners have been exposed to computers over a long period of time, but where the learners have not been involved in the construction of hypermedia projects, (2) schools in which learners have been exposed to computers over a long period of time, and where the learners have been involved in the construction of hypermedia projects, (3) schools in which learners have not been exposed to computers for a long period of time or (4) schools that have just started to introduce computers. The time concept associated with 'long' period of time or "just started" should be carefully considered.

Aspects that need further attention for future research are as follows:

It is recommended that the negative phrasing and word usage of statements in data gathering tools should be reconsidered and carefully revised for future research, as it could cause ambuigity and confusion, thus possibly influencing the learners' interpretation.

Researchers would also have to include other search related items in the PAQ to assist in finding what problems the learners have experienced while using the Internet during the searching process. Questions similar to the suggested statements in the PAQ could also be included during interviews. It is also proposed that in future research another item should also be included in the PAQ and interviews to assist the researcher in establishing why many learners had not used or had used interviews as information gathering tools. The number of statements in the PAQ could also be reduced.

It is recommended that learners should be introduced to the value of cross-referencing as well as to how it should be approached. These are necessary skills for deeper understanding and validation of information. To assist in future research, researchers are encouraged to formulate questions regarding how learners validate information with a view to assisting the researcher in helping those learners who do not know how to use this technique or at what level they can use it.

It is further recommended that before projects of a similar nature commence, in which translation skills need to be used, that learners are explicitly developed for this by teaching this new skill and then let them practice this newly acquired skill. As a result of what has been found, it is recommend that before such a project commences that learners should extensively be skilled to a much greater extent regarding research, time management and project management skills to alleviate the perceived problems, for example planning, timelines and conflict management.

The data indicates that learners had been involved in reflection, editing and revising their projects. Be that as it may, it is nevertheless recommended that for future research, more emphasis should be placed on how well the browser and learner feedback assisted them and in what ways. Likewise, questions pertaining to what kind of editing and changes occurred frequently should also be included. Questions about these issues could be included during interview planning and in the weekly journals.

Explicit criteria regarding all skills that are going to be assessed need to be developed. This should be done in collaboration with learners before the project starts. This should be provided to the learners on paper as this can serve as a guide to them so that they know what to do and what is expected.

Opportunities for constant feedback need to be created: from peers, from the teacher (facilitator) or any other person. More time should also be provided for self- and peer-assessment of projects. Learners from another class should be asked to use and review the hypermedia design and to make recommendations.

It is important to note that we cannot assume that a learner who appears to be supremely involved (engaged) in computer skills/design requires less support or no support at all. In addition, we cannot assume that so-called bright learners have all the design skills such as project management, time management, research skills, organisation and reflection skills, etc. Therefore the teacher/researcher should bear this in mind during the duration of the project by developing *“checking mechanisms”* to ascertain whether support is needed as well as support of what kind, to ALL learners.

While learners are engaged in the project or look busy, we cannot assume that all the learners are on-task. Thus we have to check progress regulary, either by ourselves (teacher/researcher) or by their peers.

As some learners could feel that they are frequently hindered, as fellow learners want their assistance, it is advisable to provide opportunities where learners can ask for help, but also to provide certain time slots where these learners can work uninterrupted. Alternatively, when a certain skilled is frequently in demand, the jigsaw model for cooperative learning could be used. Each group sends a learner to the teacher, which then provides the necessary scaffolding and learning experience. When they have mastered it, they return to their groups and teach it to the other members or become the group's expert and the groups consults him/her whenever necessary.

It is recommended that enough time is provided for the learners to engage in long-term hypermedia design projects, as these projects do take longer. McGrath *et al.* (1997) suggests at least a semester for primary school and six to eight weeks for secondary school. Teachers or researchers that implement this type of learning model should take note that everything won't be perfect the first time, an aspect that was also mentioned by McGrath *et al.* (1997). Thus, this should not be a once off project, as learners should be involved on a continual basis in hypermedia construction projects to master the intended skills (See McGrath *et al.*, 1997).

It is also advisable that one should keep record of what has and what has not worked as well as possible recommendations (McGrath *et al.*, 1997; Garthwait, 2001).

One's perceptions regarding information on screen should be reviewed as it is important to note that little information and more visual material on a screen(s) could create the impression that a learner has not done a great deal or would not know much about the content/knowledge of his topic/research/project. However, Garthwait (2001) warns that presentations in hypermedia could be deceiving, as it does not necessarily portray what the learner really knows, there could be what she refers to as "invisible learning" (Garthwait, 2001:243). It is thus suggested that teachers interview learners and also ask them to write about what they have learned in order to address this issue.

5.8 CONCLUSION

The study concluded that learners had experienced the design of a hypermedia artifact, situated and linked to a real life problem, as interesting, very enjoyable and as something new, because they had not been involved in such a project before. In the process, learners started to experience teaching and learning (school) as exciting and different. The teaching and learning context was totally different and the teacher was seen in a different light. The design skills manifested during the project, learners assisted one another and interacted in new ways.

It seems fair to say that certain critical outcomes and specific outcomes can be addressed when learners undertake the construction of a hypermedia artifact, but assessment issues need to be resolved.

Teachers need to be exposed to this type of learning as a type (not the only type) as it could assist them with the implementation of new teaching and learning strategies, the creation of a new class context which seems to be a truer reflection of *"life itself"* (Dewey, as cited by Duffy and Cunningham, 1996:173) and the creation of a new attitude towards school and learning. Teacher implementation of a similar design skill project and further research would also assist us to ascertain to what extent the construction of hypermedia artifacts can establish a new teaching and learning society: whether the findings of this research project would stand the test of time.

CHAPTER 1

SETTING THE SCENE

1.1 INTRODUCTION

Dewey states in his famous *dictum* "… education is not preparation for life, it is life itself" (Dewey cited in Duffy and Cunningham, 1996:173). Thus the argument is that by using appropriate activities and strategies, it could be possible for educators to make learning a natural and exciting experience, one where learners have a significant input into what they learn. Hence, teachers should provide learners with interesting activities, related to real life situations (Blumenfeld, Soloway, Marx, Krajcik, Guzdial & Palinscar, 1991).

To become successful learners in the *"new"* South African curriculum (Curriculum 2005) it is envisaged that learners should become active participants in the creation of knowledge, not passive recipients. The role of the teacher has also to change to that of facilitator. Classroom activities should be learner-centred and teamwork encouraged. Teachers should try to develop creative and innovative approaches in order to implement the core programmes in Curriculum 2005. It seems that the aim of Curriculum 2005 is the building of a learning culture, as learners should be encouraged to *"want to learn"* by taking learners' different learning styles into consideration (DOE, 1997a:IS). In addition, the Department of Education (DOE) (DOE, 1997a:IS) envisages that the overall emphasis in programme content should focus on learners who are taught to be critical, who can reason and reflect, and apply knowledge by means of skills, rather than learning facts by rote. The view of knowledge is that it should be relevant to the lives of the learners as knowledge is connected to real-life situations and to the world of work (DOE, 1997a:IS). It seems thus that the DOE is in agreement with Dewey's stated *"dictum"*, as it aims to make learning and the learning process more meaningful.

Jonassen, Peck & Wilson (1999:7) define meaningful learning simply as that "which occurs when students are actively making meaning". They go on to explain their conception of meaningful learning as learning that displays the following five attributes (Jonassen, Peck & Wilson, 1999):

- Active, Manipulative, Observant
- Constructive, Articulative, Reflective
- Intentional, Reflective, Regulatory
- Authentic, Complex, Contexutal
- Cooperative, Collaborative, Conversational

In summary, Jonassen, Peck and Wilson (1999:116-118) advocate the forming of communities namely: (1) discourse communities, (2) communities of practice, (3) knowledge building communities and (4) learning communities.

Similarly Novak and Gowin (1984:7) state that: "to learn meaningfully, individuals must choose to relate new knowledge to relevant concepts and propositions they already know". They further explain that "under any instructional strategy, learning can vary from being almost rote to being highly meaningful – from *reception learning*, where information is provided directly to the learner, to autonomous *discovery learning*, where the learner identifies and selects the information to be learned" (Novak & Gowin, 1984: 7). Learning in this context would become a by-product of inquiry (Doll, 1989) as the focus is not just on learning, but on all the activities and processes that assist to make learning meaningful.

1.2 BACKGROUND TO THE PROBLEM

Currently it seems that many schools are still trying to *"transfer"* as much knowledge as possible to passive learners who have to copy it down from the blackboard (Nations, 2001; Dochy, 2001). Learners have to absorb it just like sponges (Nations, 2001) as teachers instruct and talk most of the time. It seems that many schools are still following behaviouristic objectivist principles such as (1) assuming that learners are *"tabula rasa"* or *"empty buckets"* to be filled (Kruger, 1997; Aspin 1995), (2) viewing the teacher as the sole provider of knowledge (Prawat, 1992) and (3) viewing knowledge as a fixed entity, with the textbook often as the only source (Prawat, 1992; Brooks and Brooks, 1993, 1999).

These principles have become *"myths"* or a set of beliefs that provides some kind of security and reassurance to the education corps (Cornbleth, 1987:190). However, these above-mentioned socially constructed *"myths"* can instill a false sense of security to such a degree, that we do not question phenomena and beliefs, as we feel comfortable with our current set of beliefs (Cornbleth, 1987). It seems that *"myths"* drive what we believe, thus we can assume that *"myths"* could drive our learning and teaching beliefs and hence our practice.

Papert (1991) refers to the transfer approach as *"instructionism"*. However, it seems that not all instruction or teaching is bad (Papert, 1991:7), as instruction has a place, but on a different level (Papert, 1991:7). It seems that what becomes important is how we use instruction, as learners could also become instructors in a social constructivist-learning context (Papert, 1991). What is an issue is the classroom or learning context that is dominated by *"teacher-talk"* and *"rote-learning"*. Hence, instruction should not focus on the *"one right answer"* as the main outcome, because the *"right answer"* does not necessarily mean that thinking has occurred, as the *"right answer"* might be a result of rote memorization (Cornbleth, 1987:194). In addition, I would

contend that there should also be a shift from the domination of *"teacher-talk"* and *"rote learning"* to *"learner-talk"*.

The problem with the *"transfer approach"*, or *"instructionism"*, in our current society; is that we suffer from an information overload or as Eriksen (2001:17) states:

> "Unlike in other kinds of society, life in the information society is characterised by redundancy and noise: there is far too much information around, and there is certainly enough for everybody, unlike in the industrial and other kinds of society, where people experienced real information shortages (as witnessed in the common metaphors such as *'thirst for knowledge'*, etc.)"

Thus we have to realize that we cannot know everything, as there is too much information available: information has become infinite (Nations, 2001; Dochy 2001). As a result, it is no longer important to emphasize rote learning and factual recall.

What is being advocated is the importance of being able to ascertain whether learners (children or adults) understand what they have learned and whether they can assimilate, accommodate or (re)construct their new acquired knowledge. Understanding is not enough, however; we need to equip our learners with the necessary skills to become life-long learners with the capacity not only to locate information, but also to use information in meaningful ways (Dochy, 2001; DOE, 1997a:IS). It seems, therefore, that there should be a shift from *"how much"* knowledge can be conveyed to *"how well"* learners (or adults) can use or manage information or internalized knowledge. Eriksen refers to this as being able to *"filter"* information when he states that: "… the overarching aim for educated individuals in the world's rich countries must now be to make the filtering of information a main priority" (Eriksen, 2001:19). Hence, one needs to *"protect"* oneself against too much information or as he states: "A crucial skill in [an] information society consists of protecting oneself against the 99.99 per cent of the information offered that one does not want (and, naturally, exploiting the last 0.001 per cent in a merciless way) "(Eriksen, 2001:17). Enabling learners with the necessary research skills to make meaning of information and to create improved understanding becomes thus important, as information cannot necessarily be equated with knowledge (Eriksen, 2001).

According to Bruner (1996) the learning process should focus on learners who are actively involved in the *"making of knowledge process"*. From this argument it seems that Bruner stresses the importance of process in the making of a product and not just product alone. Jonassen, Myers and McKillop (1996:94) agree that process is important when they argue that the only people who significantly benefit from the design process and the use of design tools are

the designers, not the learners. Thus I shall argue in a similar manner as Jonassen, Myers and McKillop (1996) that learners should become designers by using similar hypermedia design software that an instructional designer can use as a tool, in order that the learners become designers or constructors of knowledge rather than using the software as a *"conveyance"*[1] tool.

The *"design of a product"* argument is built upon the belief that knowledge itself results from and is a design (Perkins, 1986). Perkins (1986, 1992) and Harel & Papert (1991) and Kafai (1996) contend that treating knowledge as design could influence teacher beliefs about *"knowledge is information"* and away from the domination of classroom practice dominated by teacher-talk as the act of transmitting information and passive learners as receivers. Knowledge as an active process of design (Perkins, 1986) and knowledge making (Bruner, 1996) would thus seem to support the principle of constructivism.

Perkins (1986) believes that designing concrete products can enhance the acquisition of *"useful knowledge"* or *"knowing your way around"* (Perkins, 1996:vi). The design process assists to move beyond the *"knowing that"* and *"knowing how"* to *"knowing your way around"* (Perkins, 1996) making it more meaningful, as meaningful learning results from a "personal cognitive process of design" (Grabe & Grabe, 1996:327).

Liu and Hsiao (2002:IS) state that in Project Based Learning (PBL), learners engage in cognitive processes such as problem solving, decision-making, designing and reflective thinking. PBL encourages learners to take charge of their learning and to become autonomous in decision-making (Liu & Hsiao, 2002:IS). According to Driscoll (Driscoll cited in Liu & Hsiao, 2002:IS) the theoretical underpinnings of PBL are derived from constructivist epistemological beliefs.

The aim is to implement learning in an environment based on the constructivist principles. The learning environment was designed based on the following theoretical principles (See Literature Review for an extended explanation):

- REALs (project-based) on the suggestions of Honebein (1996), Lebow (1993) and Dunlap and Grabinger (1996)
- Design Model (Lehrer, 1993) and design skills of Carver *et al.* (1992)
- Project-Based Learning (Blumenfeld *et al*., 1991)
- Cognitive Apprenticeship Model (Brown, Collins & Duiguid, 1989)
- Underpinned by the ideas of motivational theory (Blumenfeld *et al*., 1991; Blumenfeld, 1992; Csikszentmihayli, 1990 and Webster, Trevino & Ryan, 1993)

[1] *"Conveyance"* is a term coined by Clark (1994b).

- Collaboration (Johnson & Johnson, 1987;1994:IS;1999:IS)

Reading the critical outcomes (DOE, 1997a:IS; DOE, 1997b) and the specific outcomes of the Language (DOE, 1997b), Science (DOE, 1997b) and Technology (DOE, 1997b) learning areas, reveals that research and the research process are indeed of great importance in Curriculum 2005. Likewise, the Revised National Curriculum Statement also indicates that research remains highly valued and an integral part of the learning outcomes in Language (DOE, 2002a), Technology (DOE, 2002b) and Science (DOE, 2002c).

As an example: Specific Outcome 4 of the Language and Literacy and Communication document (DOE, 1997b) of the intermediate phase (grade 4 to 6) reads, “Learners access, process and use information from a variety of sources and situations”. The assessment criteria of Specific Outcome 4 in the Language and Literacy and Communication document, indicates what the learners should be able to accomplish (Table 1.1).

AC	SO 4: Learners access, process and use information from a variety of sources and situations
1	The information need is defined.
2	The aim of the information search is defined.
3	Information is located, accessed and selected.
4	Accuracy and relevance of the information is evaluated.
5	The reliability of the information is ascertained.
6	The difference between fact, fiction and bias is identified.
7	Organizational skills are applied: Organize information in a meaningful way.
8	Reasoned arguments are developed.
9	The results of the information search are presented in appropriate way.
10	The relevance of the information search is evaluated.
11	Awareness of the value of informed decision-making.
12	The ability to integrate new information into existing knowledge.
13	To apply newly acquired knowledge.

Table 1.1: Specific Outcome 4 of Language, Literacy and Communication learning area with the respective Assessment Criteria regarding research

However, an inspection of the performance indicators (PI) in the Policy Document (DOE, 1997b) to assess whether a learner has mastered the assessment criteria (AC) in order to master the specific outcome (SO), reveals that the PI’s and AC’s could make it difficult to assess whether a learner has achieved the outcome or not. The “how well” criterion is indeed left up to the teacher: there are no indications for levels of mastery in these assessment criteria. It is open to interpretation and thus could lead to a situation whereby a learner would master the outcome with one teacher and yet, when another teacher assesses the same learner for exactly the same

project and related outcomes, the second teacher could decide that the learner has not mastered the work at hand.

1.3 CONCEPTUAL CLARIFICATION

The use of a hypermedia design project as a tool for developing cognitive skills is not, in itself, a novel idea in education. This is illustrated by the research of Carver *et al.* (1992); Lehrer, (1993), Lehrer, Erickson and Connell (1994); Jonassen, Myers, and McKillop (1996); Jonassen and Reeves (1996) and Liu, Jones and Hemstreet (1998).

The term “tool” in the concept “the computer as a tool” refers to using the computer as a tool in applications where the computer is an instructional tool, similar to a pencil, typewriter, ruler and/or piano (Taylor, 1980). The learner and/or teacher use the computer as an aid, as it has been programmed to carry out certain useful tasks (Taylor, 1980).

The role of technology and the persons involved, change when computers are used as cognitive or thinking tools as the power of technology is invested in the learners, as the computer is not the teacher or tutor, rather, the computer becomes a *“mind-extension cognitive tool”* (Derry & Lajoie, 1993:5). Thus, the learner needs to provide the intelligence (Reeves, 1998:IS). Cognitive tools provide opportunities to support cognitive processes and share cognitive load, allowing learners to engage in cognitive (thinking) activities that would otherwise be out of their reach, as well as to assist learners in the context of problem solving (Lajoie, 1993:261).

Nielsen (1990:5) uses the concepts *“hypertext”* and *“hypermedia”* interchangeably, but prefers the name hypertext. The “media” part in hypermedia refers to its multimedia (multimedia: sound and animation) capabilities (Nielsen, 1990). A possible definition for hypermedia, can be defined as a message or information conveyance tool which integrates a combination of different digital media elements such as text, graphics, sound, animation and video into an interactive computer application (Nielsen, 1990:5; Neo & Neo, 2001:IS). According to Neo and Neo (2001:IS-3), authoring tools are designer or software *“allowance”* and *“performing”* tools that provide opportunities for designing. To summarise, authoring software provides opportunities to the designer or constructor to fuse separately stored sound, video, graphics and animation files into one application “to be mingled or integrated, sequenced and synchronized into a seamless application, and then delivered to the target audience *via* a CD-ROM, local area network or the Internet” (Neo & Neo, 2001:IS-3).

Hypertext with its nonsequential capabilities transcends linear or sequential normal text, as linear media for example books, are supposed to be read from start to finish to make sense (Nielsen, 1991; Jonassen, 1996). However, Lowe and Hall (1999) cite Ginige and Fuller, who

are in disagreement that all books are read in a linear fashion. Ginige and Fuller (cited by Lowe & Hall, 1999) state that readers seldom read academic papers or text books in a linear fashion, but rather browse through the information and then read the areas that they are interested in. Lowe and Hall (1999:28) illustrate Ginge and Fuller's argument by providing the following illustration:

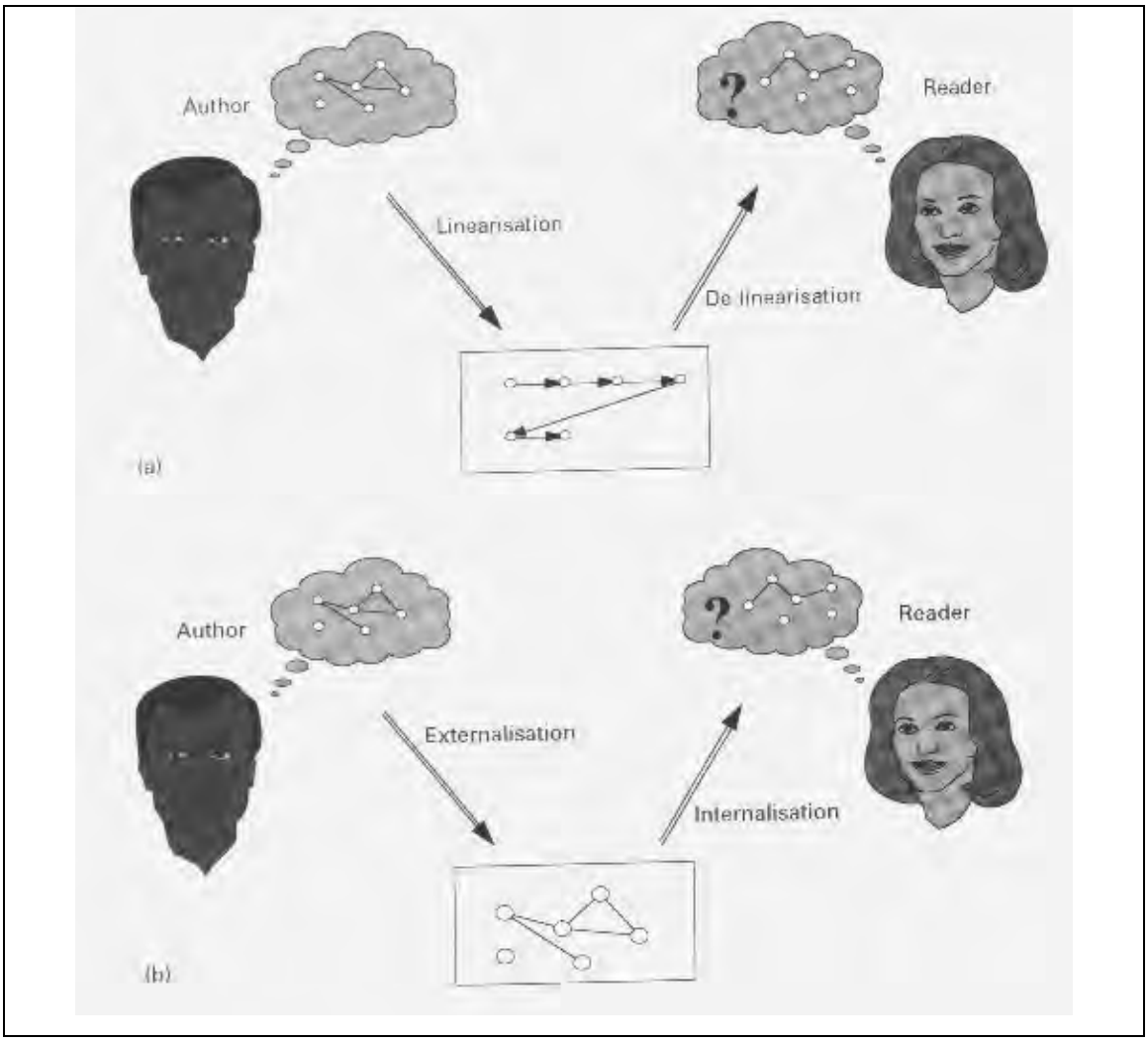


Figure 1.1: Process of writing and reading in traditional linear and non-linear hypermedia mode (Ginige and Fuller, cited by Lowe and Hall, 1999:28).

To summarise, hypermedia uses hypertext or hyperlinks in a nonlinear or non-sequential fashion, as it could be possible for each person to follow a different navigational route to explore a hypermedia document (Nielsen, 1990:1). To be classified as "hypertext" [or hypermedia], it seems that users have to be able to have some control over the interactive dynamic links among the nodes or units of information on a system (Nielsen, 1990:10). Thus, users would have to have some *"navigational power"* over information and visual aspects in the system, as the mere display of visual material to passive viewers, cannot be defined as hypertext or hypermedia (Nielsen, 1990).

1.4 PURPOSE AND VALUE OF THIS RESEARCH

This study endeavours to explore what skills are developed by designing a hypermedia product through collaboration and, in the process, whether the design process encourages collaboration, motivation and interest. The study investigates whether skills developed in this project are similar to the critical outcomes that the DOE envisages for learners in Curriculum 2005. The DOE (2002d, 2002e, 2002f) states clearly that assessment is not bound to knowledge (facts & memorizing) alone, but that reasoning, skills, product and affect (values and attitudes) need also to be assessed.

A 2002 search, by the author, of the South Africa research database Nexus (http://stardata.nrf.ac.za/index.html), which lists research conducted in South Africa, yielded no reports of research related to the construction of hypermedia or multimedia in the primary school phase. Thus this research project could provide possible recommendations in the South African context for teachers who would like to embark on a process where the computer is used as a cognitive design tool to endow their learners with skills in their quest to become life-long learners and in the process assist in the development and achievement of the critical outcomes and specific outcomes as specified in Curriculum 2005 (DOE, 1997a:IS; DOE, 1997b) and in the New Revised Curriculum Statement (DOE, 2002a; DOE 2002b; DOE, 2002c).

1.5 OBJECTIVES OF RESEARCH

The objective of this research project is to expose grade six learners to a design project where they would create a hypermedia version of existing topics that they have decided upon at the Port Elizabeth Museum in order to assist learners from our own and other schools and in the process obtain new skills, practice existing skills and construct new knowledge through hypermedia constructions.

Further objectives of this technology integration project are (1) to transcend and re-think the integration of technology into the traditional teaching model, which is characterized by *"teacher-talk"* and passive learners, and (2) to steer away from the version of *"domesticated constructivism"* (Petragalia as cited by Salomon, 1998) referring to the application of constructivist pedagogy to attain traditional goals or old ends (Salomon, 1998).

Research has shown that when hypermedia/multimedia authoring systems are being used as cognitive design tools, the major thinking skills that learners need to use as designers include project management skills, research skills, organization and representation skills, presentation skills and reflection skills (Carver *et al.*,1992). Carver *et al.'s* (1992) study documents the promising results of engaging learners in the role as designers of projects. While the above-

mentioned studies show the potentials of engaging learners as designers, research is called for to ascertain whether this is possible / sustainable in the South African context.

1.6 RESEARCH QUESTIONS

The questions that provide a framework for this project are:

1. What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia product?

2. How does the creation of a hypermedia product encourage collaboration, motivation and interest?

3. How are these skills related to the critical cross-field outcomes and the specific outcomes in the languages, science and technology curriculum statements in Curriculum 2005?

1.7 CONTEXT OF RESEARCH

Mount Pleasant Primary School in Port Elizabeth has been using their computer laboratory with 15 networked computers for a year. The school boasts a modern media center, but learners and teachers complain that there are not enough sources to be used for assignments. Taking the Strategy for Information and Communication Technology in Education of 2002 (SICTE) into consideration, the possibility of using the Internet and the current media centre as well as any other external available sources, was utilized by learners to create sources of knowledge in hypermedia web based software to be used as part of the media centre's collection and that of the Port Elizabeth Museum.

Computer skills pertaining to the creation of hypermedia presentations that embody hyperlinks and multimedia capabilities were taught to the learners and learners responded by constructing screens practically, using a similar approach as by Neo and Neo (2001:IS). The learners were able to ask questions about any design aspect at any time during the course of the lesson in the computer centre. The research project was based on constructivist principles. Not only did the teacher or/and computer facilitator guide and support learners in their construction of knowledge, but peers or fellow learners were also able to act as supporters and facilitators.

1.8 RESEARCH METHODOLOGY

The research was conducted within the interpretative paradigm using qualitative and quantitative data within a case study method.

The researcher collected data via a number of methods such as observation, interviews, learner journal writing, project assessment questionnaire, task ranking list, task elicitation lists and evaluation of project forms to generate rich qualitative and quantitative data.

1.9 STRUCTURE OF THE RESEARCH REPORT

Chapter 2 provides the foundations for the project from the literature. The design, development and implementation of the research project are discussed in Chapter 3. The collected data is analysed, interpreted and discussed in Chapter 4. Recommendations, based on the analysis and findings of the data are made in Chapter 4. The final chapter, Chapter 5, concludes the research by providing a summary of the findings and relating the findings to the critical outcomes and specific outcomes of Curriculum 2005. Further recommendations are made and an adaptation of the Design Model of Lehrer (1993) is provided to enhance understanding of the design process.

CHAPTER 2
LITERATURE REVIEW

2.1 EPISTEMOLOGICAL UNDERPINNINGS OF USING HYPERMEDIA

2.1.1 WHERE DO WE COME FROM? THE OBJECTIVIST BEHAVIOURISTIC TRADITION

The South African Educational System has been controversial for decades. Firstly, the apartheid educational system favoured the European or so-called *"white"* communities, as these communities received the largest portion of the educational budget. The infamous Bantu Education, which black South Africans received, was designed to make the black communities subservient to the ruling white party. Secondly, the educational system was based on the logical empiricist philosophy and embraced an objectivist instructionism philosophy based on behaviourism as a psychological theory to achieve its objectives as "The behavioural themes of prediction, control and change are echoed in logical empiricism" (Van Harmelen, 1995:65) and "The objectivist model of curriculum, located in behavioural theory, has arguably had the greatest influence on Western curriculum development and therefore in the shaping of school discourse in this century" (Van Harmelen, 1995:51).

This objective model or objectivist tradition as it is also referred to, was not unique to South Africa; it was a worldwide phenomenon and is still evident in many classrooms around the world. Alternative strategies are being discussed and alternative strategies are provided, such as a constructivist approach (Bopry, 1999; Grabe and Grabe, 1996; Duffy and Cunningham, 1996; Brooks & Brooks, 1993, 1999).

According to the objectivist positivist tradition with its focus on instructionism (Papert, 1991), the human mind is a blank slate without anything written on it and without any ideas (Aspin, in Higgs, 1995). Thomas Aquinas views the mind as a *"tabula rasa"* or a blank sheet with nothing written on it at birth (Aspin, in Higgs, 1995). The *"tabula rasa"* idea of Locke and Aquinas leads to the notion that learners are *"empty vessels"* or *"buckets"* that need to be filled with knowledge (Kruger, 1997). The problem with this viewpoint, is that the child is already highly programmed before coming to school with either good or/and bad habits and knowledge (Ozman, 1982) and is therefore not an *"empty bucket"* or *"tabula rasa".* This is supported by Nicaise and Crane (1999) who state that learners are curious and come to school with differences in motivation, different goals that do not necessarily correspond with the goals of the teacher, different background knowledge and experiences and differences in aptitude and attitude. This makes it

very difficult for teachers, as they cannot cater for all these different needs in an instructionist teaching environment (Nicaise and Crane, 1999) which focuses on the *"banking concept"* (Freire, 1993) of learning or *"empty bucket"* method of teaching (Kruger, 1997).

Positivism claims that the only valid way of acquiring knowledge is the use of an objective, scientific and rational approach to the world (Higgs, 1995). The traditional view of knowledge, as perceived by the objectivist tradition, is that there is an ultimate reality out there in the world that exists. This implies that learners build copies or replicas of this ultimate reality in their minds that to a greater or lesser extent match reality. The result is that individuals who are exposed to the same knowledge and internalise the knowledge must have similar replicas or copies of reality in their minds, thus their minds match reality (Bodner, 1986). The mind passively reflects this reality just as a mirror reflects images and is viewed as a *"black box"* (Bodner, 1986). It is possible to judge what stimulus goes in and what response comes out, but what happens in the box cannot be determined. What happens inside is open to speculation or guesswork (Bodner, 1986).

2.1.2 TRADITIONAL USE OF COMPUTERS: COMPUTERS AS TUTORS

The objectivist positivist tradition, underpinned by a behaviouristic psychological view of knowledge and epistemology, influenced how information and computer technology (ICT) in education was implemented and used. In this context, the computer was used as what Taylor (1980) referred to as a *"Tutor"* or in *"Tutor Mode"*. In tutor mode, the computer replaced the teacher and drill-and-practice received immense attention, as did simulations where computers simulated situations. Instead of using meaningful contexts, learners were and are still in many cases, taught command sets for software outside meaningful contexts (Jonassen and Reeves, 1996). Reeves (1998:IS-2) referred to this mode of media and technology use as the *"from"* approach as it is:

> " … the deliberate and intentional act of communicating content to learners with the assumption that they will learn something *'from'* these communications".

According to Reeves (1998:IS), there are no definite indications that the use of media and technology in tutor mode is superior to human teachers, as findings related to this issue have been modest and inconsistent. However, it appears that the value of media and technology in tutor mode is manifested in its motivational value and its increase of equity in access (Reeves, 1998:IS).

In the South African context, the dominant model of computer deployment in schools is the computer room or laboratory with computers usually arranged in rows on a work surface with

one learner allocated to a workstation (Strategy for Information and Communication Technology in Education [SICTE]: 2002). Integration of technology into the classroom is still the exception rather than the rule (SICTE, 2002:IS). It seems thus that technology integration and ICT is still entangled in the objectivist behaviouristic traditional model.

2.1.3 REVIEW: SO WHY SHOULD THERE BE CHANGE IN EDUCATION AND TECHNOLOGY?

Subscribing to the objectivist behaviouristic tradition implies that the central aim of many schools in our modern day and age is to transfer as much knowledge as possible to passive learners who have to absorb it as sponges. An overemphasis is placed on the storing of knowledge and its recall through a process of rote learning. The problem with this aim is that it is not possible to know everything, as there is too much information[1] (knowledge) available: knowledge is not finite (Nations, 2001; Dochy, 2001). The Internet and book-publishing explosions have contributed to this and experts postulate that information increases exponentially every year (Dede, 1992; Dochy, 2001). Thus, in our world where data or information increases each year, the challenge for schools and education is to prepare learners to access and use information effectively as learners become frequently lost (Dede, 1992; Eriksen, 2001) in what I term the *"oceans of data"*.

To be able to stay afloat, instead of sinking, in these *"oceans of data"*, learners would have to be taught how to filter information and to distinguish between what is relevant and what is not (Eriksen, 2001). Without higher-order thinking skills, learners would not be able to analyse, synthesize and to internalize large volumes of information into their existing knowledge structures (Dede, 1992). To make matters worse, Healy (1991:23) contends that learners are becoming more and more *"alliterate" (sic)*, "persons who know how to read [the mechanics], but who do not choose to read … They do not read for pleasure, nor do they read extensively for information" (Healy, 1991:23). According to Healy (1991) an alliterate person functions on the surface level and is not much better off than an illiterate person, one who cannot read at all. Healy argues in a similar manner to Perkins (1986) that our children don't think, because we do not provide the necessary opportunities for them to engage in active thinking through dialogue with one another in our learning activities. It seems that the over exposure of learners to visual material contributes to learners who think less and read less and as a result, many learners "have trouble with the mental organization and sustained effort demanded by reading" (Healy, 1991:24). Hence, learners find books hard to read and encounter difficulties with the interpretation of verbal logic, as reading as well as concentration, demand more focussed and mentally applied concentration (Healy, 1991). The result: Learners cannot concentrate for long

[1] It is important to note that information cannot necessarily be equated with knowledge. For information to become knowledge, we have to internalise (accommodate or assimilate) information in a comprehensible way.

periods of time and thus we have a *"Two-Minute Mind"* generation (Healy, 1991). Likewise teachers' beliefs that *"teacher-talk"* should dominate and *"learner-talk"* should be minimized contribute to this problem (Healy, 1991).

Thus, as Nations (2001) asks, how long do our children have to wait for change regarding pedagogy and technology integration in education and thinking? Dochy (2001) agrees in his article appropriately titled, *"A new assessment era: different needs, new challenges"*, that the situation is urgent. These two authors have asked and argued for the restructuring of thinking about education and assessment as well as for the reform of schooling, as Nations (2001:IS-1) comments: "Our perceptions about what schooling should look like are a mismatch with the reality of today's children".

To make meaning of information is therefore important, as the "meaning making process" assists in the process of information becoming knowledge. It is no longer important to emphasize rote learning and factual recall of knowledge as a necessary first step to higher thought and analysis (Perkins, 1992). What has become important is to ascertain whether learners [children or adults, using the ideas of Piaget] understand what they have learned and whether they can assimilate, accommodate or (re)construct their newly acquired knowledge. Keeping the above in mind, schools' educational goals should then be (1) the retention of knowledge, (2) understanding of knowledge and (3) the active use of knowledge (Perkins, 1991; 1992:5).

Perlman (1992) is in agreement with the arguments of Perkins (1986,1992), Nations (2001:IS) and Dochy (2001) as he states that education is no longer limited to the three R's namely reading, writing and arithmetic, but that the fourth R has been added to the list, that of *"Reform"*. The reason for reform is that the current system cannot adequately prepare the young for the future, as education is much more concerned with the past and tradition than with the future (Perlman, 1992).

Curriculum 2005 was introduced with a view to establishing a new educational epistemology of teaching and learning, to prepare our learners for the future and its new demands. The goal of education has changed from making learners knowledgeable in a certain domain with a basic core of knowledge to the development of highly knowledgeable individuals (Dochy, 2001). To develop these highly knowledgeable individuals, the focus should be on authentic learning in real-life contexts that develop problem solving skills as well as professional skills (Dochy, 2001) as " … successful functioning in this era demands an adaptable, thinking, autonomous person, who is a self-regulated learner, capable of communicating and cooperating with others" (Dochy, 2001:13). In addition, it is about the development of learners into *"reflective practitioners"* who

can reflect critically upon their own professional practice (Dochy, 2001). Competencies required of this new envisioned learner or person, include (Birenbaum, as cited by Dochy, 2001:13):

- "Cognitive competencies such as problem solving, critical thinking, formulating questions, searching for relevant information, making informed judgments, efficient use of information, conducting observations, investigations, inventing and creating new things, analysing data, presenting data communicatively, oral and written expression;
- Meta-cognitive competencies such as self-reflection and self-evaluation;
- Social competencies such as leading discussions and conversations, persuading, co-operating, working in groups, etc. and
- Affective dispositions such as, (for instance), perseverance, internal motivation, responsibility, self-efficacy, independence, flexibility, or coping with frustrating situations".

Dr Chabani Manganyi, Deputy Director-General of Education, stated in March 1997 that Curriculum 2005 will be based on the principles of co-operation, critical thinking and social responsibly, and should empower individuals to participate in all aspects of society (DOE, 1997a:IS-1). He added that:

> "Owing to the growing concern about the effectiveness of traditional methods of teaching and training, which are currently still content based, standards will in future be defined in terms of learning outcomes. New, flexible and appropriate curricula are needed that cut across traditional divisions of skills and knowledge. The emphasis will be on what the learners should know and can do at the end of a course of learning and teaching, instead of the means, which are to be used to achieve those results" (DOE, 1997a:IS-2).

In the same Department of Education (DOE) article as above, *"Lifelong Learning for the 21st Century - A User's Guide"* (DOE, 1997a:IS), the Government outlined such key features of the new curriculum as:

- Learners are expected to be active participants in the creation of knowledge, not passive recipients.
- The teacher is a facilitator, shifting responsibility onto the learner and his/her colleagues; so classroom activities are learner-centred, and teamwork is encouraged.
- Teachers try to develop creative, innovative approaches to implement the core programmes.
- Learners are encouraged and given feedback, which affirms their worth.
- Learners work at their own pace, throughout their lives.

Furthermore, the DOE (DOE, 1997a:IS) envisages that the overall emphasis in programme content, with reference to the critical outcomes, should focus on:

- Learners who are taught to be critical, who can reason and reflect, and apply knowledge by means of skills rather than learn facts by rote.
- Knowledge is integrated and made relevant to the lives of the learners.
- Knowledge is connected to real-life situations and to the world of work.

A closer inspection of Government's vision is portrayed in the following critical outcomes (CO) as depicted in Table 2.1 below, a vision to prepare and enable learners to develop the listed outcomes or skills (DOE, 1997a:IS-19; DOE, 1997b:13-14):

CRITICAL OUTCOMES
Identify and solve problems by means of critical and creative thinking
Work together in teams
Manage themselves responsibly
Collect and analyze information
Communicate effectively
Use science and technology effectively
See the world as set of related contexts
RELATED ISSUES TO CRITICAL OUTCOMES
Employ effective learning strategies
Become responsible citizens
Be culturally and aesthetically sensitive
Explore education and career opportunities
Develop entrepreneurial abilities.

Table 2.1: Critical Outcomes and related issues to critical outcomes

It seems that there is not clarity whether there are only seven critical outcomes and five related issues to the seven critical outcomes (DOE, 1997a:IS-19; DOE, 1997b:13-14); or whether there are twelve critical outcomes (DOE, 2000:6). In a later publication of the Education Department, *"Curriculum 2005: Towards a Theoretical Framework"* (DOE, 2000:6), it is stated that there are twelve critical outcomes. A closer examination seems to suggest that the seven critical outcomes and five related issues, as indicated in Table 2.1 above, have been added together to equal twelve critical outcomes.

2.1.4 THE SOUTH AFRICAN DEPARTMENT OF EDUCATION: ITS VIEW ON TECHNOLOGY

Information and Communication Technology (ICT) is of great concern to Government. In a publication dated 22 January 2002 titled *"Strategy for Information and Communication Technology in Education"* (SICTE, 2002:IS-6), it is stated in very clear wording that:

> "Bringing ICT connectivity to our schools and education institutions will happen and must happen. It is a task that will occur alongside the provision of basic educational infrastructure, which is the responsibility of government."

This is in line with the plea of Strommen (1992:IS-4) when he states that:

> "If we are to give these children the education necessary to succeed in our technologically intense, global future, a new form of educational practice, one that builds on children's native learning abilities and technological competence, must replace our existing methods. The theoretical foundation for such changes exists, and the time to implement them is now."

The above quotation of Strommen could also be applicable to the South African context. In addition, the South African government is in agreement that information technology is of great importance and an urgent matter. It is envisioned that ICT could trigger the development of new teaching strategies relying on: (1) collaborative work, (2) problem solving and (3) simulation, as the widespread introduction of computers in schools should support Curriculum 2005 (SICTE, 2000:IS). It seems that ICT used in a *"learning with"* context could assist in redefining the role of teachers in the learning and teaching process (SICTE, 2000:IS). Thus it is proposed (1) to steer away from IT teaching strategies where learners sit alone at a computer on a one-to-one basis and (2) to integrate technology into the classroom (SICTE, 2002:IS).

The idea of computers as catalysts of progress and change was already proposed in 1990 by Hawkridge, Jaworski and H. McMahon. Hawkridge *et al.*'s (1990) argument is that the computer could become a powerful tool that could be implemented to achieve radical change in teaching and teaching philosophy. It can be used as an instrument to implement change, as the school of today as we know it, becomes a school of the future. This implies a school where there are no subjects anymore, but where all learning material and learning areas are integrated (Hawkridge *et al.*, 1990). To achieve this, a paradigm shift is needed on various levels, as there is a power shift: learners become less dependant on the teacher, the teacher becomes a co-learner and collaboration between learners is emphasised. Thus, in addition, computer implementation has a

pedagogic rationale. The reasoning behind this is that the computer could become a valuable tool and tutor in the teaching-learning process (Hawkridge *et al.*, 1990).

In addition, computer implementation could assist in producing a technologically literate workforce that possesses computer skills (SICTE, 2002:IS). This is in line with Hawkridge, Jaworski and McMahon's (1990) vocational rationale: acquired computer skills may be advantageous to future employment.

In spite of the positive possibilities of ICT, government is concerned about two aspects: First there is the great cost implication which the government acknowledge it would not be able to finance alone, hence government wants business to assist. Secondly, there is the concern that low learner PC-time of 30 minutes per week in front of the computer, is not adequate.

2.1.5 CONSTRUCTIVIST PERSPECTIVE: A NEW TRADITION?

From the above, it seems that Government is in line with the ideas as proposed and advocated by Perkins (1992), Perlman (1992) and Dochy (2001). The proposed theoretical shift is from the objectivist behaviourist tradition to constructivism (DOE, 2000).

The DOE reflects on the new epistemology in their publication, *"Curriculum 2005: Towards a Theoretical Framework"* (DOE, 2000:11-12) when the DOE cites Brooks & Brooks' (1993, 1999) comparison of differences between *"traditional"* classroom and *"constructivist"* classrooms. To broaden the comparison, Brooks and Brooks' (1993, 1999) categorisations are included here with additional ideas suggested by Prawat (1992), Bodner (1986) and McMahon (1997) regarding the differences between the traditional and constructivist classroom (Table 2.2).

TRADITIONAL CLASSROOM	CONSTRUCTIVIST CLASSROOM
Learner primarily works alone. Passive.	Learners primarily work in groups. Active.
Knowledge is inert	Knowledge is active, situated in living worlds
Individuals are passive recipients of knowledge	Individuals construct knowledge with the help of others.
Learning occurs with programmatic repeated activities	Meaningful learning is useful and retained, building on what the learner already knows
Teacher's role is authoritative, directive	Teacher's role is coach, mediator, strategic, co-learner.
Curriculum is presented part to whole, with emphasis on basic skills.	Curriculum is presented whole to part, with emphasis on the big concept.
Strict adherence to a fixed curriculum is highly valued. Viewed as fixed entity.	Curriculum is more flexible. Pursuit of learner questions is highly valued. Connectedness.
Curricular activities rely heavily on textbooks and workbooks of data and manipulative materials.	Curricular activities rely heavily on primary sources.
Learners are viewed as "blank slates" onto which information is etched by the teacher.	Learners are viewed as thinkers with emerging theories about the world. (Cognitive apprentices)
Teachers generally behave in a didactic manner, disseminating information to learners. Teacher-talk, learner absorbs.	Teachers generally behave in an interactive manner mediating the environment for learners. Less teacher-talk, learner active.
Teachers seek the correct answers to validate learner lessons.	Teachers seek the learner's point of view in order to understand learner learning for use in subsequent conceptions.
Assessment of learner learning is viewed as separate from teaching and occurs almost entirely through testing.	Assessment of learner learning is interwoven with teaching and occurs through teacher observation of learners at work and through exhibitions and portfolios.

Table 2.2: Comparison of the visible differences between *"traditional"* classroom and *"constructivist"* classrooms

From the comparisons above, it becomes evident that constructivism does offer an alternative view of knowledge from that which shaped education theory and practice in the South African context. Constructivism as a theory of learning, in which learners construct new mental models, would demand changes in teaching and learning as evident in the DOE publication *"Curriculum 2005: Towards a Theoretical Framework"* (DOE, 2000).

It seems that Curriculum 2005, as a new curriculum, is intended to change the dynamics of education. However, it does not disregard rote learning and textbooks, as they must be used within the broader framework of a constructivist approach (DOE, 2000). Regarding rote learning or memorization, a renowned scholar in the constructivist field, Von Glasersfeld (1995:181), states that:

> "My point, therefore, is not that training, memorization and practice are useless. I merely want to stress the fact that rote learning does not lead to what Kant called 'enlightment', namely the understanding of the operative principles …"

From the above, it is clear that curriculum content is still critical (DOE, 2000:12). Moll (2002:IS) agrees that the Department of Education is in fact propagating constructivism to provide the teaching and learning solutions for Outcomes Based Education in South Africa, making special reference to the publication *Curriculum 2005: Towards a Theoretical Framework* (DOE, 2000). In this publication, Moll (2002:IS) argues, the DOE is advocating a number of features attributed to the constructivist classroom.

2.2 THEORETICAL PERSPECTIVES FOR DESIGNING AND CONSTRUCTING HYPERMEDIA ARTEFACTS IN PROJECT-BASED LEARNING

During this research-task-based learning project, the following concepts were important: (1) design or construction, (2) motivation and interest, (3) collaboration and (4) a constructivist REAL environment. These theoretical concepts are in line with what Wisnudel (1994) argues, is the theoretical rationale for having learners constructing hypermedia projects or artefacts namely: (1) constructivism and conceptual understanding, (2) programming and design and (3) motivation. McGrath, Cumaranatunge, Chen, Broce and Wright's (1997) research concerning the construction of multimedia science projects, is similar to Wisnudel's rationale, as they focused on (1) constructivism, (2) learning as design and (3) multiple intelligences. Likewise, Blumenfeld, Soloway, Marx, Krajcik, Guzdial & Palinscar (1991) also argue that the design of an artefact or product is of great importance during project-based learning, as these designed products are representations of the learners' solutions to problems that reflect their emerging knowledge states. Furthermore, design or construction could "sustain the doing and support the learning" (Blumenfeld *et al.*, 1991:369), as interest and meaningfulness enhances motivation (Blumenfeld *et al.*, 1991).

According to Wisnudel (1994), cognitive psychologists suggest that people learn by constructing meaning. Thus it is expected that the design or building process assists with the assimilation of new information with existing ideas and beliefs and hence assists with the development of conceptual understanding (Wisnudel, 1994:7). The power of hypermedia construction is not that it may not only encourage learners to think about ideas, but that it could assist to "facilitate the weaving of the learners' cognitive webs" (Salomon, 1998:IS-5) and "subsequent ways of organizing information in their [learners'] cognitive webs" (Salomon, 1998:IS-5). Hence,

construction assists with the organization of the structure of information that learners are trying to represent when they organise the content and structure of their representations.

Wisnudel (1994), with reference to Perkins (1986; 1992), states that the design process assists learners to experience knowledge as a human creation or artefact. During the design process, learners have the opportunities to develop complex mental skills such as: decomposing a topic into subtopics, gathering data from a variety of sources, organising diverse and contradictory information, formulating questions and the translating of information into knowledge (Wisnudel, 1994:7).

Motivation plays an important part in the construction of hypermedia artefacts, because learners are motivated as they participate in authentic learning experiences (Wisnudel, 1994) and experience ownership (Lehrer, Erickson & Connell, 1994) or personal value (Newman as cited by Wisnudel, 1994).

There are theories to support the use of hypermedia as design for knowledge construction. According to Chen (1999:IS) and Borsook (1997:727) “hypermedia mirrors the way the brain works”. Borsook (1997:735-739) proposes that the following theories support hypermedia as an effective learning technology:

- Cognitive Flexibility theory
- Information Processing
- Case Based Reasoning
- Generative learning
- Schema/Semantic network theory
- Dual Coding Theory

Theories related to hypermedia construction, are as follow:

- Constructivism and constructionism (Harel & Papert, 1991; Papert, 1993; Kafai, 1996)
- Knowledge as design (Perkins, 1986; Perkins, 1992)
- Situated cognition (Brown, Collins & Duguid, 1989:IS)
- Multiple Intelligences (Gardner, 1985; Ivers & Baron, 1998)
- Project-Based Learning (Blumenfeld *et al.*, 1991)

Referring to Wisnudel’s (1994), McGrath’s *et al*. (1997) and Blumenfeld *et al.*’s (1991) rationale, the following would be receiving attention in the discussion that follows: constructivism, project-based learning, knowledge/learning by design and motivation (interest). In addition, collaboration

related to hypermedia construction is added, as multimedia [hypermedia] design appears to offer great opportunities for learners to learn about collaboration and project management (Kafai, Ching & Marshall, 1997:118). The embracement of technology in a collaborative construction process of hypermedia artefacts is important, as it offers possibilities to enhance cognitive and social skills (Wisnudel, 1994, Chen, 1999:IS; Vygotsky, 1978; McMahon, 1997), hence the inclusion of collaboration as part of social skill development in this study.

2.2.1 CONSTRUCTIVISM: MAKING MEANING SOCIALLY WITH ASSISTANCE (IN COLLABORATION)

In the section 2.1.3, *Review: So why change in Education and Technology?*, the term *"constructivism"* was mentioned as being the theory suggested by DOE to be implemented in South African education using Curriculum 2005 as vehicle. But what is constructivism? This needs clarification as it relates to the learning theory suggested by the DOE and to the construction of hypermedia artefacts or the *"knowledge as design"* concept of Perkins (1986).

Fosnot (1992:167) refers to constructivism as "a theory of 'knowing' and a theory about 'coming to know' ", hence a theory about knowledge and learning (Fosnot, 1992). Von Glasersfeld (1995:1-2) takes this further when he states:

> "… I prefer to call it an approach to or a theory of knowing. … I now try to avoid the terms 'epistemology' or 'theory of knowledge' for constructivism because they tend to imply the traditional scenario … "

Constructivism is not a theory about teaching, it is a theory of knowledge (Jaworski, 1993:IS). Smerdon, Burkam & Lee (1999:9) state that:

> "… constructivism is a theory of learning, rather than a prescription for teaching, methods of constructivist teaching typically are not spelled out precisely and, moreover, are frequently somewhat ambiguous".

In constructivism, knowledge is relativistic as nothing is absolute. Constructivism does not necessarily deny the existence of an objective reality, but it does deny the existence of an objective knowledge since there are many ways to structure the world (Bodner, 1986). Thus from Bodner (1996), constructivist theory views knowledge as temporary, developmental, non-objective, internally constructed, and socially and culturally mediated. Knowledge is not something that exists independently in the world, waiting for us to be found, it is the assigning of meaning to something by humans as "knowledge is constructed in the mind of the learner" (Bodner, Klobuchar & Geelan, 2001:IS-1). However, it is important to note that meaning

assigned to facts and facts alone are meaningless until they are interpreted and added up into a coherent picture (Hinchey, 1999:45).

What are the tenets of constructivism? Examining Von Glasersfeld's (1995:56) essential epistemological tenets of radical constructivism below, provides us with an opportunity to establish the common threads of constructivism:

- Knowledge is not passively received either through the senses or by way of communication.
- (Rather), the individual actively builds up knowledge.
- Cognition is an adaptive process that functions to make an individual's behaviour more viable, to present a better fit or viability;
- Cognition organizes and makes sense of one's experiences, it is not a process to render or provide an accurate representation of reality.

Radical constructivism builds on the ideas of Piaget (Bodner, 1986; Ernest, 1993) and Von Glasersfeld (1995). Learning is based on an individual's particular construction of his/her experiences. It implies that teachers cannot transmit for instance, mathematical knowledge, but that the learner needs to construct it himself/herself out of his/her prior experiences and understandings. It's a very 'hard' type of constructivism as "such a view makes it hard to establish a social basis for interpersonal communication, for shared feelings and concerns, let alone shared values" (Ernest, 1993:4).

To the above-mentioned tenets of constructivism, as articulated by Von Glasersfeld, a fifth one can be added, based on the ideas of Vygotsky and articulated in texts by Gergen (1995), Jaramillo (1996), Ernest (1995) and McMahon (1997). This tenet brings the social dimension to constructivism and could be articulated as follows:

- Knowing and knowledge is a negotiated, shared social experience and a construct mediated through language *via* meaningful dialogue in a meaningful context through social interaction (Gergen, 1995; Jaramillo, 1996 & Ernest, 1995). Learning is thus a socially shared experience rather than an individual experience, mediated by language *via* social discourse (McMahon, 1997:IS) with the metaphor of "persons in conversation" (Ernest, 1995).

The importance of the individual to make meaning should not be ignored in the social constructivism approach as the individual tries to assimilate and adapt knowledge as he/she tries to build his/her reality. The best 'fit' to the individual's world of experience will be adopted or

retained (Ernest 1993). In the social constructivist approach, the influence of society, culture and language is stressed. However, although society or the group construct knowledge (and this is where the link comes in between the radical and social approach), it is still the individual who has to assimilate and adapt this socially constructed knowledge to 'fit' his/her reality or, as Hein (1991:IS-1) argues, "constructing implies that learners construct knowledge for themselves: individually and socially". Thus we cannot negate that the individual has still to make meaning of the constructed knowledge in the end, even when involved in a social constructivist context. Emotional scaffolding for the individual during this process, is also of great importance (Mahn & John-Steiner, 2002:IS). Hence, this research is informed by a social constructivist approach in which the individual makes meaning through social interaction.

From the above, it can be assumed that constructivism is an epistemology and a learning theory, a theory of knowing and a theory of learning. However, one part is missing: its relatedness to a theory of teaching (Fosnot, 1992; Jaworski, 1993). According to Fosnot (1992:169), the problem is that teachers "are being asked to make the leap into designing instruction that is aligned with this new view of learning". Education is in need of this leap, but this leap requires a paradigm shift (Brooks & Brooks, 1993, 1999; Van Harmelen, as cited in Wilmot, 1998: 88). What is needed is the construction of new models of pedagogy (Fosnot, 1992:175). Hence, Project-Based Learning could provide the basis for a new pedagogic model.

2.2.2 PROJECT-BASED LEARNING

Project-based learning (PBL) is the engagement of learners in an investigation of authentic *"nontrivial"* problems and hence encompasses a comprehensive approach to classroom teaching and learning with a view to moving beyond current understanding (Blumenfeld *et al.*, 1991). Project-based problems are relatively long-term, problem-focused and meaningful, as they can integrate concepts (and ideas) from a number of disciplines (Blumenfeld *et al.*, 1991) or learning areas in the South African context. In sum, the relationships between the perspectives of Project-based learning (Blumenfeld *et al.*, 1991:371-372) and REALS (Lebow, 1993; Honebein, 1996) are compared in Table 2.3.

	PROJECT-BASED LEARNING	REALs
Importance of Thinking	Focus on understanding, the development of minds with thinking as focus	• Help learners develop metacognitive skills (reflection & evaluation: thinking about their thinking or what they have done, what have/have not worked, strategies used, what do the same next or different next time?) • Learn from and about their learning
Context: Real-Life	Aim is the solving of real-life complex problems (complex problems that are nontrivial, moving beyond current understanding)	• Situate learning in meaningful context (why have to learn this, real world relevance, how is it linked to anything?) • Extend ownership
Engagement	Active engagement by learners	• Engage in dynamic, high-level knowledge construction
Time Related Issues	Duration is long-term, not just a week	• Allow enough time for learning • Manage own learning (Planning & Time management skills) & Decision making • Learners determine what they need to learn through goal setting (especially what deficits need to be addressed in goal setting)
Integration	Integration with other learning areas	• Encourage revisiting of content [from other learning areas also when necessary]
Represents Learners' Knowledge Construction	Creation of product or artefact that represents knowledge construction	• Engage in dynamic, high-level knowledge construction • Promote articulation & presentation of ideas, perspectives, strategies, tactics • Encourage revisiting of content
Collaboration	Embedded in a social cooperative learning context	• Require learners to contribute to each other's learning through collaborative activities • Zone of Proximal Development / Scaffold (tackle problems together and solve it as many cannot do it alone)
Learner to Learner, Teacher to Learner and Learner to Teacher Relationship	Master and apprentice relationship between teacher and learner	• Require learners [peers and teachers] to contribute to each other's learning through collaborative activities • Dialogue with teachers and friends • Share ideas, help each other • Role of teacher: hold back, do not give correct answer immediately, guide them
Importance of the Process	Importance of feedback and reflection for revising product and to improve learning	• Non-Threatening environment that is safe for learning: • Feedback for peers • Encourage experimentation & risk taking • Do not punish when making mistakes • Encourage trial-and-error

Table 2.3: Comparison between Project-Based Learning (Blumenfeld *et al.*, 1991) and REALS (Lebow, 1993; Honebein, 1996).

There are two components that drive projects or PBL (Blumenfeld *et al*., 1991:371):

1. It requires a real-life question or problem that needs to be solved and
2. Activities must result in the creation of a product or artefact that culminates in the driving question or problem.

The teacher or learners can decide upon the question or problem to be researched or undertaken. However, learner involvement could make the project more sustainable and enhance motivation (Blumenfeld *et al*., 1991). It is important that the learner(s) need to develop approaches to answering the question or solving the problem. The creation of a product or products is of great importance as generation is a process of knowledge construction and hence represents the learner's thinking (Blumenfeld, 1991:372). Concreteness provides opportunities for feedback and critique by peers (fellow learners from same class or other class groups) and the teacher, which assists learners to revise and reflect upon their products and thinking with to improve upon their design and learning (Blumenfeld *et al*., 1991).

However, PBL is not easy to implement, one has to guard against the following potential problems (Blumenfeld *et al*., 1991:373-374,393):

- Teachers need support to implement it successfully
- Learners need support and need to be motivated to engage in PBL
- Teacher thinking about knowledge, teaching and learning, classroom structure, classroom activities and assessment.

A possible motivator could be the use of computer technology as it has the potential to sustain learner motivation (novelty effect), could support learning and doing (creation of a product) and to relieve the teacher of certain tasks (Blumenfeld *et al*., 1991). This means less *"teacher-talk"* and more guidance in a process that Johnson, Johnson & Smith (1991:81) refer to as "Becoming a guide on the side instead of being a sage on the stage".

It is important to note that learners need to be taught the necessary social and computer skills in order that they can work alone, work in groups effectively and use technology. We cannot assume that the learners just know or have social skills (Johnson, Johnson & Smith, 1991; Chen, 1999)

According to Blumenfeld *et al*. (1991:375), interest and value could be instilled by the following elements:

- Novelty
- Variety
- Authenticity
- Challenge
- Product creation
- Choice
- Collaboration

For learners to feel confident, they need to feel competent. Aspects that could assist in this regard are (Blumenfeld *et al.,* 1991:378-380):

- Having access to information to fill knowledge gaps
- Acquiring the necessary tool skills (how to use computer software, Internet, mathematical equipment, etc.)
- Knowing some problem solving techniques (for example brainstorming)
- Viewing errors or mistakes as part of the learning process, as mistakes offer new opportunities to learn from.

The task focus should also be reviewed, as the focus should be on learning and not on performance, as performance is entrapped in a final mark or grade (Blumenfeld *et al*., 1991:380). Barnes, Clark and Stephens (2000) echo this as they state that assessment determines what gets taught and what gets tested, hence there is a strong link between assessment and instruction. Performance that is equated with the *"one right answer"* (See Cornbleth, 1987) becomes a barrier to learning as learners might not be interested in taking risks in solving problems, but would rather focus on what the teacher wants, as this would lead to a high mark or grade. Hence assessment strategies should be reviewed (Blumenfeld et al., 1991), as assessment can be the engine of the curriculum reform process or its principal impediment (Barnes *et al*., 2000). According to Barnes *et al.* (2000) and Dochy (2001), attempts at curriculum reform would be futile if it is not accompanied by the necessary assessment reform.

In summary: Motivation in project-based learning depends on several factors, such as the learners' (1) perceived interest and value of the project, (2) their perceived competence and (3) their task focus towards the nature of the project (Blumenfeld *et al*., 1991).

2.2.3 LEARNING AS DESIGN AND DESIGNING TO LEARN

The term *"tool"* in the concept *"cognitive tool"* refers to using the computer as a tool in applications where the computer is an instructional tool, similar to a pencil, typewriter, ruler and/or piano (Taylor, 1980). The learner and/or teacher use the computer as an aid, as it has been programmed to carry out certain useful tasks (Taylor, 1980). Using the computer as a tool by using hypermedia software, the argument would be that learners as actively involved designers in a social constructivist environment make ideas by constructing artefacts; they don't get ideas (Kafai & Resnick, 1996:1; Resnick, 1998:IS-3). Hence they become makers rather than spectators (Salomon, 1998:IS). The focus during the design process is not just on product, but on process too. Hence, hypermedia usage should shift from being a mere visual database, to becoming a knowledge construction tool with which learners create and display their own constructed mental models (Dede, 1992:56). During the construction process, concepts and ideas are visualised, as learners organise their information, make connections and draw relationships between ideas and/or concepts (Wisnudel, 1994:5).

The design argument is built upon the belief that knowledge itself results from and is a design, "the shaping of objects to purposes" (Perkins, 1986:1). The *"design to learn"* idea could be linked to the maxim that to learn something well, one has to teach it (Rieber, Luke & Smith, 1998:IS; Reeves, 1998:IS). Both of these beliefs are in contrast to the so-called *"knowledge as information approach"* or *"truth mongering"* in education (Perkins, 1986:xv-xvi) which highlights storage instead of *"knowledge as an implement of action"* (Perkins, 1986:5). Cornbleth (1987) has also voiced dissatisfaction, like Perkins, with the pre-occupation of the so-called *"one truth"* or *"one right answer"*. Perkins states that, "Truths are sold to learners as givens to be learned, without context, without critical perspective, without creative application" (Perkins, 1986:xv) and hence learners pass tests, but do not necessarily really understand the material that they are tested on (Brown *et al*., 1989:3; Blumenfeld *et al*,. 1991:369). Learning about design could assist to enhance the learning process as learners learn about design during the design process, but also learn through design, their curricular subjects (Kafai, 1996:72) or learning areas in the South African context.

Perkins (1986) regards knowledge as construction (Chen, 1999:IS), a "product of meaningful learning" (Grabe & Grabe, 1996:327). According to Turkle and Papert (1991:162) the computer could assist with the *"revaluation of the concrete"* as it has the ability to make abstract thinking concrete when learners are actively engaged in constructing artefacts. Abstract concepts or ideas become concrete when one can "get into the *'right relationship'* with the abstract concepts by linking the concepts to themselves and to one's prior knowledge concepts" (Willensky, 1991:198,201). As an example: when learners design their hypermedia constructions on their storyboards, they think on an abstract level about what their screens should look like and then

concretise it by drawing or designing it on the storyboard or on cardboard paper by linking their abstract concepts in relation to the drawings or design. Learners who do not plan their design on paper, but who design directly on the computer, also have to start by visualizing and thinking about their representations (screens) on an abstract level and then visualize and relate their design on screen on a concrete level. Hay, Guzdial, Jackson, Boyle and Soloway (1994:302) are in agreement that the construction process could enhance thinking, especially making the abstract concrete during the design of multimedia systems, as well as assisting with the transfer of knowledge learned in one situation to a different one.

When learners are actively involved in the process of constructing knowledge, it is important that learners understand the purpose and the structure (e.g. components, properties) of the knowledge (Perkins, 1986:5). In addition, learners also need to show or draw examples that demonstrate their understanding of the newly acquired knowledge (Perkins, 1986:5) as well as being able to argue and explain why their design should work, through a process of evaluation. According to Chen (1999:IS) with reference to Perkins, learning must become an expanded experience. Grabe and Grabe add to the idea of learning as an *"expanded experience"* that learning should also be purposeful, or as they state, "learners should spend a good part of their school time in active, purposeful learning" (1996:329). In a similar manner, Harel and Papert (1991), Wilensky (1991) and Resnick (1998:IS) propose the development and use of design in a constructional sense: the development of new technological tools to assist children to work on design projects and to learn through design (Resnick, 1998:IS).

According to Ehrmann and Balestri (1992) design has received much attention across the curriculum in colleges and schools, as more and more designing is required in the educational process. This statement is also supported by Resnick (1998:IS-2) who states that the value of design projects is growing in recognition. Activities that could be related to design include constructing, modelling, composing, writing and investigating (Ehrmann & Balestri, 1992:2) as well as reflective thought (Rieber, Luke & Smith, 1998:IS).

Design can be both a product and a process (Kafai, 1996). The product is the final aim or outcome (Kafai, 1996). The process can only be partially reflected in the product; hence the importance of focusing on the process of design, as it is this part where the real learning and thinking happens (Kafai, 1996). According to Chen it is the learning that occurs during the process stage that "pulls development forward" (1999:IS-12). Lehrer (1993:197) also stresses the importance of both process and product during the design process. Lehrer (1993:197) argues that design goes beyond product and process, as it includes structure. This relates again to the idea of knowledge as design (Perkins, 1986; Harel & Papert, 1990; Kafai & Resnick, 1996) where learners become designers or users of knowledge instead of passive consumers of

knowledge. The importance of process is also highlighted by Thayer who states that, “it is not what one knows that is important, but how one comes to know what one knows” (Thayer cited in Letseka, 1995:304).

The value of knowledge as design, for example in game design, is not just its entertaining value, but that it also involves sophisticated intellectual skills (Rieber, Luke & Smith, 1998:IS) such as problem solving and creativity that could assist learners in the construction of a more personalized and reflective understanding (Rieber, Smith & Noah, 1998:35). This view is also supported by Kafai, Ching and Marshall (1997) who state that design requires more than just programming in code, as learners have to consider issues such as interface design, content related aspects, creation (designing), debugging and maintenance (Kafai, Ching & Marshall, 1997) which emphasize decision making. The *“learning as design”* process includes elements such as construction of a product, creativity and novelty, discovery, feasibility, aesthetics and analysis (Ehrmann and Balestri, 1992:3), thus including thinking, as well as visual representation of the thinking process.

The constructive and creative aspects related to design, are also echoed in Curriculum 2005, as one of the critical outcomes is creative and critical thinking (DOE, 1997a:IS). However, it is important to note that all problem solving does not necessarily imply that creative and critical thinking skills will always be developed. Creative and critical thinking towards the solving of problems occurs when problems are novel to learners (Blumenfeld *et al*., 1991). If learners are asked to solve problems that they have experience in, thus that are not novel to them, one might ask whether a great deal of creative and critical thinking takes place.

According to Ehrmann and Balestri (1992:3-4) it seems that designing can play a powerful role in the curriculum and hence, in teaching and learning. Resnick (1998:IS-2) is in agreement with Ehrmann and Balestri (1992), as he contends that design projects can provide rich opportunities for learning. A comparison between the thinking of Ehrmann and Balestri (1992:3-4) and Resnick (1998:IS-2-3), follows in Table 2.4:

Key Ideas for Comparison	Ehrmann and Balestri	Resnick
Thinking Skills	Equipping learners with design skills through the process of learning to design with a view to assist them with designing of things later in life,	• Design encourages "*pluralistic thinking"* which promotes the idea of multiple strategies and solutions to problem solving. • Design provides opportunities for reflection, revision and extension of their internally constructed models of the world. • Design promotes thinking about an audience, as learners have to think about how others would understand their design or construction, hence they have to try and place themselves in the minds of others.
Learning and the Curriculum	Enhancing the learning of subject matter through designing to learn	• Design activities could bring various concepts from various learning areas together; hence it promotes *"interdisciplinary"* learning.
Collaboration and Social Skills	Enhance pleasure through teamwork.	• Learners become active participants in the design process • Greater learner involvement
Power and Control	Engaging learners more fully in other elements of learning as it empowers learners	• Greater learner control over the learning process

Table 2.4: Comparison between key aspects of design roles (Ehrmann & Balestri, 1992 and Resnick, 1998)

Perkins (1986:xv) questions teachers' perceptions that learners cannot think creatively or critically, cannot solve problems, cannot think analytically and cannot make inferences, by asking whether teachers prepare learners and provide adequate opportunities to develop these thinking skills or whether the concentration is not on fact-learning. Thinking is important, as "Learning is a consequence of thinking" (Perkins, 1992:8).

The challenge thus, should be on how active knowledge (see tenents of constructivism above) and hence the "knowledge-as-design approach could assist in making learning more manageable, mindful and motivating" (Perkins, 1986:34). Resnick (1998:IS-3) supports the idea that learning should become a more mindful experience and hence contends that new technological tools should be used to "create new representations and formulations of knowledge" and therefore, we should not use new computational media to merely reimplement traditional classroom activities on the computer (Resnick, 1998:IS-3). Perkins (1986) believes that designing concrete products can enhance the acquisition of *"useful knowledge"* or *"knowing your way around"* (Perkins, 1996:vi). The design process assists to move beyond the *"knowing that"* and *"knowing how"* to *"knowing your way around"* (Perkins, 1996) making it more meaningful, as meaningful learning results from a "personal cognitive process of design" (Grabe & Grabe, 1996:327).

Research on hypermedia seems to indicate that hypermedia construction could assist to achieve the call for the development of *"thinking learners"* (Lehrer, 1993; Chen, 1999:IS and; Liu, 1998,2002), because thinking could be enhanced as learners are exposed to the roles of being hypermedia designers (Lui, Jones & Hemstreet, 1998; Lui, 2002). During the design process, learners assume the roles of different professionals: they design, develop, and evaluate the process in which they are involved as well as their products (Lui, Jones & Hemstreet, 1998; Lui, 2002). Hence, as designers, learners become producers of multimedia [hypermedia] software instead of consumers (Kafai, Ching & Marshall, 1997).

Planning is an important aspect during design (Lehrer *et al.*, 1994) and learners need assistance in this regard. However, it is important to be aware that all learners do not engage with planning in the same way (Turkle & Papert, 1991; Papert, 1993 and Kafai, 1996). Turkle and Papert (1991) define two kinds of planners: *"Hard-thinking planners"* and *"soft-thinking 'bricoleurs'[2]"*. According to Turkle and Papert (1991:168-169) *"planners"* can be defined as persons who value hierarchy, abstraction and premeditated control. Kafai (1996:77) refers to *"planners"* as persons who would before they would start with their design, would carefully lay out what they want to do in advance. *"Bricoleurs"* on the other hand would develop their designs as they go along (Kafai, 1996:77) preferring negotiation and rearrangement of their material at regular intervals after contemplation (Turkle & Papert, 1991:169) instead of the hierarchy and abstraction of the *"planners"* or *"hard-thinkers"*. However, Kafai (1996:93) warns that both planning and *"bricolage"* can coexist in one person. According to Segall, what Turkle and Papert are advocating is the acceptance of *"epistemological pluralism"* (Segall, 1991:239) as each individual is different. According to Segall (1991), Turkle and Papert (1991) encourages the importance of creating a learning environment that provides equal opportunity of access to the tools that learners need to build their own representational worlds (Segall, 1991:239-240). Mellon (1999) also states that each person or learner is different, as everyone does not necessarily have the same learning style and might not want to use the same tool, for example a technology tool such as the computer, to engage in learning and to solve problems.

Perkins (1986), Harel & Papert (1991) and Kafai & Resnick (1996) contend that treating knowledge as design could change teacher beliefs from *"knowledge as information"* and the *"knowledge-as-transmission-model"*, as the designing act promotes active and creative use of knowledge by the learners. It requires learners to make use of their diverse intelligences such as artistic, logical, linguistic, musical as well as other talents, to accomplish the design task (Ivers & Baron, 1998). All learners have all the intelligences according to Gardner (1985) but some may

[2] The word 'Bricollage' is from French origin. It is taken from the anthropologist Lévi-Strauss.

be stronger developed than others (Ivers & Baron, 1998). An interpretation of the intelligences related to roles in hypermedia design, follows in Table 2.5 below (Ivers & Baron, 1998:5):

INTELLIGENCE	OBSERVED STUDENT BEHAVIOURS	ROLES IN MULTIMEDIA PROJECTS
Linguistic	Loves to read books, write, and tell stories; good memory for names, dates, and trivia; communicates well	Gather and develop text for project; provide narration; keep journal of group progress
Logical-Mathematical	Excels in math; has strong problem-solving skills; enjoys playing strategy games and working on logic puzzles	Design flowchart; write scripting and programming code; develop navigation routes
Spatial	Needs a mental or physical picture to best understand things; draws figures that are advanced for age; doodles a lot	Create graphics, animation, and other visual media for project; design layout
Bodily-Kinesthetic	Excels in one or more sports; good fine motor skills; tendency to move around, touch things, gesture	Keyboard information; manipulate objects with mouse; operate multimedia equipment
Musical	Remembers melodies; recognizes when music is off-key; has a good singing voice; plays an instrument; hums a lot	Identify works for content integration; create musical score for project; input audio/sound effects
Interpersonal	Enjoys socializing with peers: has leadership skills; has a good sense of empathy and concern for others	Coordinate group efforts; help set group goals; help solve group disputes
Intrapersonal	Has strong sense of self; is confident; prefers working alone; has high self-esteem; displays independence	Conduct independent research to share with team-mates; pilot test multimedia projects; lead multimedia project presentations

Table 2.5: Roles of multiple intelligences in the creation of multimedia projects

2.2.4 MOTIVATION AND INTEREST

According to Alessi and Trollip (2001) there are two motivational theories that are frequently used in multimedia design: The Malone and Lepper[3] (1987) motivational theory for design and the Keller (1983) ARCS model for motivation design. The Malone Lepper model suggests four important factors for motivation and interest, namely (1) challenge, (2) curiosity, (3) control and (4) fantasy. The Keller ARCS model (1983) refers to factors such as (1) attention, (2) relevance, (3) confidence and (4) satisfaction.

Another approach to motivation is that of Spitzer (1995) and his *"Super Motivation Approach"*. Spitzer (1996) argues that the more motivators that are built into the context of an activity, the more motivating it will be. Hence, any activity can become motivational, one just has to add the

[3] The interpretations of Alessi and Trollip (2001) were used as a basis for interpretation of the theory of Keller (1983) and Malone and Lepper (1987). Likewise, the interpretations of Webster *et al*. (1993), Rieber *et al.* (1998) and Rieber (1996) and Reeve (1996) were used to interpret Csikszentmihalyi's theory (1990).

motivators (Spitzer, 1996). Spitzer's motivational approach highlights the importance of the context in which the task or activity takes place. The ideas of Malone and Lepper, Keller and Spitzer have been used as basis for the discussion on factors that influence motivation and interest. Webster, Trevino and Ryan (1993) attribute the element of *"playfulness"* as another important factor that can enhance motivation and interest towards computer activities, based on the theory of *"Optimal Flow"* of Csikszentmihalyi (1990). Optimal flow is " … the state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will do it even at great cost, for the sheer sake of doing it" (Csikszentmihalyi, 1990:4).

The *"playfulness"* concept is also supported by Resnick (1998:IS) who advocates a *"kindergarten approach"* to learning where learners manipulate objects through play, as well as by Rieber *et al.* (1998), who contend that children explore their environments through play. Play is an active activity or process which often includes physical engagement (Rieber, 1996). Hence *'play'* as a life long learning process should be promoted in learning not only for young children [learners], but for everyone (Rieber *et al.*, 1998). However, it is misleading to define work as the opposite of play, as work can become play. Work can become play when adults and/or learners engage voluntarily in an active activity from which they derive great enjoyment when they spend an enormous amount of time, energy and commitment on that activity (Rieber *et al.,* 1998; Rieber, 1996). The learning activity or work would become play when satisfaction is the primary focus and reward secondary (Rieber, 1998).

Reviewing literature on motivation, the following categories were grouped together and will be discussed:

- Curiosity, Fun and Attention
- Challenges, Competence and Relevance
- Control, Choice and Voice
- Fantasy and Novelty
- Collaboration and Connectedness to others through Recognition

Curiosity, Fun and Attention: Webster *et al*. (1993), Rieber *et al.* (1998) and Rieber (1996) all refer to the ability of the computer to encourage *"playfulness"* which contribute to motivation and interest. This playfulness refers to experiencing the interaction between human being and computer as pleasure (Webster *et al.*, 1993). Webster *et al.* (1993) suggest that the idea of playfulness might be useful to understand interactions between human and computer. Webster *et al.* (1993) try to define and measure the level of playfulness by referring to Csikszentmihalyi's concept of optimal flow. What Webster *et al.* (1993) propose for the occurrence of *"optimal flow"*,

is that learners should experience the environment as *"play"* instead of work. Thus, the greater the *"optimal flow"*, the greater the chance for learning to occur. Hence one must make learning a *"fun experience"* by incorporating humour, surprises and little treats from time to time (Spitzer, 1995). Enjoyment and *"optimal flow"* could result when a learner or learners' attention is completely absorbed in or focused on an activity in such a way that time disappears or passes without notice or/and when the activity is so demanding and absorbing that it frees one temporarily from negative affective influences, for example worry (Rieber, 1996:48). Thus, attention as a motivational element should be maintained throughout the lesson (Keller, 1983). This could be done by fostering curiosity throughout the learning process (Alessi & Trollip, 2001).

The learning situation (environment/ context) should thus be designed accordingly to capture this kind of experience (See Spitzer, 1995 on context and task relation). However, Webster *et al.* (1993) also warn against the negative effects of playfulness that need to be guarded against, namely (1) longer time for completion and (2) over involvement. The motivational aspects discussed above, are in line with McCombs (1997:IS) who states that key aspects to motivating learners are: perceiving the task or learning as fun, interesting, personally meaningful or relevant in some way.

Challenges, Competence and Relevance: Blumenfeld *et al.* (1991) and Webster *et al.* (1993) state that the activity should not be beyond the individual's reach, yet it should involve a challenge, as challenge could lead to enjoyment and could become a motivator (Rieber, 1998). Hence, it is important that activities should not be too demanding for learners, as this produces anxiety instead of flow (Webster *et al.*, 1993). At the same time, if the activity is not challenging enough, boredom and not flow, may be the result (Webster *et al.*, 1993; Spitzer, 1995). To achieve maximal enjoyment or *"flow"*, the solution lies in the word *"balance",* as balance should exist between skill, challenge (Reeve, 1996) and anxiety (Rieber et al., 1998). Thus, any activity can be enjoyed, provided that there is a balance between skill, challenge and anxiety, or as Spitzer (1995:47) states: "What makes any activity motivating is its context, not the task itself. Therefore, there is no reason why people can't be just as excited about learning as they are about participating in their favourite sport or game."

In a challenging context, learners set goals for themselves at an appropriate difficulty level, as they seem to be much more committed if they have set the goals than when someone else, for instance the teacher, imposes the goals on them (Malone & Lepper, 1987:230-131,248). Enjoyment and motivation could thus be enhanced when an activity has clear goals (Rieber, 1996). The activity that learners are involved with, should provide short-term and long-term goals (Malone & Lepper, 1987:248).

However, the task or project must also be relevant. To make sense to the learners, the learning experience must be useful or related to the values and experiences of the learners (Keller, 1983; Alessi & Trolip, 2001). It is important to take note that motivation is an active state, not a passive one; hence, humans must be actively engaged in learning (Spitzer, 1995).

According to Blumenfeld *et al.* (1991), with specific reference to Project-Based Learning, perceived value and interest are enhanced by factors such as variation and novelty, authenticity and value, challenge, product creation, choice and collaboration or social interaction (See also Blumenfeld, 1992). Perceived competence can be enhanced by providing sufficient access to resources, adequate level of tool skills, the use of cognitive and metacognitive strategies during the project and by assisting learners to recognize that they have to accept that they will make errors along the way as these errors are necessary in the steps of learning (Blumenfeld *et al.*, 1991:378-380).

With reference to error tolerance, both Spitzer (1995) and Blumenfeld *et al*. (1991) state that mistakes[4] are inevitable in learning and “errors are detrimental to learning when they are construed as representing failure to learn" (Blumenfeld *et al*., 1991:379). The problem is that when learners make errors, it results in punishment and demoralization of learners most of the time (Spitzer, 1995). Consequently, we should rather strive for a safe environment where learners feel that they can make errors without being criticized all the time (Spitzer, 1995; Blumenfeld *et al*., 1991). When measurement is being used, it should be used to positively track success or progress, not negatively to find fault. Thus, its judgemental focus should be sidelined and instead, measurement should be used as a facilitative force, using it in formative evaluation: improvement orientated (Spitzer, 1995). Self-measurement and learner input in what is to be measured should be valued (Spitzer, 1995).

Control, Choice and Voice: According to Malone & Lepper (1987) there are three rules relevant to learner control namely contingency, choice and power. Humans desire choice, hence one should provide as many possible choices regarding content, learning methods, etc. (Spitzer, 1995). Being in control (Spitzer, 1995; Rieber, 1996) and having a choice, could also support motivation and enhance enjoyment (Spitzer, 1995).

According to Alessi and Trolip (2001) lessons that include an environment in which the learner can create computer programmes or use computer tools such as painting or graphical software, leads to motivation. Opportunities that provide the possibility to be successful, and that include learner control, also assist with learner confidence (Keller, 1983; Alessi & Trolip, 2001).

[4] See also Ehrmann and Balestri (1992)

At the same time, learners need to experience that people such as their teacher, peers, parents, etc. listen to their voice[5] (McCombs, 1997:IS; Taylor, 1993) as this also enhances motivation.

Fantasy and Novelty: Fantasy situations encourage learners to imagine themselves in imaginary contexts by using vivid images (Alessi & Trollip, 2001). By engaging learners in creative and imaginative thinking, *"play"* could liberate the mind and may provide fantasy elements (Rieber, 1996). Thus fantasy could become a useful motivator.

Perkins (1992) states that it is believed that novel learning opportunities result in the *"fingertip effect"* which is the belief that, "When we put opportunities at learners' fingertips, they take the opportunities" (1992:145). It seems that it is expected that learners would be interested in exploring and using new opportunities, which they are exposed to and yet, learners might not necessarily seize new opportunities, as change is not necessarily a natural process (Perkins, 1992). Reasons why the *"fingertip effect"* does not occur can be attributed to opportunities that are not recognized, the extra cognitive burden that new opportunities bring along and the absence of motivational structure (Perkins, 1992). Hence teachers would need to implement change in a responsible manner by planning for it to occur (Perkins, 1992). However, when novel strategies are introduced, one should guard against the danger of novelty as "interest may sometimes be heightened at the expense of cognitive engagement" (Blumenfeld *et al*., 1991:375). To conclude; technology cannot be the sole motivator or be the answer alone to the complex problem of motivation to encourage learning, it is the learners' "willingness or ability to learn that is paramount" (Mellon, 1999:31). Computers are only one of the tools for learning and in some cases, it might not even be the best tool (Mellon, 1999).

Collaboration and Connectedness to others through Recognition:
Humans have a desire for social contact with one another, thus cooperative and small group discussions, peer tutoring, collaborative problem-solving and decision-making activities should be included (Spitzer, 1995). Ongoing recognition motivates, hence one should point out as many positives as possible during learning and not only major milestones (Spitzer, 1995). Recognition can by done by the teacher, peers (fellow learners) or by including them in the learning programme (Spitzer, 1995).

[5] See the section, Constructivism and Apprenticeship Model: Implications for Teachers, for an expanded discussion of the influence of affective factors in learning with reference to Vygostky's term *"Perezhivanie"*.

2.2.5 COLLABORATION OR COOPERATIVE LEARNING

According to McMahon (1997:IS), the majority of social constructivist models stress the importance of collaboration among learners. This is built upon the Vygotskian notion, which favours "learning as a social construct which is mediated by language *via* social discourse" (McMahon, 1997:IS). This would lead to more *"learner-talk"* than *"teacher talk"* in the learning and classroom context. However, collaboration is not necessarily confined between learners only, as the teacher could also become a co-learner. Collaboration as an interactive engagement activity between learners, could be used to assist learners to move through their *"Zone of Proximal Development"* (ZPD).

The ZPD can be defined as "the distance between actual developmental level as determined by independent problem solving and the higher level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978:86; Hedegaard, 1996). The ZPD has significant implications for peer collaboration, as it could assist less capable learners to transcend their current level of actual performance *via* assistance of more capable peers to a higher level of potential development (Franzen, 1997).

During the collaboration process, social discourse between learners (peers) and learners (peers) or learners and teacher(s) plays an important role, as thinking and understanding becomes audible, it becomes possible for peers or the teacher to provide possible scaffolding or assistance to aid learners to bridge their misconceptions or problems that they might experience. Learning in the ZPD is learning that assists with learner development that focuses on the process rather than the final product (Chen, 1999:IS).

According to Alessi and Trollip (2001), it seems that many teachers use the terms *"cooperative"* and *"collaborative"* interchangeably. However, Alessi and Trollip (2001) suggest that it would be useful to distinguish between the two terms. Cooperative learning can be defined as a context in which learners help each other rather than hindering, competing with, or ignoring one another (Alessi & Trollip, 2001). They might be working on an individual project, yet they might receive help from, or teach, one another. Thus, cooperative learning refers to sharing similar goals and helping one another. Collaboration on the other hand refers to working together on a shared or joint goal (Alessi & Trollip, 2001). In spite of the distinction, it seems that there exists disagreement about the terms *"cooperative"* and *"collaborative"* learning (Alessi & Trollip, 2001). In a similar way Teasley and Roschelle (1993) also make a distinction between cooperative and collaborative learning. According to Teasley and Roschelle (1993:235):

> "Collaboration is a coordinated, synchronous activity [joint goals] that is the result of a continued attempt to construct and maintain a shared conception of a problem… Cooperative work is accomplished by the division of labour among participants, as an activity where each person is responsible for a portion of the problem solving [similar goals]."

For this research project, no distinction is being made between the two terms (see above) as learners are going to work on a shared goal, namely the construction of a hypermedia product for the museum, and they are going to work on individual goals that they set in their journals. Thus *'cooperative'* and *'collaboration'* are going to be used without a distinction between the two terms. The definition given in Johnson and Johnson (1994:IS) from their website (www.cooplearn.org/index.html) is going to be used with slight changes within square brackets to indicate how it could be used interchangeably with regards to the explanation above:

> "Cooperation is working together to accomplish shared [and individual] goals. Within cooperative activities individuals seek outcomes that are beneficial to themselves and beneficial to all other group members. Cooperative learning is the instructional use of small groups so that learners [peers] work together to maximize their own [goals] and each other's learning [shared goals]" (Johnson & Johnson, 1994:IS).

It is important to note that the placement of learners into groups does not necessarily create a cooperative relationship; it has to be structured and managed by the teacher or professor (Johnson & Johnson, 1994)

In order for an activity to be cooperative (collaborative), five basic elements are essential and need to be included (Johnson, Johnson & Smith, 1991:16-24; Johnson & Johnson, 1994:IS, 1999:IS-5) namely (1) positive interdependence, (2) Individual accountability, (3) Face-to-face promotive interaction, (4) social skills and (5) group processing.

1. "Positive interdependence: Positive interdependence is the perception that we are linked with others in such a way that we cannot succeed unless they do. Their work benefits us and our work benefits them.
2. Individual accountability: Individual accountability exists when the performance of each individual student is assessed and the results are given back to the group and the individual. The purpose of *cooperative learning* groups is to make each member a stronger individual. Students learn together so that they can subsequently perform at a higher level as individuals. To ensure that each member is strengthened, students are held individually accountable for their share of the work.

3. Face-to-face promotive interaction: Individuals promote each other's success by helping, assisting, supporting, encouraging, and praising each other's efforts to achieve.
4. Social skills: Contributing to the success of a *cooperative* effort requires interpersonal and small group skills. Placing socially unskilled individuals in a group and telling them to cooperate does not guarantee that they will be able to do so effectively. Persons must be taught the leadership, decision-making, trust-building, communication, and conflict-management skills just as purposefully and precisely as academic skills.
5. Group processing: Group processing exists when group members discuss how well they are achieving their goals and maintaining effective working relationships. Groups need to describe what member actions are helpful and unhelpful and make decisions about what behaviors to continue or change." (Johnson & Johnson, 1999:IS-5).

Cooperative learning groups provide an alternative to traditional learning groups (Johnson, Johnson & Smith, 1991:25) as illustrated in Table 2.6 below:

COOPERATIVE LEARNING GROUPS	TRADITIONAL LEARNING GROUPS
Positive interdependence	No interdependence
Individual accountability	No individual accountability
Heterogeneous membership	Homogeneous membership
Shared leadership	One appointed leader
Responsible for each other	Responsible only for self
Task and maintenance emphasized	Only task emphasized
Social skills directly taught	Social skills assumed or ignored
Teacher observes and intervenes	Teacher ignores groups
Group processing occurs	No group processing

Table 2.6: Difference between cooperative and traditional learning groups

2.3 CONSTRUCTIVISM AND APPRENTICESHIP MODEL: IMPLICATIONS FOR TEACHERS

Becoming a constructivist teacher is not an easy task, since many teachers in the current system have been trained for teaching in the traditional manner, as discussed previously. To change "requires a paradigm shift" (Brooks & Brooks, 1993;1999; Van Harmelen cited by Wilmot, 1998) and "requires the willing abandonment of familiar perspectives and practices and the adoption of new ones" (Brooks and Brooks, 1993:25). It requires a different kind of thinking about learning as well as the role of the teacher as indicated by Rallis, Rossman, Phlegar and Abeille (1995). According to Rallis *et al.* (1995) dynamic teachers adopt no less than seven roles namely: (1) Moral Steward, (2) Constructor (3) Philosopher, (4) Facilitator, (5) Inquirer, (6)

Bridger and (7) Changemaker. It seems that the role of the teacher, as well as his/her thinking about knowledge, learning and teaching has to change.

Learning that occurs within a social constructivist context, demands that teachers need to take their learners' *"Perezhivanie"* (Vygotsky cited in Mahn & John-Steiner, 2002:IS-4-5) or *"lived emotional experience"* into consideration: the ways in which the learners perceive, experience and process the emotional aspects of social interaction. According to Mahn and John-Steiner (2002:IS-1), for learning to be successful in the ZPD, teachers [and learners] should build on their fellow learners' [peers'] prior experience, as this aids the development of confidence and competence in the social context. This is possible by providing caring support, as affective factors play just as important a role in the learning process as the cognitive factors. Hence, emotional scaffolding is just as important as cognitive scaffolding and teachers should create the necessary *"safety zone"* for their learners by getting to know their learners, engendering trust and lending support (Mahn and John-Steiner, 2002:IS-10).

Carver, Lehrer, Connell and Erikson (1992); Lehrer (1993) and Lehrer, Erickson and Connell (1994) recommend that a cognitive apprenticeship model should be used in a *"learning by hypermedia design"* context, based on the situated cognition theory of Brown *et al*. (1989). According to situated cognition theory, activity and the context in which learning takes place is not merely regarded as ancillary to learning, nor is it neutral, rather it is an integral part of what is learned (Brown *et al*., 1989:IS-1). Learning and cognition are fundamentally situated as "situations might be said to co-produce knowledge through activity" (Brown *et al*., 1989:IS-1).

According to Brown *et al*. (1989:IS) cognitive apprenticeship is the development of concepts through continuing authentic activity, hence closely related to an image of a knowledge tool. Its aim is to provide a teaching method that teaches the processes that experts use. Learners are involved in authentic practices through activity and social interaction in a similar way as craft apprenticeship, an evidently successful method (Brown, *et al*, 1989:IS-12).

In addition to the above, Brown, Ash, Rutherford, Nakagwana, Gordon and Campione (1993) propose the development of a classroom climate of communal sharing in which teachers and learners share expertise and take responsibility for the tasks allocated to one another. In addition to responsibility, the importance of mutual respect among learners, learners and teacher, and learners and outside experts need to be cultivated (Brown, *et. al*., 1993). Learners need to be made aware of *"turn taking"* while busy with dialogue and the need to listen to one another. They also have to understand that evaluation and feedback from teacher and peers are not criticizing them, but are used to develop and share expertise (Brown, *et. al*., 1993).

The implications for teachers are that they have to introduce techniques such as modeling (Carver *et al.*, 1992) and coaching (including scaffolding, fading, articulation and reflection) (Herrington & Oliver, 1996) beyond the traditional explicit direct instruction. Direct or explicit instruction could still form an integral part of this model (Carver *et al*., 1992; Lehrer *et al*., 1994), but not the only part. Rieber (cited in Chen, 1999:IS) suggests that direct instruction has its place in a constructivist context, as it is the combination of constructivism and instructivism that assists learners to move from the known to the unknown (Chen, 1999:IS). From the above, it seems that what is proposed is that teachers should move beyond the use of direct instruction as the *"one way of doing"*.

Modelling of design processes refers to the sharing of one's thinking (thinking aloud) and/or demonstrating (step-by-step fashion) or explaining something (type of direct instruction) (Tinzmann, Jones, Fennimore, Baker, Fine & Pierce, 1990:IS). Hence when to model and when to directly instruct, are decisions that are very important. Coaching involves the giving of hints or clues, providing feedback, re-directing effort and helping learners to use a strategy (Tinzmann *et al*., 1990:IS). The correct amount of scaffolding is of importance: neither too much nor too little, in order for learners to maintain responsibility for their own learning. When to become involved and when to fade during learning is another aspect that teachers should take into consideration (Tinzmann *et al*., 1990:IS).

Penuel and Means (1999:IS) suggest that design-oriented classrooms should be characterized by:

- Learners engaging in longer-term, more complex assignments
- Teachers acting as coaches and facilitators of learner learning
- Learners engaging in more small-group collaborative activities
- Greater involvement with external resources, including heightened attention to external audiences for learner work

It needs to be asked: What should a constructivist learning environment look like? Wilson (1996:5) offers a definition of a constructivist-learning environment:

> "[a constructivist learning environment is] a place where learners [and teachers] may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities."

In addition to Wilson's definition above, it seems that one should establish Rich Environments for Active Learning (REAL). This is an important aspect in the establishment of a constructivist

environment and constructivist values for learning as REALs provide opportunities for meaningful learning (Dunlap & Grabinger, 1996). According to Lebow (1993:5), REALs are based on: (1) collaboration, (2) personal autonomy, (3) generativity, (4) reflectivity, (5) active engagement, (6) personal relevance and (7) pluralism. Honebein (1996) adds to this by referring to the ideas of Cunningham, Duffy and Knuth (cited in Honebein, 1996:11-12) that constructivist learning environments live by seven pedagogical goals:

- Provide experience with the knowledge construction process
- Provide experience in and appreciation for multiple perspectives
- Embed learning in realistic and relevant contexts
- Encourage ownership and personal *"voice"* in the learning process
- Embed learning in social experience
- Encourage the use of multiple modes of representation
- Encourage self-awareness of the knowledge construction process

From the above it becomes evident that the teacher should review his/her role in a REAL learning context. Teachers have to note that they are not the only "mediators" that shape the learning of young people, but that learners' fellow peers have also an important role regarding "the shaping of learning" (Toomey & Ketterer, 1995:480).

2.4 HYPERMEDIA: TUTOR AND TOOL MODE IN EDUCATIONAL USE

According to Taylor (1980), computers can be used in three modes: as tutor, tool and tutee. As tool, the computer can be programmed by an expert to tutor a learner in a certain subject. As tool, learners can use the computer as an aid to assist them (Taylor, 1980). Lajoie (1993:261) states that as cognitive tool, computers can assist to "support the cognitive processes such as, memory and metacognitive processes and share the cognitive load by providing support for lower level cognitive skills so that resources are left over for higher order thinking skills". As tutee, the learner "tutors the computer" (Taylor, 1980:4). To be able to tutor the computer, the learner must be able to programme the computer in such a way that the computer can understand the given instructions (Taylor, 1980). Taylor's (1980) argument is that one cannot teach what one doesn't understand; hence the human who programmes or tutors the computer has to learn what he/she has to teach the computer. In the process, the human learns how computers operate and how his/her own thinking works (Taylor, 1980). What is important in tutee mode, is that "students [learners] *'teach'* it [the computer] how to tutor [someone else]" (Taylor, 1980:4). Hence, by programming [designing] in tutee mode, the computer is tutored by the learner [programmer or designer].

Jonassen and Reeves (1996), Jonassen, Myers and McKillop (1996) and Reeves (1998:IS) refer to using computers in two modes: (1) *"Learning from"* it mode and (2) *"Learning with"* it mode. According to Jonassen, Myers and McKillop the *"learning from"* mode refers to hypermedia/multimedia being used as tutors or teachers and the *"learning with"* mode as hypermedia/multimedia being used as construction tools in which the learner enters "into an intellectual partnership with technology" (1996:96) as they are not controlled by the medium.

Presentation (*"learning from"*) refers to quick and easy access to information or as Ayersman (1996) states, the *"consumer mode"*. The Internet and its search engines, e.g. http://www.google.com and Microsoft's Encarta Multimedia Hypermedia Based Encyclopedia, would be a good example today. Though the access might be fast, the information found may not necessarily be useful. Microsoft's Encarta Multimedia Hypermedia Based Encyclopedia would function in a similar manner as one would only need to type in a keyword and all material containing the keyword that has been searched for, would be displayed. In a similar way to the information found in Google, the information found in Encarta may not necessarily be useful. Linked to the above, it seems that Nelson and Palumbo's (cited by Chen, 1999:IS) argument that the mere browsing and searching of hypermedia material may not result in effective learning, has merit.

Upon closer inspection of these two modes, one notices a link between Taylor (1980) and Jonassen, Myers and McKillop (1996:96) as *"learning from"* refers to using the computer as "conveyors of information, communicators of knowledge or tutors of students" (Jonassen, Myers and McKillop, 1996:96), which is fairly close in concept to the tutor mode of Taylor (1980). Using hypermedia in this context would refer to knowledge presentation or representation by the hypermedia software (Nelson and Palumbo, cited by Yang, 1992) or as data delivery (Dede, 1992). Resnick (1998:IS-4) states that new technologies can support new representations, but that the aim of new technology should not only be new representations to enhance understanding, rather it should promote new relationships or deeper cognitive connections while learners follow their interests.

"Learning with" refers to "the mindful engagement of learners in the tasks afforded by tools" (Jonassen, Myers and McKillop, 1996:96) as construction using technology assists the learners to enhance their thinking and learning (Jonassen, Myers and McKillop, 1996), or to what Brown *et al.* (1993:211) refer to as "facilitate thinking". Thus, the *"learning with"* refers to Taylor's (1980) *"tool mode"* as well as to the *"tutee mode"*. The hypermedia construction process implies *'tool mode'* and the hyperlinking (linking) of screens (nodes) implies *"tutee mode"* as the learner provides the software with instructions to carry out a certain task when the hyperlink is accessed. Hypermedia used in this context would thus refer to what Nelson and Palumbo (cited

by Yang, 1992) refer to as *"knowledge construction"* or what Dede (1992) refers to as the creation of *"knowledge webs"* where learners "create their own mental models" (Dede, 1992:56) or what Brown *et al.* (1993:215) refer to as *"shaping thought"*.

Construction (*"learning with"*) is the designing of nodes and links. Ayersman (1996) refers to this mode as the *"producer mode"*. This mode is significantly different from the representation mode where it is quite easy to navigate in a hypermedia programme, as the construction mode requires design and construction, processes that are entirely different from navigation (Lehrer, et al., cited in Salomon, 1998:IS). According to Lehrer (1993:201) construction of hypermedia is, " … the opportunity to develop a number of different links among units (screens/nodes) of information, resulting in a new geometry of composition" and in the process "Students [learners] are placed in the role of organizing information in multiple ways, and are transforming information into knowledge" (Lehrer, 1993:201). This is in line with Chen (1999:IS) who states that design or construction is the most powerful use of the hypermedia medium as it "makes the organization of information explicit" (Chen, 1999:IS). In addition, it also offers the possibility to promote different ways to link information by each designer (Chen, 1999:IS). This would seem to indicate that designing could be representing the different thinking and knowledge construction of each *"learner as designer"*. Thus, screen design and layout, as well as hyperlinking of screens (nodes), is part of the construction process in which the learner (designer) designs. This is in line with the previous discussion of knowledge as design (See section 2.2.3).

During the construction process it could be possible to develop several design skills such as project management, searching, presentation and representational skills, decision-making and evaluation and revising skills (See the Lehrer (1994) Design Model below or in Carver *et al*, 1992).

2.5 THEORIES RELATED TO HYPERMEDIA AUTHORING

Several cognitive theories have been related to hypermedia. Borsook (1997) refers to cognitive flexibility theory, information processing, case-based reasoning, generative learning, dual coding and semantic networks. Another theory, that of schemes or *"semantic cognition",* based on the ideas of Rumelhart and Norman (1978), can also be related, as it seems that *"Schemes"* is based on the principles of Piaget's *"Cognitive Constructivism"*. The following theories are discussed below: (1) Piaget's Cognitive Constructivism, (2) Schema Theory, (3) Semantic Networks, (4) Cognitive Flexibility Theory and (5) Dual Coding Theory.

2.5.1 PIAGET'S COGNITIVE CONSTRUCTIVISM

Piaget's cognitive constructivism defines learning as a process of accommodation, assimilation and equilibration. In this constructivist process, " …the learner strives to organise his/her own

experiences in terms of pre-existing mental structures or schemes" (Bodner, 1986:873). Assimilation is the use of "a pre-existing scheme or mental structure to interpret sensory data" (Bodner, 1986:873). When a person cannot assimilate experiences into existing schemes, disequilibrium occurs and equilibrium has to be restored to resolve discrepancy. This could be achieved by accommodation, i.e. the modification of existing structures to fit the newly assimilated data that the learner has been confronted with (Bodner, 1986).

2.5.2 SCHEMA THEORY

Bodner's position on Piaget can also be related to schema theory, as well as to Rumelhart and Norman's (1978) modes of learning theory. Rumelhart and Norman (1978:37-53) propose three modes of learning namely: (1) accretion, (2) tuning and (3) restructuring. Accretion refers to normal kinds-of-fact-learning, the daily accumulation of information in which we engage (Rumelhart & Norman, 1978:38). Tuning involves more than merely the addition or accumulation of data and hence refers to the adjusting of terms to improve accuracy, generalizability, specificity and the determining of default values (Rumelhart & Norman, 1978:39,51). Restructuring is the reorganization of a person's existing knowledge base or schemata (Rumelhart & Norman, 1978:39,51). To make restructuring possible, a person would need to recognize discrepancies in his/her current knowledge structure (Rumelhart & Norman, 1978:50). It seems thus that it could be possible to link Bodner (1985) and Rumelhart and Norman (1978) as accretion would refer to accommodation, tuning to disequilibrium and restructuring to assimilation.

Applied to hypermedia design, the *"modes of learning theory"* would seem to mean that while the learner is constructing a hypermedia artefact, learning becomes more than just acquiring knowledge, as *"new"* knowledge would have to be *"tuned"* according to the learner's current schemata or hypermedia design (Chen, 1999:IS). If tuning is not possible, the schemata or hypermedia design would have to be re-organised (revised) through restructuring or modification of the learner's current schemata or current hypermedia design to accommodate the new schemata in his/her design and mental organization (Chen, 1999:IS).

2.5.3 SEMANTIC NETWORKS

Semantic networks seem to underpin fundamental concepts of hypermedia as it serves as what Jonassen and Reeves (1996:706) refer to as a *"cognitive map"*. Jonassen and Reeves (1996:706) expand this when they state that, "Cognitive maps are spatial representations of ideas and their interrelationships that are stored in memory". Human memory is organized semantically, according to meaningful relationships between ideas in memory, ideas that are referred to as *"schemas"* (Jonassen & Reeves, 1996). Schemas are arranged in networks of interrelated ideas known as *"semantic networks"* (Jonassen & Reeves, 1996).

The purpose of semantic networks is to represent and display the organisation of ideas embedded in a person who knows something about the phenomenon at hand (Jonassen & Reeves, 1996). A structural relationship thus exists among the content to be studied (Jonassen & Reeves, 1996:706). It seems therefore that learners as designers in a process of designing to learn, are able to represent their semantic networks (nodes/screens) in relation to their semantic associations (links) (Borsook, 1997). Hypermedia construction by learners, could thus make the learners' semantic networks and semantic link structures visible (See Lehrer, 1993). Nelson and Palumbo (cited by Chen, 1999:IS) state that the human memory is much more powerful than a linking mechanism as in hypermedia linking, but warn us that the linking process in hypermedia design makes it possible to create *"meaning-free"* links and hence the challenge is the design of *"meaningful links"* between screens (Chen, 1999:IS).

2.5.4 COGNITIVE FLEXIBILITY THEORY

Cognitive Flexibility Theory in hypermedia emphasizes the complexity and ill-structuredness of many knowledge domains (Spiro *et al*., 1991; Liaw, 2001). Spiro *et al.* (1991) contend that there is a tendency towards over simplification of complex entities or concepts which in turn leads to misconceptions and hence, to failure of transfer or application of knowledge to new cases (Spiro *et al*., 1991:24). Oversimplification or ill-structuredness needs to be remedied, as "ill-structured aspects of knowledge pose problems for advanced knowledge acquisition" (Spiro *et al*., 1991:25). According to Spiro *et al.* (1991) continued errors of oversimplification can compound each other (Spiro *et al*., 1991:27) leading to incorrect knowledge structures and non-comprehension or incorrect building blocks. According to Spiro *et al*. (1991:24-25) we are prone to use linear media to explain complex, ill-structured and advanced knowledge domains. Liaw (2001:IS-5) adds to the Spiro *et al.* (1991) argument by stating that the linear or sequential techniques of traditional instructional design tools such as textbooks, computer-drill software and teacher-talk lectures are not assisting in solving problems experienced within ill-structured domains. Thus linearity or sequentiality leads to oversimplification of the subject matter and hence results in misconceptions within learners (Spiro *et al.*, 1991).

However, computers, with specific reference to hypertext systems, are ideally suited to overcome this problem with their non-linear capabilities (Spiro *et al*., 1991:24,29) as "Users [readers] of hypermedia are freed from the linear, highly directed flow of printed text" (Marchionini, 1988:8). This is possible as several paths have been set up for exploration by the hypermedia author (Nielsen, 1995:2). With this in mind, Spiro *et al.* (1991) advocate the use of a nonlinear medium such as hypertext, as it assists in "landscape criss-crossing" (Spiro *et al.,* 1991:29) and hence would be a more flexible approach (Spiro *et al*., 1991; Marchionini, 1988).

This linear or sequential approach to which Spiro *et al.* (1991) refer, could be linked to what King (1999:IS) calls an emphasis on *"homomorphism"*, that implies that each learner must complete the same activities or follow the same path if they are to acquire the desired skills and/or objectives embedded in the curriculum: to arrive at the mountain top. This way of thinking excludes *"equifinality"*, which suggests that there are many different ways or pathways to reach destination (King, 1999:IS). Non-linear hypermedia software would thus assist learners to view complex materials from different perspectives and in different situations in order to restructure and adapt their existing knowledge (Spiro *et al.,* 1991:28) leading to King's (1999:IS) *"equifinality"*.

Linked to hypermedia's non-linear or non-sequential capabilities, it would seem to mean that authoring in hypermedia offers possibilities, as two or more learners could construct the same complex information in different ways. Hence another person could use it to obtain several perspectives on the same complex information as indicated by the example of Borsook (1997:726) below (See figure 2.1). Borsook's argument is that if one slices an orange in half, as indicated below, one sees one particular perspective. However, it is also possible to slice it in half in another way and then one sees a different picture of the same orange although it is also sliced in half. Hence, it should lead to better understanding, as it is viewed from two perspectives (Borsook, 1997). The possibility of offering several perspectives to view issues, ideas and/or concepts (Borsook, 1997) could then assist with the restructuring of the complex subject matter or ill-structured domains, as suggested by Spiro *et al.* (1991). Restructuring is important, as mere linking of nodes does not necessarily equate with understanding, or as Yang (1996:48) states "linking is not merely the linking together of two nodes; a mechanical association dealing only with surface meaning. Merely having learners connect ideas does not guarantee true understanding", as what is needed is discrepancy and restructuring of the current knowledge structure (Chen, 1999:IS).

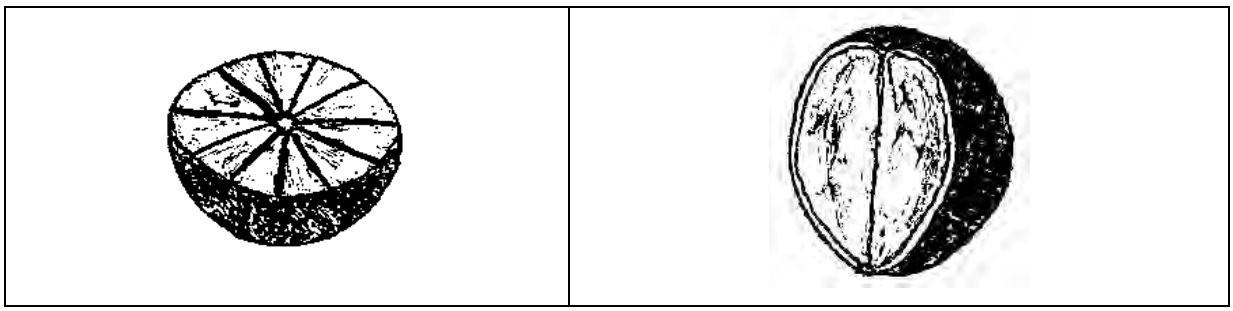


Figure 2.1: Different perspectives of the same object (Borsook, 1997:726)

2.5.5 DUAL CODING

Dual coding theory could also assist in explaining the value of the construction or design process as learners process information through one of two generally independant channels. One

channel stores the verbal information: text and audio. The other one stores nonverbal images such as illustrations (visual media) and sounds (Najjar, 1996; Borsook, 1997). Information processed through both channels [referential processing] could facilitate improved understanding and/or recall in contrast to information processed through one channel only (Najjar, 1996). Using both the verbal and nonverbal channels enhance the recall of information (Paivio cited by Najjar, 1996:134).

2.6 RESEARCH ON HYPERMEDIA CONSTRUCTION

Research reports seem to be very positive about hypermedia construction. Research on hypermedia construction in which learners are the designers, suggests that learners as designers may have or experience:

- Better retention and comprehension of content materials (Lehrer, 1993 and Beichner, 1994; Chen, 1999:IS)
- Greater higher order thinking skills (Farrow, 1993; Chen, 1999:IS)
- Increased self-esteem and confidence (McGrath, 1997)
- Ownership (Lehrer, 1993)
- Greater awareness of audience (Beichner, 1994) and of their audience's [users'] needs (Turner & Dipinto, 1992)
- Improved motivation, interest and cooperation (Beichner, 1994; Turner & Dipinto, 1992; Liu, 1998)
- Internalization of design skills (Liu & Hsiao, 2002).

Turner and Dipinto (1992) researched some process-oriented questions, affective and social issues as well as content specific issues. Thirty seven grade seven learners participated. Learners gained new perspectives on organizing and presenting (communicating) information during the design process. (Turner & Dipinto, 1992:197). In addition, it was found that learners were enthusiastic to share information and to assist peers. Another interesting aspect was the distinctive non-linearity in their stacks (nodes). They were motivated by the strong sense of audience to present the information in such a way that it could be easily understood. Working in pairs facilitated the cooperative environment and assisted to give and to receive feedback to one another. Learners developed also new insights into writing (Turner & Dipinto, 1992:198).

Carver *et al.*, (1992:388-389) developed a design skills model of the major thinking skills that learners need to develop to become successful designers. The design model comprises the following:

Project Management Skills

- Creating a timeline for the completion of the project.
- Allocating resources and time to different parts of the project.
- Assigning roles to team members.

Research Skills

- Determining the nature of the problem and how research should be organized.
- Posing thoughtful questions about structure, models, cases, values, and roles.
- Searching for information using text, electronic, and pictorial information sources.
- Developing new information with interviews, questionnaires and other survey methods.
- Analyzing and interpreting all the information collected to identify and interpret patterns.

Organization and Representation Skills

- Deciding how to segment and sequence information to make it understandable.
- Deciding how information will be represented (text, pictures, movies, audio, etc.).
- Deciding how the information will be organized (hierarchy, sequence) and how it will be linked.

Presentation Skills

- Mapping the design onto the presentation and implementing the ideas in multimedia.
- Attracting and maintaining the interests of the intended audiences.

Reflection Skills

- Evaluating the programme and the process used to create it.
- Revising the design of the program using feedback.

Carver *et al*. (1992:393,397) implemented this model at two research sites in grade eight (at Rochester) and nine (at Verona) to investigate the learners' internalization of design skills and whether the classroom became a design community. The teachers provided direct instruction, coaching and modeling at both sites regarding the design skills specified in the design model. Contrasting results from the Rochester and Verona sites indicated that it was very important for teachers to be familiar with apprenticeship techniques, the design skills and the design skills model as well as the application of these skills in design activities (Carver *et al*., 1992:400-401). Some issues related to assessment were addressed, but further experimentation regarding assessment is needed (Carver *et al*., 1992:401).

Lehrer (1993:201) contends that hypercomposition (designing one's own hypermedia) requires learners to transform knowledge into dimensional representations, to determine what is important and what is not (decision-making), to segment and sequence information into nodes (different screens), linking the information and deciding how to represent the ideas *via* design.

This is a highly motivating process because the authorship leads to ownership of the ideas, design and presentation (Lehrer, 1993:201). Lehrer (1993:202) proposed a framework that follows from Hayes and Fowler (cited by Lehrer, 1993) for hypermedia design based on: planning, transforming, evaluating and revising. A visual representation of the Lehrer (1993:202) model follows:

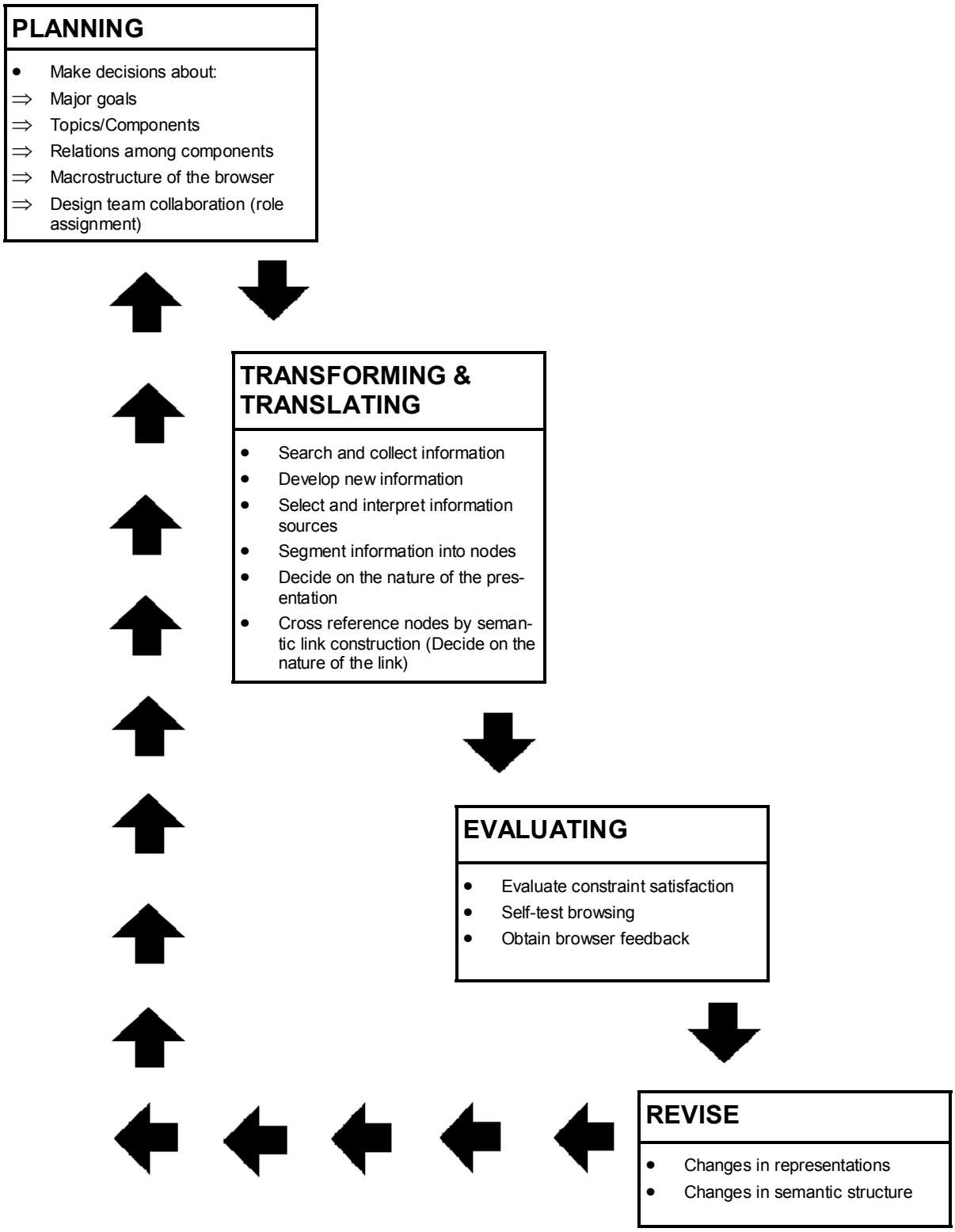


Figure 2.2: A framework for hypercomposition-based design (Lehrer, 1993:202).

Lehrer (1993) implemented this *"knowledge-as-design"* approach with *"HyperAuthor"* in a hypercomposition of history, the American Civil War. Ten learners in grade eight participated, 4 girls and 6 boys. Five learners were more successful in school, the criteria being that they score higher marks. Their history teacher described them as involved and motivated. A comparison between the two groups was based upon (1) the degree of involvement and engagement, (2) patterns of design and (3) knowledge organization (Lehrer, 1993). It was found that the more successful learners showed a very high degree of involvement throughout the project. They used a top-down approach and a combination of a hierarchical and web based structure to organize information (Lehrer, 1993:211-212). Each learner had a major responsibility for a subtopic and a minor one in the "successful learner group". This group followed a *"round-robin approach"* of collaboration for each subtopic. Alternatively, the less successful learner group used a more bottom-up approach to design (Lehrer, 1993:212). Their involvement increased as the project proceeded. Their design showed a more hierarchical structure (Lehrer, 1993:216). They included in their design more examples of interpretation. This group was uncertain about the selection of subtopics and off-task activities characterized this group during the first third of the project. However, collaboration increased towards the second third of the project and consisted of division in labour (Lehrer, 1993:212)

In a follow-up study, Lehrer *et al.* (1994) used the hypercomposition-based design framework by engaging twenty learners in grade nine in a project where they had to create projects on American history to be used by their peers. There were five learners in a group. High levels of learner effort and involvement were apparent and off-task behaviour declined throughout the project. Knowledge was seen in a fundamentally new way due to their involvement with the information, as they designed or constructed their artefacts rather than just receiving it from the teacher (Lehrer *et al.,* 1994:248). They developed a number of skills related to the design skills model: finding and interpreting information, articulating and presenting knowledge and using the computer as cognitive tool (Lehrer *et al.,* 1994:248). The hypermedia composition also revealed the development of more critical standards for knowledge. Learners also made use of multiple representations and iconicity to illustrate ideas (Lehrer *et al*., 1994:246). It was observed that generally, learners with less organized knowledge about the subject-matter tended to focus on the concrete aspects of design (scanning, creating cards, etc.) without connecting it to the more abstract level (higher levels) of design (Lehrer *et al*., 1994:248). Lehrer *et al.* (1994:248) states that "design can serve as the fulcrum of the classroom".

In the same year, Beichner (1994) reported on a project completed by grade seven and eight learners in a middle school situated on the grounds of a large metropolitan zoo. It is a magnet school that emphasizes science. Learners are admitted based on a lottery. Learners had to

design a hypermedia product for the metropolitan zoo. The project took two years. The learners seemed to have a strong appreciation that they were designing a product for a real audience. It was also found that learners demonstrated great concern for accuracy in their displays and quickly assumed the major responsibility for content and editing decisions, despite the fact that the original task of designing the displays had been structured for them by the teacher[6]. Learners accessed wide ranges of science materials and sources to find the content they desired, and that their commitment to and enthusiasm for the project remained very high (Beichner, 1994).

In 1996, Kafai undertook a different, but related study over a six-month period on sixteen grade four learners who designed and produced educational games that teach fractions. They were allowed to walk around in class and discuss and view other learners' projects. Most of the learners started the sessions by planning for a while before they went off to the computers. Afterwards they returned to their classroom and wrote about their experiences.[7] Younger learners who evaluated and discussed the older learners' game projects visited the learners on a monthly basis. The aim was a finished product; hence learners also worked in the art class on a cover design for the packaging of their games and in their language classes on advertising their product and the documentation to accompany it. It was found that all learners do not plan in the same way. Some do *"hard-thinking"* by planning well in advance. Others are *"soft-thinkers"* or *"bricoleurs"* and plan on the way. The majority followed a middle approach between *"bricolage"* and planning. Kafai (1996:94) concludes that "learners did not only learn through design, but also about design and reached a level of reflection that went beyond traditional school thinking and learning."

Another related study by Turner and Dipinto (1997:392) over a four-year period in a middle school learning environment, in which the teacher seldom instructed in a whole class approach, indicates that collaboration can be encouraged, facilitated and taught. Learners were dependant on one another for assistance, not on the teacher. Learners also had the freedom to move around to see what their peers were doing and to consult with one another. The research demonstrated that cognitive and social factors are important for the establishment of a constructivist design environment. It was found that the collaborative environment between teacher and learner and learners with learners, assisted learners to take charge of their own learning. (Turner & Dipinto, 1997). Turner and Dipinto identified nine elements as critical for the establishment of a collaborative culture: (1) exploration, (2) teaching on a need-to-know basis (3) mastery-oriented help-seeking and help-giving, (4) teacher as facilitator of peer collaboration, (5)

[6] In my project, I provided the idea for creating a hypermedia product related to the museum. However, learners had a free-hand in deciding on a topic, related to what they had seen in the museum.
[7] This influenced my project, hence I included journal-writing as a data gathering tool.

student experts, (6) teacher as co-learner, (7) peer assessment, (8) sense of audience and (9) sense of community (Turner & Dipinto, 1997).

Liu (1998) researched the effect of hypermedia authoring on elementary school learners' creative thinking. Two fourth grade classes totalling 38 learners participated. The study took place over a period of six months and was designed in such a way that it formed an integral part of the science curriculum. The software, *Hyperstudio*, was used. The Torrance TST of Creativity and Thinking (TTCT, figural streamlined) was administered to learners before and after the treatment to compare whether there was a difference in creativity afterwards. Results showed a significant increase in posttest scores from pretest scores for the measures of fluency, elaboration and the resistance to premature closing (Liu, 1998:35). No difference was found between the pre- and posttest for originality and abstractness of titles. It was found that the low and intermediate ability learners appeared to have benefited the most from the learning environment, more than the high ability learners. Collaborative hypermedia authoring resulted in greater gains than individual hypermedia authoring (Liu, 1998:48).

Another study of Liu (1998) was the involvement of high school learners as multimedia designers in a cognitive apprenticeship-style learning environment. The aim was to gather evidence regarding motivation related to using the apprentice-based learner-as-designer environment. The specific objective was to ascertain whether this environment contributed to the learning of design knowledge over an extended period of time and whether experienced learners who participated in an earlier study performed differently from novice learners. The sample was 26 learners from a school where a high percentage of learners are lablled to be at-risk of not finishing school. The one-way ANOVA's with repeated measures indicated significant effects for intrinsic goal orientation, task value, control of learning beliefs and self-efficacy. Learners tend to become more interested and focused towards the end of the project. Regarding the design skills, the ANOVAs with repeated measures indicated significant increases from pre- to posttreatment in: planning, searching, connecting ideas, audience and collaboration. Data on the experienced learners versus novice learners showed that the more experienced learners had a better understanding of multimedia design. They were also more knowledgeable and more proficient in using the design tools (Liu, 1998).

One of McGrath et al's (1997) students, Chen (1999:IS), examined the impact of designing hypermedia documents on learners' conceptual learning with special reference to amount of organization, depth of organization and directionality of concepts. In addition, the impact of hypermedia concepts on the participant's knowledge construction and representation processes were analyzed. Furthermore Chen (1999:IS) explored the nature of learner engagement in relation to the various tasks involved during hypermedia design. The project was a single-case

study that involved 29 learners in a high school located in a Midwestern city. It was found that, generally, learners found the more demanding sophisticated skills of hypermedia representation easier that linear composition (Chen, 1999:IS). Chen agrees with Borsook (1997) when she states that hypermedia mirrors human cognition and is thus a natural way of learning. This design project was particularly attractive to learners who struggled with conventional school assignments (Chen, 1999:IS). The design process enhanced the learners' knowledge representation skills as well as their information integration techniques (Chen, 1999:IS). Chen added that hypermedia benefitted the learners' comprehension. It was also found that the complexity of node-, link- and structural construction increased throughout the project. Scores indicated an overall increase in knowledge organization and elaboration as well as the depth of knowledge (Chen, 1999:IS). New relations between concepts were established and concepts were organized on a more abstract level as learners modified and reorganized their knowledge structures (Chen, 1999:IS).

Regarding abstraction, it was found to be crucial for conceptual integration rather than associativity or nonlinearity (Chen, 1999:IS). Hypermedia served thus as a *"mind-expanding"* tool (Chen, 1999:IS), as complex learning (restructuring and tuning) was evident in some groups and hence, it can be concluded that hypermedia authoring encourages and supports generative thinking (Chen, 1999:IS). With reference to Perkins, Chen states that it seems thus that there was an improvement in retention and understanding, aspects advocated by Perkins (Perkins cited by Chen, 1999:IS) during hypermedia design (Chen, 1999:IS).

A high degree of engagement in organizing information into hypermedia format was also evident. However, the creation of impressive displays of sound and video was not visible in most learners' representations and yet these learners engaged in higher levels of cognitive engagement (Chen, 1999:IS). Chen's findings seem to correlate with Garthwait (2001) who also states that visual representation is not necessarily an indication of a learner's conceptual understanding. Regarding motivation towards the tasks involved in hypermedia design, persistence seemed to be more important than enthusiasm (Chen, 1999:IS).

Despite all the positive effects, Chen indicated a few negative aspects (1999:IS-106):

- The teacher must be extremely patient, as the process is more important than the final product.
- The learners have to be taught the value of time management, resource management and peer relations (social skills) before projects can work well
- The teacher has to spend a great deal of time on motivational, counselling and management issues
- Learners need to have the necessary technology and computer skills.

Finally, yet another research project of Liu and Hsiao (2002:IS), regarding the enhancement of cognitive skills through multimedia design, found that middle school learners as multimedia designers became aware, after an eighteen week period, of the different steps involved in creating a multimedia product and realized the significance of planning, designing and testing. According to Liu and Hsiao (2002:IS), this was consistent with the findings of other studies that the engagement of learners over an extensive period of time assists learners to internalize the design knowledge and skills (Lehrer et al., 1994; Liu, 1998). It was also found that learners were able to list the different tasks attributed to the design process. Equally important, learners were also able to differentiate the more important ones from the less important ones (Liu & Hsiao, 2002:IS). Liu (2002:IS) contends that the study of Liu and Hsiao (2002:IS) has found that middle school learners had trouble overall dealing with time and environment constraints, as managing time well and effort regulation were not easy tasks for the middle school learners. At first learners were highly excited and motivated, but towards the end they became less interested and motivated (Liu & Hsiao, 2002:IS). According to the Liu and Hsiao (2002:IS), this could be attributed to the long and repetitive development process.

2.7 SUMMARY: WHY COGNITIVE (THINKING) TOOLS THEN?

In conclusion: The following principles sum up the foundations for using cognitive tools (Jonassen & Reeves, 1996:698):

- “Cognitive tools will have their greatest effectiveness when they are applied within constructivist learning environments”
- “Cognitive tools empower learners to design their own representations of knowledge rather than absorbing representations preconceived by others”
- “Cognitive tools can be used to support the deep reflective thinking that is necessary for meaningful learning”
- “Cognitive tools have two kinds of important cognitive effects; those that are *with* the technology in terms of intellectual partnerships; and those that are *of* the technology in terms of the cognitive residue that remains after the tools are used”
- “Cognitive tools enable mindful, challenging learning rather than the effortless learning promised but rarely realized by other instructional innovations”
- “The source of the tasks or problems to which cognitive tools are applied should be learners, guided by teachers and other resources in the learning environment”
- “Ideally, tasks or problems for the application of cognitive tools will be situated in realistic contexts with results that are personally meaningful for learners”.

It seems that *"learning with"* computers as cognitive thinking tools through a process of designing products (artefacts), has much to offer as Harel and Papert (1991:41) state, "Computers cannot produce *'good'* learning, but children can do *'good' 'learning with'* computers". The question is: How can South African teachers achieve implementation of the so-called *"learning with"* computers to achieve the critical outcomes identified in Curriculum 2005? The following chapters might provide some possible answers.

CHAPTER 3

RESEARCH FRAMEWORK AND METHODOLOGY

3.1 INTRODUCTION: TYPE OF STUDY

The research is conducted within the interpretative paradigm using mainly qualitative and some quantitative methods within a case study. According to Guba (cited by Denzin & Lincoln, 2000:19) the term paradigm refers to "a basic set of beliefs that guide action". It seems, from my examination of a table in Denzin and Lincoln (2000:22), that the terms *"paradigm"* and *"theory"* are confusingly used interchangeably. Denzin & Lincoln (2000:19) state that, "all research is interpretative, guided by a set of beliefs and feelings about the world and how it should be understood and studied." Thus the aim of the interpretative paradigm is "… to understand the subjective world of human experience" (Cohen, Manion & Morrison, 2000:22). This social reality is thus *"dialogic"* which is in contrast with the empirical *"monologic"* understanding (Habermas, 1981:161ff). The goal is understanding or what Held (1980:308) terms: *"Verstehen"* as it aims at answering the question *"what?".* However, one should also ask the *"how?"* and the *"why?"* questions, as these two questions assist not only with understanding, but also with interpretation (Chamberlain, 2000:290). This is indeed what the interpretative social science intends, to make meaning and understanding of the found phenomena, or as Carr and Kemmis (1991:88) states, "to discover meanings [and] to make action intelligible".

A case study can be seen to satisfy the three tenets of the qualitative approach: describing, understanding, and explaining (Tellis, 1997:IS). A frequent criticism of case study methodology is that its dependence on a single case renders it incapable of providing a generalizing conclusion (Cohen *et al*., 2000). Likewise, according to Berg (1998), it must be borne in mind that a limitation of the case study is its weak potential to generalise (Berg, 1998). However, Yin (1994:36) agrees that generalization is not automatically possible, but argues that replication could assist with generalization. Tellis states that a goal of the case study should establish the parameters that then could be applied to further research. In this way, even a single case could be considered useful, provided it met the established objective (Tellis, 1997:IS). Nevertheless, as is evident in the *'SITES'* study (Kozma & Anderson, 2002:390) "the focus is not on the uniqueness of these cases but on what can be learned from them about how technology is being used to support educational change." Hence, it seems that case studies within a technological context (for example the design of a hypermedia artefact), could offer possibilities to think about current practices of teaching and learning; and to question whether technology could assist as an agent of change in teaching and learning.

The value of case studies, according to Yin (1994), lies in the possibility of the single case to confirm, extend or challenge a well-formulated theory, bearing in mind its propositions as well as the believed circumstances (Yin, 1994:38). Thus, it could assist to enlighten the researcher

whether the theoretical propositions are correct or whether alternative explanations are relevant (Yin, 1994:38).

Case studies can be either single or multiple-case designs and the one undertaken here is a single case study. The research approach will take the form of what Yin (1984) terms an *'exploratory case study'*.

Validity is problematic in qualitative research and the case study as research method has been a source of criticism because of potential investigator subjectivity (Cohen *et al*., 2000:26-27,184). According to Yin (1994:34-35) this can be overcome by the following as counter measures: (1) using multiple sources of evidence, (2) establishing a chain of evidence and (3) having a draft case study report reviewed by key informants.

The need for triangulation arises from the need to confirm the validity of the research process (Cohen *et al*., 2000:103-112). According to Stake (1995:107,112), triangulation is the use of several or different protocols to ensure accuracy, as it assists with confirmation. Thus, it is a process in which the researcher uses multiple perceptions to clarify and verify meaning, as well as the researcher's interpretation (Stake, 2000:443). Cohen *et al*. (2000:112) define triangulation "as the use of two or more methods of data collection in the study of an aspect of human behaviour". Triangulation would thus become a *"strengthening mechanism"*, as the use of several kinds of data sources (qualitative and quantitative) would assist the research process and hence validity (Patton, 1990:187).

In this research project, the researcher will collect data using:

- Interviews
- Observation
- Learner journal writing
- Project Assessment Questionnaire
- Task Ranking List
- Task Elicitation
- Reflection and Evaluation

These multiple sources of evidence will assist in generating rich qualitative and quantitative data.

3.2 AIM

The aim of this research project is to explore (1) what design and collaboration skills learners develop and (2) how the creation process encourages collaboration, motivation and interest and (2) how these skills mentioned in 1 and 2 relate to the Critical Cross-Field Outcomes specified in South Africa's Curriculum 2005.

3.3 RESEARCH QUESTIONS

I attempt to ascertain what skills the learners develop in a *"design community"*. In addition I endeavour to ascertain whether these skills can be related to certain of the Critical Outcomes and certain Specific Outcomes as envisaged in Curriculum 2005.

The questions that provide a framework for this project are:

1. What decision-making, research, project management, time management, design, reflection, evaluation and revision skills are developed by learners creating a hypermedia product?
2. How does the creation of a hypermedia product encourage collaboration, motivation and interest?
3. How are these skills related to the critical cross-field outcomes and the specific outcomes in the languages, science and technology curriculum statements in C2005?

3.4 CONSENT

Before the research project started, the director of The Bayworld Museum in Port Elizabeth, was contacted in writing to obtain permission to use the Museum as a starting point (See Appendix A). Bayworld gave its full cooperation and was delighted to be involved in the project. After Bayworld had approved the project, the principal of the school (a primary school in Port Elizabeth in the Republic of South Africa) as well as the Governing Body were contacted in writing regarding the proposed project (See Appendix B). In the letters, the rationale for the research project and what it would entail were clearly communicated. The school gave its full permission, but stated that participation would only take place on a voluntary basis. Parents were contacted in writing to ask for consent. The project was also explained to them in the letter (See Appendix C). It was clearly stated that participation was voluntary.

3.5 PARTICIPANTS

The participants were 27 white, Afrikaans-speaking grade 6 learners, aged between 11 and 12. There were 14 boys and 13 girls. All the boys and all but one of the girls decided to participate.

Each learner received a letter that explained what the research was all about and what would be expected of them during the project. Learners had to read the letter and had to decide whether or not they were interested in participating in the project. Those who were interested, had to take the letters home and discuss the project with their parents. Learners who wanted to participate had to sign the letter after their parents had given their consent. Learners could decide at any stage to terminate their participation. The only condition for termination was that they would have to write a short letter or note explaining why they wanted to leave the project.

Two weeks before the project started, another girl indicated that she did not want to continue, but a few days later, revoked her decision and decided to continue. Twenty-six learners participated in the project.). However, during 2003, four learners left the school. Thus, only 22 learners completed the Project Assessment Questionnaire and Task Ranking Procedure in 2003. It was also not possible to conduct follow-up interviews with the learners who had left.

3.6 THE RESEARCH ENVIRONMENT

In 2000, a computer centre was built and furnished at Mount Pleasant Primary School. The computer and media centers of the school are interlinked, thus making it possible for learners to be either in the computer room or library and moving to and through the different rooms at any point in time. Many companies were approached by the researcher and parties associated with the school and some of the companies donated equipment, software and other related computer furniture.

The school has 15 Pentium III Celeron 550Mhz computers and a Pentium III 500Mhz server. All the computers are networked to a Catalyst Hub. The 15 networked workstation computers use Windows 95 as operating system and the server runs the Windows 2000 Server Edition. Each workstation computer has 32 MB of RAM, a hard drive, keyboard, mouse, stiffy-drive, colour card and 14-inch colour VGA monitor. The server consists of the same components, but has 128 MB RAM. The server is the only computer with a CD-Rom drive. One scanner is also available as well as an Internet link that can be used at any time by any learner or group.

The school Governing Body appointed a computer facilitator on a full-time basis in 2001. The facilitator introduced the learners from pre-primary to grade 7 to the *Microsoft Office 2000*. The *Microsoft Office Premium Edition 2000 Suite* consists of the following software packages: (1) a word processor, *Word 2000*, (2) the spreadsheet *Excel 2000*, (3) a desktop publisher, *Publisher 2000*, (4) presentation software, *PowerPoint 2000*, (5) the e-mail utility *Outlook 2000*, (6) graphics package, *Photo Draw 2000* and (7) web based hypermedia creation software, *FrontPage 2000*. The command sets of the *Microsoft Office 2000* suite are very similar in each of the software packages and this makes switching from one of the software packages to another easier. Learners also have access to *Encarta*, *Microsoft Oceans* and educational AVI video files stored on the server. Video files could be inserted into their projects had they wished to do so.

Classes at school are divided into two groups of not more than 20 learners per group. Each group visits the computer centre once a week for 60 minutes. The facilitator decides who works where. On some computers the learners work individually and on some they are grouped in twos. However, for this project all 26 learners went simultaneously to the computer centre.

Learners had about 20 months of school computer experience prior to the project and had used the computer centre more or less 45 times before the start of the project.

During the project, learners were involved in 9 contact sessions of approximately 2 hours each (Table 3.1). Twenty-six learners participated in the project that started on 13 September 2002 and ended on 29 November 2002 (Table 3.1).

COMPUTER SESSION DATES	
• 13 September 2002	• 25 October 2002
• 18 September 2002	• 08 November 2002
• 27 September 2002	• 15 November 2002
• 11 October 2002	• 29 November 2002
• 18 October 2002	

Table 3.1: Project dates – Sessions in the computer room

3.7 PREPARATION FOR THE LEARNING ENVIRONMENT

The creation of a hypermedia-constructed project was something new for the learners. To prepare them to use *FrontPage 2000*, learners were given 4 weeks of instruction prior to the commencement of the project. During this period, learners had to create a hypermedia document on the topic: "Who am I?" They had to design several pages that described different aspects of themselves and interests they had. They had to link these pages by using hyperlinks. Computer skills, such as the creation of tables, insertion of backgrounds and photos and the designing and making of links between documents, for example, were explicitly taught by the computer facilitator, not by the researcher.

During August 2002, learners were taken to the Bayworld Museum in Port Elizabeth and visited each room in the museum. Each room represents a topic such as marine life, birds, reptiles, dinosaurs, maritime history, fashion, etc. At the completion of the tour that lasted one hour, they had to decide which room in the museum interested them the most. Learners started to form groups and it was observed that some initially followed their friends, but after a while they decided to change their group and topic to a topic that interested them, rather than being with a friend or friends. However, in some cases, certain learners still chose to join a group where there was someone that they could relate to. This person was not necessarily a close friend. The following groups were established with the number of members and gender indicated in Table 3.2.

GENDER	GROUP 1 DINOSAURS	GROUP 2 BIRDS	GROUP 3 REPTILES	GROUP 4 MARITIME HISTORY	GROUP 5 MARINE LIFE	TOTAL # OF BOYS & GIRLS
Boys	2	2	2	4	4	**14**
Girls	2	4	3	0	3	**12**
Total	4	6	5	4	7	**26**

Table 3.2: Groups and group distribution

Learners then started to re-visit the room that interested them the most and started to make notes from the information provided in the rooms. One digital camera was available and a parent took photographs of all the objects in the rooms that learners wanted. These JPEG (compressed picture format) images were downloaded onto the server at school, for later use by the learners.

3.8 THE LEARNING ENVIRONMENT

Learners had nine weeks in which to complete the project and spent two hours per week in the computer centre. They could also work during break times on the day that their computer session was scheduled. During the project, learners were asked not to work at home, as the intention was that they did as much as possible during their sessions in the computer centre.

Two adults were with the learners during the project: the researcher, who also participated in the project, and the computer facilitator responsible for the computer centre. The researcher was also their class teacher and they were therefore very familiar with him. Learners could ask the researcher (class teacher), facilitator, members of their group or any member of another group for assistance at any time, similar to projects conducted by Harel and Papert (1991); Kafai (1996) and Neo and Neo (2001:IS).

Each session had more or less the same format:

1. Explanation of what needed to be done. What they should be aware of and be careful about. (3 minutes)
2. Completion of the first part of their Journals regarding goal setting (5 minutes)
3. Participation in the User group on the server where they could voice their problems or ask any question and where other learners could respond to their problems or questions. (5 minutes).
4. Explanation and discussion about any aspects regarding design or computer related skills that was noted during observation by the facilitator and researcher (3-5 minutes)
5. Work either in the library or computer centre individually or in collaboration with any number of members in their group or even with learners of another group. (80-90 minutes)

6. Completion of Journals for the day concerning what they found easy, difficult, problems experienced, whether problems were resolved or not and by whom, if they were resolved, and any other comments that they wanted to make. (5 minutes)
7. Participation in the User group, should they want to. (3-5 minutes)

Collaboration, communication, discovery (discovery learning) and teamwork were encouraged throughout the project and learners could give each other assistance. All of this is in compliance with the proposal put forward by the Government in the User's guide for Curriculum 2005 (DOE, 1997a:IS). The facilitator and researcher (class teacher) tried to make the learning process and atmosphere as enjoyable and non-threatening as possible. Expectations as well as the rules of the library and computer centre were discussed and clearly communicated after consensus was reached of what would be expected of them and the disciplinary actions to be taken should anyone not comply.

3.9 PROCEDURE OF DATA COLLECTION

In this research project, the researcher will be collecting data as indicated in Table 3.3 below:

#	DATA SOURCE	METHOD	DATE & SEQUENCE OF GATHERING	APPENDIX
1	Individual interviews: Set 1	Qualitative	September to November 2002	APPENDIX G
2	Observation / Researcher notes	Qualitative	September to November 2002	NONE: (RECORDED ON TAPE)
3	Learner Journal Writing	Qualitative & Quantitative	September to November 2002	APPENDIX D
4	Task Elicitation Procedure 1 (TEP 1)	Quantitative	August 2002	APPENDIX E
5	Task Elicitation Procedure 2 (TEP 2)	Quantitative	November 2002	APPENDIX F
6	Evaluation and Reflection Sheet	Qualitative	November 2002	APPENDIX I
7	Individual Interviews: Set 3	Qualitative	March 2003	APPENDIX K
8	Group Interviews: Set 2	Qualitative	March 2003	APPENDIX J
9	Task Ranking List (TRL)	Quantitative	March 2003	APPENDIX H
10	Project Assessment Questionnaire (PAQ)	Quantitative	March 2003	APPENDIX L

Table 3.3: Data Collection and associated time frames

3.9.1 INDIVIDUAL INTERVIEWS SET 1 (APPENDIX G)

Structured individual interviews were designed before the research started, based on the ideas of Carver *et al.* (1992), Lehrer (1993), Lehrer *et al*. (1994) and Liu (2002), regarding the framework for hyper-composition-based design and the Cognitive Components of Hypermedia Design (Lehrer, 1993). The hyper-composition-based design refers to the four processes of the instructional model of Lehrer (1993) and the Cognitive Components of Hypermedia Design to design components and the primary skills involved. Added to these categories were learner interest/motivation, classroom and teacher experience and analogy. The interview questions were coded and categorized during the design of the interview questionnaire and grouped accordingly to assist with data analysis. Interviews were conducted only after the project was in progress for three weeks. Some interviews were conducted during the contact session while some were conducted during break times or after school. These interviews were conducted during the project from September to the end of November in 2002.

3.9.2 OBSERVATION

Observation was done as frequently as possible during each contact session. A small Dictaphone recorder was used and all observations were recorded on tape. Observations were recorded whenever there was an opportunity. Sometimes it was not possible to observe all the learners at the same time or even, a small group, as the researcher was a full facilitator as well as a participant and had to assist learners whenever they asked for assistance. When it was possible to record observation notes, what was seen was recorded. Hence some sessions provided for more data collection via observation and other sessions produced less observational data as learners demanded greater attention from the researcher.

The observation notes were not the primary data source, but were used to assist with interpretation. Sacks (cited in Silverman, 2000) suggests that audio recording of fieldnotes is valuable as (1) a person cannot rely completely on human memory for recollections and (2) because it is virtually impossible to take everything down that is being observed. According to Patton (1990:202) observation data assists with description such as (1) the observed setting, (2) the activities that occurred, (3) the participants in these activities and (4) the *"meaning-making"* of what was observed. The aim is thus to enhance understanding of the described situation (Patton, 1990:202). Unstructured observations would make it more difficult to find what it is looking for (Cohen *et al*., 2000) in comparison with a structured or semi-structured observation where categories are predetermined. Hence the researcher used Carver *et al*.'s (1992) cognitive model of design (See Literature Review Chapter) as a guide to record on audio what was seen. In spite of predetermined coding or even extensive preparation, one has to bear in mind that it is not possible to observe everything directly (Patton, 1990:25).

To prepare learners for the observational process, the tape recorder was introduced in class in July 2002, approximately a month and a half before the project started. Learners' viewpoints and

group discussions were recorded in class. At the start, learners were a bit hesitant, but soon learners become familiar and comfortable with the small Dictaphone recording their discussions. This assisted when interviews and observations were done during the project, as it was then less threatening to the learners. All the observations were transcribed.

3.9.3 LEARNER JOURNAL WRITING (APPENDIX D)

Each period started and ended with learners making entries in their journals. This was based on the ideas of Harel and Papert (1991:44-45) and Kafai (1996:75), who used a similar technique. However, in this study, additions were made to the journal entry format suggested by Kafai (1996). Entries at the start of the contact sessions were related to goal setting and entries at the end of each session dealt with what they had learned, problems experienced, whether problems were solved and who assisted, what they found easy or difficult and any other general remarks or reflections about the project.

3.9.4 TASK ELICITATION 1 (TEP 1) (APPENDIX E)

At the start of the project, learners were asked to write down the tasks that they thought that they would have to develop to complete their projects, similar to the research of Lehrer *et al*. (1994) and Carver *et al.* (1992). They also had to record the steps that they took to decide on their topic and had to explain why they decided on this topic. This was done to gather what learners thought was important before the design of a hypermedia computer related project commences. The Task Elicitation Procedure was based on the work of Cantor and Kihlstrom (1987), similar to the research of Lehrer *et al*. (1994) and Carver *et al.* (1992), regarding life tasks and strategies and was completed at the start of the project. Cantor and Kihlstrom (1987), with reference to Little (cited in Cantor and Kihlstrom, 1987), contend that the tasks which a person mentions, are central organizing forces in an individual's behaviour. Hence, the mentioned tasks could indicate which *"forces"* a person values in a project.

3.9.5 TASK ELICITATION 2 (TEP 2) (APPENDIX F)

A slightly different Task Elicitation Procedure (TEP 2) was also completed at the end of the project, based on the research of Lehrer *et al*. (1994) and Carver *et al.* (1992). Learners listed all the tasks that they had to complete to develop their project on the front page of the Task Elicitation List 2. On the following pages, numbered boxes were placed, each containing a section on what had helped and what had hindered them in the completion of the tasks that they had written down on the first page.

3.9.6 REFLECTION AND EVALUATION DATA FORMS (SEE APPENDIX I)

At completion of the project, two Reflection and Evaluation data forms were handed to each group. Each group completed these two forms collaboratively. Group members were encouraged to discuss the questions on the forms and to record the group's response to these questions after consensus had been reached. Open and critical discourses were encouraged

(Taylor, 1993; Dunlap & Grabinger, 1996). Learners were also encouraged to be reflective and assess the process and product (Dunlap & Grabinger, 1996).

3.9.7 GROUP INTERVIEWS SET 2 (APPENDIX J)

According to Lewis (cited in Cohen *et al*., 2000) group interviews assist in the generation of a wider range of responses than an individual interview provides. Cohen *et al*. (2000) note that group interviews are a time saver, as they are often quicker than individual interviews. They continue, stating that group interviews assist to bring people of varied opinions together. Thus it could produce a wider spectrum of ideas than an individual interview. This type of interview might also be less intimidating for children (Cohen *et al*., 2000). Kvale (1996:101,293) adds that group interviews often add spontaneity and lively interpersonal dynamics.

The group interview questions were also constructed based on the ideas of Carver *et al.* (1994). The aim was to follow up on the previous interview (interview set 1) to generate more rich qualitative data, to explore how and why the learners had responded and worked in certain ways and to what Kvale (1996:145) refers to assist with the verification and clarification of [previous] statements [answers] from interviewees and the researcher's interpretations. These interviews were conducted in 2003.

3.9.8 INDIVIDUAL INTERVIEWS SET 3 (APPENDIX K)

Follow up individual interviews were conducted during 2003 to assist with further interpretation. The questions were also based on the design model of Carver *et al*. (1992). The questions were constructed after the journal writing, Task Elicitation Procedures (1 & 2), observational audiotapes and interview set 1 were analysed. The aim was to explore why learners had responded in certain ways during these data instruments and to clarify aspects that were not clear to the researcher, as proposed by Kvale (1996). They also assisted to verify certain responses.

3.9.9 TASK RANKING LIST (APPENDIX H)

A Task Ranking List, based on the work of Lehrer *et al.* (1994) and Liu (1998), was distributed to learners at the end of the project. Learners had to rank tasks related to design from most important to least important. The ranking list consisted of 24 tasks. Learners had to choose the five most important and 5 least important tasks. They then had to rank them in order of greater and lesser importance. Learners wrote down the 5 most important tasks first. Then they wrote down the 5 least important tasks. Only then did they rank the most important tasks from 1 to 5. After this was completed, they ranked the least important tasks from 1 to 5. This model was used to ascertain which tasks were ranked as being most salient.

3.9.10 PROJECT ASSESSMENT QUESTIONNAIRE (APPENDIX L)

Examining which design processes are most salient to learners, is crucial (Lehrer *et al*., 1994; Carver *et al.,*1992). To establish which design processes were important, learners responded to 70-statement project design questionnaire in doing multimedia projects, a self-report of mental activities, similar to the research of Lehrer *et al*. (1994) and Carver *et al.* (1992). A 7-point Likert scale was used with 1= corresponding to a description that the learners thought did not describe them well and 7 = corresponding to a descriptive statement that the learners thought described them very well. The median was used to calculate the response. Figure 3.1 below provides a detailed outlay of the scale:

Beskryf my glad nie						**Beskryf my baie goed**
1	**2**	**3**	**4**	**5**	**6**	**7**
Does not describe me at all						**Describes me very well**

Figure 3.1: Example of scale used in the Project Assessment Questionnaire

This self-report questionnaire on design activities was related to thinking skills that are required for the production of multimedia projects (Lehrer, Erickson and Connell, 1994; Carver *et al.*, 1992; Lehrer *et al*., 1994 and Liu, 1998, 2002). These statements depicted categories of design. Table 3.4 indicates the different categories and the number of thinking skills and number of statements attributed to each design skill:

THINKING- & DESIGN SKILLS	EXAMPLE OF STATEMENTS
PRESENTATION & AUDIENCE	I do not try to present my information in such a way that my audience would easily understand what the topic is about.
COLLABORATION	Overall I feel positive about working with others on a project.
INDIVIDUALIZATION	When I don't understand something, I would rather try and find out for myself than asking for help.
INTEREST & MOTIVATION	Doing projects sure beats listening in class
MENTAL EFFORT	It's hard to know in what order to put my ideas.
PLANNING & DESIGN	I design most of my screens first on cards before I design my screens on the computer.
PRESENTING & CONNECTING (LINKING)	I have designed my links in such a way that people cannot easily make connections between the headings.
PRESENTATION	I think it is important to use illustrations, pictures, photos or AVI Video files in my project.
PROJECT MANAGEMENT	I set goals for myself during the project.
PROJECT MANAGEMENT & TIMELINES	I thought about what I could do to finish on time with my project.
SEARCHING	I use the library to search for information.
COMPETENCE IN SOFTWARE	I do not think it is important to know *FrontPage*, the software that I use to design my project with, well.
EVALUATION & REFLECTION	After I have completed the project, I think a lot how I could improve it in future.

Table 3.4: Examples of design skills in Project Assessment Questionnaire

The project assessment questionnaire was given at the end of the project. The items that were selected were those that were responded to either very positively with a median of 6 or more and those very negatively with a median of 2 or less. Depending on the phrasing of a statement, a response with a score of 1 to 2 could also indicate a positively rated item and *vice versa*. This was carefully taken into consideration during the analysis process.

3.10 ANALYSIS OF DATA

A demonstration version of a computer software package, *MAXQDA*, was used to analyse the data. Codes were assigned in the code system section of the software. Certain codes were pre-determined, based on Carver *et al.* (1992), Lehrer (1993) and Lehrer *et al*. (1994) design model and framework for hypercomposition-based design. The idea was to explore common themes, patterns and regularities as suggested by Yin (1994) and Coffey and Atkinson (1996). When unexpected findings were noted, so-called irregularities or inconsistencies, the data was rigourously re-examined to try and find possible explanations from the data itself (Coffey & Atkinson, 1996:46). This was done to achieve what Coffey and Atkinson (1996:46) refer to as "to move beyond the codes, categories [themes] and data bits back to what the *'whole'* picture is or may be," with a view to look at the data in new and different ways. The importance of coherent

coded data cannot be stressed enough. However, one has to move beyond coding to meaningful interpretation, as coding in it self, is not interpretation (Coffey & Atkinson, 1996; Bogdan & Biklen, 1992), but coding could assists to move towards interpretation. It is indeed this interpreted and meaningful data, that is derived from the coding process, that assists with theorizing and generalizing (Coffey & Atkinson, 1996:47), thus *"speaking to"* the researcher. In order for the data *"to speak"* to the researcher, as well as to the prospective audiences, one should not focus merely on description (the *"what?"* question), but should engage with the *"how?"* and the *"why?"* questions, as it is the last two that assist with interpretation (Chamberlain, 2000:290). During the analysis, careful consideration was given to the above.

All recorded interviews (Set 1, Set 2 and Set 3) were typed by using a Dictaphone machine (See Table 3.3). *Microsoft Word 2000* was used to capture the data. All interview data (individual and group interview data) was imported into *MAXQDA* and coded using the codes in the code system section of the software. Interview set 2 and 3 were used to enrich the quality of the data and to obtain possible clarifications for observation data, journal writing and previous interviewed data to confirm or alter interpretation. The aim was to establish a coherent picture. As the data was read and re-read, additional codes were added to the *MAXQDA* coding system when deemed necessary (See Appendix M regarding coding).

Observation notes were recorded on a small Dictaphone while the learners were busy with the project. All the recorded observational data were typed using a Dictaphone machine and saved in *Microsoft Word 2000* format. Observation data was also imported into *MAXQDA* and coded accordingly, using the same coding system in the software. Likewise, with interview data, codes were added to the coding system whenever necessary.

Journal entries of the learners as well as the data of TEP 1 and TEP 2 were also typed from the learners' completed forms and saved in *Microsoft Word Format*. They was also imported into *MAXQDA* and coded accordingly.

Data from the Reflection and Evaluation data forms were typed in *Microsoft Word 2002* and saved in the same format. Categories were assigned to responses and each group's responses were typed in columnar format next to each other to assist with the analysis process.

The Task Ranking List was analysed by counting how many learners had indicated that that particular task was important or not important. The tasks that were indicated the most number of times, were then selected to interpret which responses received the most votes.

The Project Assessment Questionnaire (PAQ) was analysed by using *Microsoft Excel*. The median function was used to calculate the median. The statements from the PAQ that were selected for inclusion, were those that were responded to either very positively with a median of 6 or 7 and those that were very negatively responded to with a median of 1 or 2. This was based

on a similar approach used by Lehrer *et al.* (1994) during a similar hypermedia design project. The percentage was calculated for those statements that adhered to the criteria. When the median was, for example, 1 or 2 for a statement (Table 3.2), all the 1 and 2's were counted for that statement and the percentage calculated using a total of 22 learners. This gave the percentage of learners that disagreed. All the 6 and 7's were counted for the same statement number and the percentage calculated using a total of 22 learners. All the 3, 4 and 5's of the same statement number were also counted and the percentage calculated using a total of 22 learners. Figure 3.2 below illustrates an example of how the reporting of the PAQ had been done.

				1 or 2 Response	3, 4 or 5 Response	6 or 7 Response
DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
SEARCHING	61	I use the library to search for information.	7	0%	9%	91%

Figure 3.2: Example of reporting the PAQ

Depending on the phrasing of a statement, a response with a score of 1 to 2 could also indicate a positively rated item and *vice versa*. During the analysis process, this was carefully taken into consideration.

All the coded data, codes (See Appendix M) and inserted typed data transcripts could be relatively easily extracted from *MAXQDA* and could even be exported in Rich Text Format (RTF), including line numbering. Searching for any word, a phrase, a certain worded sentence, wildcard words, etc. can also be done. The *MAXQDA* software is also able to do counting of codes, word and phrase occurrences in all the imported data instruments. It was then possible to cut and paste data sections into any groupings that were needed. All necessary functions in the software were used whenever required.

CHAPTER 4

FINDINGS

4.1 INTRODUCTION

In the sections with numbered headings 4.2 to 4.7, the findings relate to the first question: *"What decision-making, research, project management, time management, design, reflection, evaluation, revision skills are developed by learners creating a hypermedia project?"*. In the sections with numbered headings 4.8 to 4.9, the findings related to the second question: *"How does the creation of a hypermedia project encourage collaboration, motivation and interest?"* are discussed. The answers pertaining to question three *"How are these skills related to the critical cross-field outcomes and the specific outcomes in the languages, science and technology curriculum statements in C2005?"* are discussed and indicated throughout the sections.

4.2 DECISION MAKING SKILLS

4.2.1 INTRODUCTION

Decisions have to be made throughout one's life. Hence, providing opportunities for decision-making would relate to the real-life context and would assist in relating the learning process closer to what Dewey referred to as *"life itself"*.

4.2.2 REASONS FOR DECIDING ON TOPIC

At the start of the project, learners were asked to provide reasons in writing for choosing their specific topic. Twenty-six learners responded, providing various reasons. Reasons for their decision are listed below with the number of learners citing each reason:

- Interest (16)
- Enjoy or like topic (12)
- Want to know more about topic (5)
- Have information on topic (4)
- Easy to find information about topic (2)
- Variety of things to do about topic (1)
- Understand topic (1)
- Economical Value of topic (1)

These findings are in line with Blumenfeld *et al*. (1991) who state that elements such as involvement, variety and having access to information could make projects more sustainable and enhance motivation.

4.2.3 STEPS IN DECIDING ON THEIR TOPICS

Learners had to list the steps for deciding on their topic at the start of the project. Interest and appeal were widely cited by the learners as playing a vital role in their selection of a topic The main influencing factors cited by the learners were: availability of knowledge, feelings towards the topic, curiosity, social factors such as friends and group compilation, *"do-ability"*, visual appeal and the opportunity to learn new. Analysing the data provided the following possible reasons in the decision-making process for deciding on their topics as indicated in the Table 4.1 below. In addition, 19 of the 26 learners provided data in TEP 1 that could be used to determine their thinking for decision-making, which is also included in Table 4.1 below:

PATH 1	**PATH 2**	**PATH 3**	**PATH 4**	**PATH 5**	**PATH 6**
Interest	Interest	Interest	Interest	Interest	Interest
Have knowledge about topic	Enjoy or like it	Group will work well together	Exciting	Not too difficult	Don't know much about topic
Enjoy or like it	Temperament of animals	Friends influence	Pretty/Beautiful	Understandable	Perfect opportunity to find out more
X	Felt sorry for them / Felt good about dinosaurs	Lots of information available	Lots of information available	X	X
X	Want to know more	X	X	X	X
REASON FOR DECISION	**REASON FOR DECISION**	**REASON FOR DECISION**	**REASON FOR DECISION**	**REASON FOR DECISION**	**REASON FOR DECISION**
Interest	Interest and feelings	Interest and social factors	Interest and visual appeal	Interest and do-ability	Interest and opportunity to learn more
# OF LEARNERS	**# OF LEARNERS**	**# OF LEARNERS**	**# OF LEARNERS**	**# OF LEARNERS**	**# OF LEARNERS**
7	2	1	2	2	5

Table 4.1: Different ways of decision making

Later in this chapter, Table 4.9 indicates the relatedness between decision-making, research skills and the critical and specific outcomes.

4.3 RESEARCH SKILLS

4.3.1 INTRODUCTION

This was the first computer-supported research project with which the learners were involved. It was also the first time that they had been involved with the designing of a hypermedia computer project, in collaboration with their teacher, for such a long period of time (nine sessions of two hours each).

Research skills were also not something new to them: they had been taught and exposed to basic research and related skills since grade one (The level of research at school, is different for each grade). Since the start of the year (January 2002) until the project commenced in September 2002, learners were involved in small-scale projects. During these projects research skills had been covered again. Thus, it was not research that was new to them during this project, but the manner in which the project and learning would be conducted. Furthermore, the computer-based- and museum environment as part of the learning environment was new to them, as it had not ever been explored at Mount Pleasant Primary School in the same manner as was used during this research.

4.3.2 FINDING INFORMATION: PRIORITY

To find information about their various topics, learners used different avenues. From the journal writing, it became evident that searching for information was a priority during the first two weeks of the project. Of the 26 learners, 61% reported in their journals that searching for information was one of their goals in week one and this number increased to 88% during week two. The Task Ranking Procedure (TRP) confirmed that searching for books containing information about a learner's topic was deemed to be one of the five most important tasks that needed to be done for the design project. As the project proceeded, searching for information became a lesser priority, as only 34% of the learners set it as a goal in week three and week four. In the observation notes it was noted that activity in the library at the start of the project, was high. The highest priority during the first two weeks of the project was the searching process. At the same time, other learners were busy with planning, designing in rough and even planning on the computer, evidence provided when their journals were analysed. This behaviour of the learners was in line with the findings of Lehrer (1993) and Papert (1993) who also found that certain learners approached the designing and planning process differently.

4.3.3 SOURCES USED TO OBTAIN INFORMATION

The Project Assessment Questionnaire (PAQ) indicates that 91% of the learners had searched for information in the library (Table 4.2). The researcher observed that searching for books had been the focus in the library.

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
SEARCHING	61	I use the library to search for information.	7	0%	9%	91%

Table 4.2: Using the library to search for information

However, using the library was not the only place where learners had searched for information. It was observed that learners made use of the Encarta Multimedia Encyclopedia on the computers in the interlinked computer and library center to search for information. Likewise, the interviews confirmed that many learners used books in the library, but also provided further evidence that alternative sources were used to search for information such as the Encarta Multimedia Encyclopedia. This was clearly evident from comments such as this one from Learner 25: *"Meeste van my inligting het ek in die biblioteek gekry … In boeke meneer"* (Translation: I found most of my information in the library … in books sir) and Learner 14 commented that she found most of the information in: *"Encarta en boeke"* (Translation: Encarta and books). Learner 26 confirmed this when he stated: *"Ek het in 'n boek hier in die biblioteek, ek is nie nou seker watter boek nie, so 'n groot leer, en ek het ook die meeste op Encarta gekry"* (Translation: I have found information in a book in the library, I am not sure which one, it is in a file, and I have also found a lot in Encarta).

Books and Encarta were not the only sources. It was observed that the Dinosaur Group used magazines that they brought from home. These magazines were exclusively about dinosaurs. Watching the video to obtain information was also one of their goals mentioned in their journal at the start of the project. For the first two weeks the dinosaur group watched and discussed what they saw on the video. This group planned and decided to follow a different route to find information, a finding that is in line with Lehrer (1993). A possible reason for their approach, could be that they wanted to set the scene for their investigation with a view to ensure that everyone receive the same introductory information on which they then could build further. Learner 13, who brought the video to school, reported in Task Elicitation Procedure 2 (TEP 2) that an important task was that they had to watch the video and collect information as a group: *"As groep saam video kyk en inligting versamel"* (Translation: Watch the video as a group and collect information).

Observation notes indicated that this specific group had been discussing a great deal while watching the video, as one group member repeatedly paused the video when he was asked to do so. This also provides evidence that their whole approach was different from other groups that had gone straight to the library or who had used the Encarta multimedia encyclopedia from the start.

It was expected that many learners would try to use the Internet to search for information as it was thought that the *"fingertip effect"* (Perkins, 1992) would occur: that learners were expected to use the new opportunity that was placed at their fingertips as they had not used the Internet previously in the computer class. As expected, using the Internet as a source to search for information was mentioned several times in the Task Elicitation Procedure 1 (TEP1). However, from Task Elicitation Procedure 2 (TEP 2), it became evident that only 3 learners (11%) tried to use the Internet to search for information. The low percentage could be attributed to the fact that although some learners indicated at the start of the project that they wanted to use the Internet, they could have forgotten to mention that they wanted to use the Internet as TEP 2 was only completed after the project had been completed. In a like manner, the PAQ indicates that 68% of the learners had not used the Internet frequently to search for information (Table 4.3).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
SEARCHING	62	I use the Internet to search for information.	2	68%	18%	14%

Table 4.3: Searching for information using the Internet

This could have been attributed to the fact that it was the learners' first major experience with the Internet on their own. Visiting a website when you have its web address is one thing, trying to locate a website that could contain information that you need by searching for it in a search engine such as http://www.google.com or http://www.yahoo.com is something totally different. Skills are needed to search on the Internet effectively and this could have been a reason for learners not using the Internet to search, as they might have not been able to locate the information that they had needed during their Internet search process. An examination of Task Elicitation Procedure 2 (TEP 2) reveals that this might have been the case, as Learner 26 complained that what hindered him was that there was too little information about his topic on the Internet and Learner 18 added that the Internet was not rendering much assistance.

After all, the behaviour of the learners towards the Internet is not something new as Perkins (1992) has noted that *"the fingertip effect"* seldom happens. This could possibly be attributed to that fact that *"optimal flow"* requires a match between skills and challenges (Webster *et al.*, 1993) and when skills are lacking, the enjoyable state of optimal flow is challenged, because if there is an "appropriate balance of skill and challenge, any activity can be enjoyed" (Reeves, 1996:63). According to Blumenfeld *et al.* (1991) novelty and challenge are motivators. In addition, Reeve (1996) states with reference to the theory of *"optimal flow"* of Csikszentmihaly (1990) that motivation and interest is enhanced when there is a balance between competency (skills) and challenge.

Observation indicated that learners have not yet been able to use search engines like Google (www.google.com) to search for information, or any other search engine, as they are not sufficiently skilled in this area. Learners also commented in their journals that the Internet was not a good source for the easy finding of information as Learner 26 wrote: *"Die internet het nie gewerk nie"* (Translation: The Internet did not work) and Learner 6 reported that information could not be found on the Internet, adding that he lacked the skills necessary to use the Internet. Even though only 14% indicated in the PAQ that they had used the Internet, this does not necessarily mean that they had found something useful.

Thus in future research, another item should be included in the PAQ to assist the researcher in finding what problems are experienced during the searching process. Suggested statements could be "I could find information regarding my topic on the Internet" and "It was easy to use search engines on the Internet to find information about my topic". Questions similar to the suggested statements in the PAQ could also be included during interviews.

Only two learners used interviews with staff at the Museum to obtain information. These interviews consisted of a few questions posed to the staff of the museum. This did not provide much usable information initially, but progress was made later as Learner 22 stated in TEP 2 that: *"Hierdie een was 'n bokker maar dit was ook lekker mense het ons gehelp. Daar was min mense wat geweet het oor seeperde maar daar was toe iemand wat uitgekom het vir ons"* (Translation: This was really difficult, but also nice, as people have helped us. There were few people who knew about seahorses, but there was one found later who was helpful). Another learner working on crocodiles, Learner 4, commented that she did obtain information from the interviewees, but that they conveyed the information too fast: *"Ek het vrae gevra by verskillende mense Hulle gee die inligting te vinnig"* (Translation: I posed questions to various people. They supply the information too fast).

A possible explanation why only two learners indicated that they had used the interview method, was that although learners were made aware of its possibilities, they were not taught the necessary interview skills such as how to contact people for an interview, how to conduct an interview, ways in which they could gather the data during the interview and what kind of questions they should ask. It is proposed that before such a project is undertaken in future, that learners would have to be exposed to interviews as a data-gathering tool and to the related interview skills.

It is proposed that in future research another item should also be included in the PAQ to assist the researcher in establishing why many learners had not used or had used interviews as

information gathering tool. During interviews, questions related to why or why not learners had used interviews as data and information gathering tool should also be included to try to assist the researcher in establishing reasons for using the interviews as data gathering tool, or choosing not to.

It was observed that some learners searched for books using the card catalogue index. Others went directly to the shelves as the Dewey number and subject were clearly indicated by huge labels on top of each shelf. Learner 6 commented in TEP 2 that what helped him to search for books in the library was: *"Die biblioteek se kassies [kaartkatalogus] wat gesê het waar die boeke is* " (Translation: The card catalogue in the library which indicated where the books can be found in the library) but also added that it hindered him as it: *"Vat baie tyd, maak my moeg"* (Translation: took a lot of time and it makes me tired). Others paged through the located books looking for headings referring to their topics or used the index or contents page to ascertain whether they would find applicable information. It seems that learners had the basic skills for locating and searching for books in the library. However, in future, learners should be made more aware of the card catalogue and its value as well as practical hands-on experience in using this tool.

4.3.4 THE RESEARCH PROCESS: LEARNER EXPERIENCES

An analysis of TEP 2 indicated that 65% of the learners regarded the selection, locating or research of information as important. The PAQ indicates that 59% of the learners felt that they had to spend a lot of time on searching for information, as indicated by Table 4.4 below. At the same time, 41% of the learners indicated that they were uncertain. Their uncertainty could be attributed to the fact that some learners thought that they had to spend time on searching for information, but was uncertain what the "a lot of time" phrase in the statement meant. They could have interpreted their disagreement with the statement, as indicating that they had not spent any time on searching. Thus, indicating that they were uncertain, could illustrate that they had spend time searching for information, but not necessarily a lot of time.

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
SEARCHING	6	I spend a lot of time finding information for the project.	6	0%	41%	59%

Table 4.4: Time allocated to searching for information

In support of this interpretation, an analysis of the weekly journal writing indicated that during the first two weeks, searching for information was a priority. During week one, 62% of the learners indicated that it was a priority and 88% during week 2. However, from week three the priority was less, as only 31% indicated it as a goal during week three and four. In a like manner, it

became a less important goal as only 15% and 8% of the learners respectively stated that it had been as a goal during weeks five and six (Table 4.5).

WORKING DATE	PERCENTAGE OF LEARNERS SETTING GOALS RELATED TO THE FOLLOWING TASKS IN JOURNALS					
	Search for Information & Summarize	Planning	Design or Plan pages in rough	Design on computer	Finish Design	Edit and/or rounding design off
13 Sept 2002	**62%**	19%	15%	8%	0%	0%
18 Sept 2002	**88%**	15%	19%	15%	0%	0%
27 Sept 2002	**31%**	15%	0%	31%	8%	0%
11 Oct 2002	**31%**	0%	15%	58%	4%	4%
18 Oct 2002	**15%**	0%	0%	50%	8%	8%
25 Oct 2002	**8%**	0%	0%	35%	15%	4%
08 Nov 2002	0%	0%	0%	62%	62%	15%
15 Nov 2002	0%	0%	0%	42%	54%	38%
29 Nov 2002	0%	0%	0%	12%	31%	19%

Table 4.5: Learners setting goals related to tasks in their journals

Likewise, a further analysis of their weekly journals indicates that time was allocated and spent on other tasks, such as planning in rough, designing on computer and editing during the beginning of the project. This again illustrates that although time was spent on searching, a lot of time had also been spend on other tasks, as indicated in Table 4.5. At the same time 73% of the learners indicated in the PAQ that they thought that they knew where to find relevant information for their projects (Table 4.6).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
SEARCHING	65	I never know where to find good information for my project.	1	73%	27%	0%

Table 4.6: Knowing where to find relevant information

Learners seemed to respond positively towards finding information, as it was mentioned several times in their journals. This would seem to indicate that they did not struggle to find relevant information. Samples of their responses to what they found easy in their journals, were:

- Finding info as I am getting used to it (Learner 23)
- Finding books (Learner 3 & 5)
- Finding Information (Learner 26)

- Finding info (Learner 13)
- Easy to find info in library (Learner 4)
- Easy to find info (Learner 23)
- Easy to find books on dinosaurs (Learner 10)

The interviews portrayed a picture that learners had experienced some difficulties in searching for information. This became evident during an interview, when the Maritime Group was asked what they did not enjoy. They commented that finding information in the school's library was not easy. Learner 6 and 8 of the Maritime Group had stated that searching for information was difficult. This was based on their experience, as they could not find the information that they were looking for. They commented: *"*Om *inligting te soek, meneer, want party van die plekke het nie inligting nie"* (Translation: Searching for information sir, because some of the places do not have information). Likewise, Learner 18 concurred with their view that searching and finding information about his topic (The Peacock) was difficult. He mentioned several times in TEP 2 that he had experienced difficulties searching for information when he wrote: *"Baie probleme om meer inligting vinnig te vind. Baie boeke gesoek maar te min inligting. Moeilik om inligting te versamel. Gaan biblioteek toe, amper niks inligting. Inligting baie moeilik om te kry. Encarta besoek, maar Encarta het, maar weer eens te min"* (Translation: Had many problems [difficulties] finding information fast enough. Searched for many books, but very little information found. It is difficult to find information. I go to the library, but nearly no information available. Information is difficult to find. I visited Encarta Multimedia Encyclopedia, but again very little information available).

To circumvent their above-mentioned problem, it was observed that the Maritime Group then started to zoom in with a Photo Editor software package on photos that were taken in the museum in the maritime room. They discovered that they could use the photos taken in the museum as a source of information. These photos were photos of information, which were displayed alongside the exhibit. Indeed, this portrays great initiative and a creative way of solving their problem.

Although Learners 3 and 5 commented at some stages in their journal writing that they did find searching for information easy. They often contradicted this when they also wrote in their journals that: *"Die projek raak te veel vir my, maar ek probeer positief bly"* (Translation: The project gets a bit too much for me, but I try to stay positive). These two learners were in the same group and worked together. Their feelings and comments were also confirmed in TEP 2 when they stated that one of the problems that they had experienced during searching for information was: *"Ek kon nie baie van die skilpad se eetgewoontes kry nie"* (Translation: I could not find much regarding the tortoise's eating habits), and *"Dit het baie lank gevat, want daar was*

baie min inligting daaroor in die biblioteek" (Translation: It took a long time as there was not much information available in the library). As the library did not provide them with what they were searching for, they consequently tried Encarta Encyclopedia on the computer, but struggled also with this as demonstrated when they wrote that: *"Dit was moeilik, want ons het nie geweet wat om te doen nie"* (Translation: It was difficult as we did not know what to do) and *"Ek het helploos gevoel, want ek het nie geweet wat om te doen nie"* (Translation: I felt helpless as I did not know what to do). It was observed that these two learners stayed away from the computers as long as possible and worked mainly in the school library, as an informal interview during observation provided evidence that they felt *"jittery"* about working on the computer. In addition, further interviews portrayed the same picture, that they were nervous to use the computer. This was illustrated when they commented during an interview that: *"Ek is bietjie skrikkerig want ek is bang ek doen iets verkeerd maar ek weet ook nie hoe alles lekker werk nie"* (Translation: I am a bit nervous because I am scared in case I do something wrong, but I also do not know how everything works) and Learner 3 in a like manner added that: *"Ek weet nie waar om alles te kry op die rekenaars nie, en ek weet ook nie baie goed hoe om met rekenaars te werk nie"* (Translation: I don't know where to get everything on the computers and I also don't know a great deal of how to work on the computers very well). Similarly their fear of computers became again evident in TEP 2 when they wrote that what hindered them was: *"Ons het nie lekker geweet wat op die rekenaar aangaan nie, ons was 'n bietjie bang vir die rekenaar"* (Translation: We did not really know well what goes on on the computer, we were scared of the computer). From TEP 2, it seems that they eventually did find information in the library as Learner 3 wrote that: *"Ons kon nie baie inligting kry die 1ste keer, maar toe kom ons reg"* (Translation: We could not find much info when we started, but later we did).

To conclude, searching for information seems to be a problem for some learners. On the other hand looking at their end products illustrated that they had found information, as their screens portrayed this. Although some screens of certain learners had more information than others, this would not necessarily indicate that learners had not found much information. A study of Garthwait (2001) revealed that the text on screen does not necessarily indicate how much a learner has learned and how much information has been located. Garthwait (2001) discovered during an interview that a learner, who had not much text on his hypermedia-designed screen, had in fact knowledge about the topic on the screen. Hence she warns teachers not to be necessarily influenced by what they see, but recommends that interviews might provide an alternative to illustrate what a learner really knows. For this reason one has to be careful to jump to conclusions by looking at the final products only, but should rather analize all the data. Although learners indicated that they found finding information as being difficult, this does not indicate after all that they did not found information eventually.

As a result of what has been found, it is recommended that particular emphasis be placed on the development of search skills before and during such a project to alleviate this perceived problem. According to Taylor (1993) dialogue between teachers and learners should not be underestimated in enhancing learning and to assist with teaching (Taylor, 1993). As not all learners have the necessary research skills, dialogue between teachers and learners could provide the ideal opportunity to discuss to what research skills learners feel competent about and what skills would need to be taught.

4.3.5 INFORMATION FOUND: WHAT NOW?

The PAQ illustrates that 55% of the learners thought that they could not use all the information that they had located (Table 4.7). In contrast, 41% indicated that they were uncertain. This could mean that these learners felt that they could have used most of the information most of the times, but that they had to think carefully whether they wanted to use the information that they had found or whether they did not want to use it. Thus it could indicate that these learners did not want to select an extreme value on either side. However, the PAQ might provide evidence regarding the relationship of usability between information located and the topic of the learner, as there is only a 9% difference. As 55% indicated that they could not use all the located information, 64% indicated that the information located usually had something to do with their topic (Table 4.7). This indicates a very close relationship.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
SEARCHING	53	I find that I can use every bit of information that I collect.	1	55%	41%	4%
	83	The information that I usually find has nothing to do with my topic.	1	64%	32%	4%

Table 4.7: The value of the information found

In spite of the portrayal above that learners could not use all the located information, but that the located information was relevant to the topic in most cases, learners were not deterred and continued with meaning making of the sources. This became evident in the PAQ in which 91% of the learners indicated that they do make notes on what they had read (Table 4.8).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
SEARCHING	33	I make notes about the content that I read.	6	0%	9%	91%

Table 4.8: Making notes during the search process

It was observed that when relevant sources were located, many learners translated information from English to Afrikaans. In a like manner, interviews indicated that learners had translated the located information into Afrikaans. Learner 6 and 8 stated: *"As dit Engels is, vertaal ons dit eers. As dit Afrikaans is skryf ons alles wat belangrik is dadelik neer"* (Translation: If the information is in English, we translate it to Afrikaans. If it is in Afrikaans, we immediately write what is important). Translation of English to Afrikaans was particularly evident as most of the sources in the library were in English. A few learners mentioned in their journals that they had to translate information and found it to be difficult as well as time consuming. To make it more comprehensible, learners translated into their own mother tongue in their own words, words that made sense to them. This was indeed the case as Learner 6 and 8 commented during an interview that: *"Meneer ons gebruik ons eie woorde"* (Translation: Sir, we use our own words) and Learner 20 and 21 likewise stated that: *"Ons gebruik meestal ons eie woorde"* (Translation: We used mostly our own words).

Some learners used keywords to summarize, as Learner 26 stated: *"Ek som dit op en dan maak ek net die sin reg wanneer ek op die rekenaar werk"* (I summarize the information and when I type the sentence on the computer, I correct it in order to make sense). This was confirmed by Learner 18 who stated that she used keywords to summarize: *"Ons som dit op op sulke klein blaadjies, want ons wil nie elke liewe woord neerskryf nie, so ons gebruik kort woorde"* (Translation: We summarize on small pages, because we do not want to write down every blessed word, so we use short words) and Learner 25 added *"Ek skryf net die hoofwoorde neer meneer* " (Translation: I only write the main words sir).

Although it seemed that learners could manage the translation process, there still seemed to be a number of learners who had struggled. Based on the work of Lehrer (1994) and Liu (2002) it becomes evident yet again that we cannot expect learners just to *"have"* the necessary skills such as using a dictionary with a view to translation from one language to another. Skills such as translating need to be taught and practiced. This is indeed what should be done to a greater extent with the participants during this project. It would be helpful in projects of a similar nature if learners have been involved in translating texts.

4.3.6 VALIDATION OF RETRIEVED INFORMATION

During the interviews, it became evident that learners believed that information sources, for example books, are always truthful and reliable sources. When they were asked how they decided whether their information was accurate, truthful and relevant; Learner 1 responded that he believed everything that he had located in his sources and Learner 26 responded, *"… want ek ken nogal visse, die Geelbek en die Grunter en ek dink nie boeke sal sommer vir my lieg nie"* (Translation: because I know my fishes quite well and I don't think books will tell lies). As

Learner 1 had done a project on snakes before, a possible explanation for his response that he did not question his sources could be that he had acquired enough information previously to validate the information he had selected from his sources. That he had enough information was indeed confirmed when he stated during an interview that: *"Soos die projek wat ek Pietersburg gedoen het. Ek moes dit net op papier doen, en prentjies kry"* (Translation: Like the project at Pietersburg that I had to do. I had to do it on paper and had to find pictures).

Interviewed learners responded that they validated located information by trying to compare it with another, similar source covering the same topic, as Learner 14 stated: *"Want gewoonlik is daar twee van die boeke wat dieselfde sê"* (Translation: There are normally two books that supply the same information about the topic). Learner 6 and 8 used each other to check whether they differed on the truthfulness and reliability of located information about their topic and also used their peers to assist by reading their information and then giving their opinions about it. One learner even used his parents, as Learner 4 replied to the question whether she believed all that she found or read in books regarding her topic: *"Nee, ek gaan vra my ma of pa of hulle dalk weet"* (Translation: No, I ask my mother or father if they perhaps know). Learner 20 and 21 stated that they used a kind of cross-referencing by comparing sources when they stated that*: "Partykeer gee hulle [verskillende boeke] dieselfde inligting en dan skryf ons dit neer"* (Translated: Sometimes they [the books] presents the same information and then we write it down). This seems to illustrate that some learners had developed a valuable skill (cross-referencing) for future usage on a higher academic level, such as at university. In spite of what they had said, they quickly added during the interview that whenever they found discrepancies between two sources, they used the first book as the one containing the correct information or the one that they thought was correct. This was illustrated when they said during an interview that: *"Dan skryf ons maar die een wat ons eerste gekry het of wat ons dink reg is"* [Then we write the one that we had found first or the one that we think is correct). In spite of their initial response, their second response indicated that they might have an elementary understanding of cross-referencing; on the other hand they were lacking the skills of cross-referencing to really use it confirm the authenticity and accuracy of information.

It is recommended that learners should be introduced to the value of cross-referencing as well as to how it should be approached. These are necessary skills for deeper understanding and validation of information. To assist in future research, researchers are encouraged to formulate questions to probe how learners validate information with a view to assisting the researcher in helping those learners who do not know how to use this technique or at what level they can use it.

4.3.7 RESEARCH AND DECISION MAKING SKILLS RELATED TO CRITICAL AND SPECIFIC OUTCOMES

Table 4.9 below, provides a summary of the research and decision-making findings related to the critical and specific outcomes.

CRITICAL OUTCOMES	RESEARCH PROVIDES ANSWERS TO THESE QUESTIONS	SPECIFIC OUTCOMES: SELECT THE ONES TO BE ASSESSED
Collect, analyse, organize & critically evaluate information. Identify and solve problems by means of critical and creative thinking by asking themselves: • How can I learn about this topic? • What sources do I need? • Where can I find the information? • Are there any other sources except books that I can use? • Is it truthful? In the process, Employ effective learning strategies, as a critical outcome is also addressed. Work effectively with others as a memember of a team, group, organization, community • Who can assist? • How do we engage in fruitful conversation?	**RESEARCH SKILLS** Where to find the information? What skills do we need to do this well? • Library: Card catalogue and Shelves • Computer: Searchable multimedia encyclopedia • Knowledgeable people • Other media: Television & video What sources could be used? • Books • Magazines • Computer Multimedia Encyclopedia • Internet • Video • Interviews What do learners do with information? • Summarise in own words • Summarise by writing down a key word How is information validated? • Use cross referencing • Ask someone who knows (so-called expert) • Validate with own existing knowledge **DECISION MAKING (PLANNING) SKILLS** What is the problem? How can I solve (address) the problem? What is my topic? Why have I chosen this topic?	**LANGUAGES (Investigations)** SO 1 Learners make and negotiate meaning and understanding • AC3 Meaning is created through reading and inferences are made from texts • AC4 Meaning is constructed through interaction with other language users • AC8 Reasoned arguments about interpretation of meaning are developed SO 2 Learners show critical awareness of language usage • AC5 The manipulative uses of language and text are identified, analysed and responded to effectively • AC6 Visual and other non-verbal/non-manual features of texts are identified and analysed • AC7 Ideologically driven and biased language is identified, analysed and responded to effectively SO 4 Learners access, process and use information from a variety of sources and situations • AC1 The information need is defined • AC2 The aim of the information search is defined • AC3 Information is located, accessed and selected • AC4 Accuracy and relevance of the information is evaluated • AC5 The reliability of the information is ascertained • AC6 Organisational skills are applied • AC7 The difference between fact, fiction and bias is identified • AC8 Reasoned arguments are developed in the course of applying information • AC9 The results of the information search and processing are presented • AC10 The relevance of the information search is evaluated

		• AC11 Awareness of the value of informed decision making • AC12 The ability to integrate new information into existing knowledge • AC13 To apply newly acquired knowledge **TECHNOLOGY** SO 1 Understand and apply the technological process to solve problems and satisfy needs • AC1 Identify and explain problems and needs • AC2 Make an informed decision **SCIENCE** SO 1 To use acquired skills to investigate phenomena associated with the Natural sciences • AC1 Identify phenomena • AC2 Identify research questions • AC4 Collect data • AC5 Analyse, evaluate and interpret the data • AC7 Identify phenomena and ask questions • AC8 Analyse situations and formulate research questions • AC9 Observe • AC10 Formulate hypothesis • AC11 Predict • AC12 Put together a plan of research action

Table 4.9: Critical Outcomes & Specific Outcomes that could be achieved during the searching process

4.4 PROJECT MANAGEMENT SKILLS

4.4.1 INTRODUCTION

Project management, in this research context, refers to the formal group discussion(s) of tasks assigned to each member of the group, the informal acceptance of tasks to be undertaken, individual planning activities such as the journal writing process, which was actually an external attempt to help learners to think about planning. Carver *et al.* (1992:388) define project management as the assigning of roles to particular members of the team for example: who will do what and when and collective (collaborative) planning.

4.4.2 COLLECTIVE PLANNING OF PROJECT

The PAQ indicates that some thinking occurred about project management. Although the median of statement 29 falls outside the defined criteria for inclusion (See Chapter 3, section 3.9 and 3.10), it was decided to include it as it provided evidence about the planning of tasks for which individuals would be responsible. Statement 40 was included as it refers to group planning. “Planning as a group” refers to all the tasks or things that have to be done collectively.

It does not necessarily mean that a task has been allocated to one person only, but rather that discussion has taken place.

Only 37% of the learners (Table 4.10) indicated that team-discussion related to what each person should do, had occurred. At the same time 13% of the learners indicated that this did not happen. These low percentages on both sides could indicate that learners need more assistance in collective planning and in assigning roles to assist with their project management. In contrast to statement 29, discussed above, planning regarding what the group should have done, showed a significant increase, as 59% of the learners indicated that they had done a lot of planning in their groups about what they should do. The 27% of learners that indicated that they were uncertain might have indicated that they did "some" planning but not a "lot" or could even have responded in this way because they were uncertain of how to respond to this statement, as it is slightly ambiguous (Table 4.10).

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PROJECT MANAGEMENT	29	We discuss a lot in our team what each person should do.	5	13%	50%	37%
	40	We have done a lot of planning in our group about what we should do.	6	14%	27%	59%

Table 4.10: Project Management and Planning Collectively

In support of the findings from the PAQ above, the interview data also confirms that very little collective planning occurred. Collective planning that occurred referred mainly to ensuring that more than one learner did not choose the same topic and to planning very broadly what should be done. This became evident during the interview process when the teacher asked learners: "Have you at any time assigned different roles to each person regarding what he/she should be responsible for?" Learner 17, a member of the Bird Group replied that: *"Ja, ons het saamgekom en besluit wie wil wat doen, sê nou ek wil arende doen en Leerder 15 wil poue doen, ens."* (Translation: Yes, we got together and decided who wanted to do what, for instance I want to do eagles and Learner 15 wanted to do peacocks, etc.).

Learner 10 of the Dinosaur Group replied: *"Ons het een keer bymekaar gekom en gesê dit is wat ons nou gaan doen en dit wat ons later gaan doen"* (Translation: We got together once and said this is what we are going to do now and this is what we are going to do at a later stage) and elaborated that: *"Leerder 11 moes eers die inhoud van die hele ding, en Leerder 13 moet die video doen en ek en Leerder 12 moes ander dinge doen soos kyk of dit reg lyk en so"* (Translation: Learner 11 had to compile the contents of the whole thing, and Learner 13 had to

provide the video and Learner 12 and I had to do other things such as checking whether it looks right and so on).

In TEP 1, only 38% of the learners mentioned that planning and planning collectively were important aspects of such a project. This figure increased marginally in TEP 2 as 42% mentioned or made reference to planning. These references include the following statements of learners as indicated in Table 4.11 below:

TASK ELICITATION PROCEDURE 1	TASK ELICITATION PROCEDURE 2
PLANNING COLLECTIVELY • *"Beplanning"* [Translation: Planning] (Learner 2)	**PLANNING COLLECTIVELY** • *"Saam beplan wie gaan wat doen"* [Translation: Planning collectively who is going to do what] (Learner 7) • *"Mekaar help"* [Translation: Assist each other] (Learner 7)
BRAINSTORMING • *"Idees uitruil en 'Brainstorm' "* [Translation: Exchange ideas and brainstorming] (Learner 14) • *"Moet mekaar se idees skommel"* [Translation: Must discuss or brainstorm each other's ideas] (Learner 26)	**BRAINSTORMING** • NO REFERENCE MADE
DIVIDE WORK AMONG MEMBERS • *"Die werk moet opdeel"* [Translation: Must divide work] (Learner 25)	**DIVIDE WORK AMONG MEMBERS** • *"Beplan, die hele groep"* [Translation: Plan, the whole group] (Learner 24) • "S*ê wie gaan wat doen"* [Translation: Discuss who is going to do what] (Learner 26) • *"Beplan, ons het almal besluit wat ons moet doen"* [Translation: Planning, we decided what each one should do] (Learner 9) • "Keuses maak" [Translation: Making choices] (Learner 20)
RESPONSIBLE TO FINISH YOUR PART OR SECTION ON TIME • *"Almal moet hulle dele doen"* [Translation: Everyone must do their section (Learner 26) • *"Almal moet hul goed betyds reg hê"* [Translation: Everyone must have their work ready on time] (Learner 6) • *"Jou deel klaar te maak van die werk"* [Translation: Finish your section of the work] (Learner 7)	**RESPONSIBLE TO FINISH YOUR PART OR SECTION ON TIME** • NO REFERENCE MADE

Table 4.11: Learners reference to planning in Task Elicitation Procedures

A question arises: What could possibly cause the lack of collective group planning?

Firstly, from analysing the responses of the Reptile Group, it seems that some members feared that they would have to work on the computer and thus tried not to be involved in collective planning. As a result, the assigning of roles happened without discussing or planning among

group members. Collective planning happened for two learners, Learners 3 and 5, who decided on their own that they would rather search for information in the library than work on the computer, as the computer intimidated them. Learner 5 explained that planning in the group context was not well organized when she stated that: *"Ons het nie regtig besluit ons gaan in groepies deel nie, elkeen het sy eie ding gesê wat hy wil doen"* (Translation: We did not really decide to work in groups, each one has said what he wanted to do). This has happened, as these two learners did not really want to use the computer as they felt that they did not have the necessary skills. Furthermore, they also did not want to learn how to use computers as Learner 5 stated: *"Ek en Leerder 3 het gesê dat ons nie eintlik op die rekenaar wil werk nie en het nie geweet hoe dit werk nie en wou ook nie rêrig leer hoe om dit te werk nie. En toe besluit ons om vir almal die inligting te kry wat hulle nodig het, en toe doen ons dit."* (Translation: Learner 3 and I said that we did not really want to work on the computer and that we did not know how it works and did not really want to learn how to use it, either. And then we decided to search for the information that everyone needed and then we did it.)

Secondly, seven learners were absent during the first session (13 September 2002) as they had participated in a flower arrangement competition. This could have contributed to less collective group planning as Learner 13 wrote in TEP 2 that something that hindered him was that everybody was not available for planning. Thus some learners in some of the groups could have planned on their own. This indicates how important it is that all group members have to be present throughout the project.

Thirdly, from the PAQ above (Table 4.11), it seems that learners need much more assistance with collective planning and the assigning of roles to assist them in their project management.

Fourthly, all learners do not engage with planning in the same way (Turkle & Papert, 1991). *"Hard-thinking"* planners would carefully plan every step before the project commences whereas *"soft-thinkers"* or *"bricoleurs"* would develop their designs as they go along (Kafai, 1996). *"Hard-thinking"* and *"soft-thinking"* can also co-exist in the same person (Kafai, 1996).

4.4.3 REFLECTION ON THE COLLECTIVE PLANNING PROCESS

Although the desired level of collective planning was not achieved as expected, it did serve to alert learners to the importance of collective planning before the commencement of the project. Assessment as a tool could be used to support and enhance learning (Shepard, 2000) and from the data, it seems that the reflection process has made learners more aware. Thus, in the process, not only has the teacher learned that much more attention should be given to project management should similar hypermedia design projects be undertaken in the future, but learners become aware of its importance too. That learners reflected on the planning process

and the assigning of roles is clear from Learner 2 and 4 of the Reptile Group who replied during an interview that they would change the planning process should they be involved in a similar project:

> *"Ons sal saamwerk as 'n groep op een ding en nie apart nie."* (Learner 2) (Translation: We will work together as a group on one aspect and not separately).

> *"Ons pligte sal wees, een moet inligting soek, een moet op die rekenaar werk, een moet die screens probeer design, een moet die tikwerk doen. Miskien kan een vinniger tik en die ander een weet weer meer oor rekenaars (uitleg)"* (Learner 4) (Translation: Our tasks would be: one must search for information, one must work on the computer, one must try to design the screens, one must do the typing. Maybe one can type faster and the other one knows more about computers [designing]).

> *"Ons beplanning was nie eintlik so goed nie. Learner 1 het sommer dadelik begin, ek en Leerder 2 het eers beplan wat ons gaan doen op die rekenaar. Partykeer het ons nie reg beplan nie."* (Learner 4) (Translation: Our planning was not really good. Learner 1 started immediately, Learner 2 and I planned first what we are going to do on the computer. Sometimes we did not plan correctly).

Better planning for future projects was also evident in the Recommendation, Evaluation and Reflection Forms that learners completed at the end of the project. This was evident when groups replied to the question; "Would you do a similar project in the same way next time? If NO, what would you change or do differently next time?":

> *"Ja, ek [ons] sal dit dieselfde doen, maar net 'n bietjie beter beplan"* (Dinosaur Group) (Translation: Yes, we would do it in the same way, but we would plan a bit better).

> The Dinosaur Group replied and the Marine Life Group echoed it when they stated that:

> *"Ons sal 'n bietjie verander. Ons sal eers met mekaar bespreek wat almal moet doen. Ons sal reg doen wat ons laas keer foute in gemaak het."* (Marine Life Group) (Translation: We would change a bit. We would discuss first what we should do. We would rectify the aspects in which we made mistakes).

4.4.4 INDIVIDUAL PLANNING

Although planning as a group and the assigning of tasks to group members, did not seem to be a high priority, individual planning and the setting of goals by learners were a high priority.

An analysis of the journal writing (Table 4.12), illustrates that goal setting referred to many different aspects and tasks right through the project. It also indicates that different types of goals relating to different aspects and tasks, were set at different stages. For example, during the first four weeks goals referring to the search process seem to be important, but as the project commenced, the searching-related goals became less important. Such goals related to designing on the computer, to finishing the project and to editing and rounding off the design, were not a high priority at the start, but their importance increased towards the end of the project (See bold emphasis in Table 4.12).

WORKING DATE	PERCENTAGE OF LEARNERS SETTING GOALS RELATED TO THE FOLLOWING TASKS					
	Search for Information & Summarize	Planning	Design or Plan pages in rough	Design on computer	Finish Design	Edit and/or rounding design off
13 Sept 2002	62%	19%	15%	8%	0%	0%
18 Sept 2002	88%	15%	19%	15%	0%	0%
27 Sept 2002	31%	15%	0%	31%	8%	0%
11 Oct 2002	31%	0%	15%	58%	4%	4%
18 Oct 2002	15%	0%	0%	50%	8%	8%
25 Oct 2002	8%	0%	0%	35%	15%	4%
08 Nov 2002	0%	0%	0%	**62%**	**62%**	15%
15 Nov 2002	0%	0%	0%	**42%**	**54%**	**38%**
29 Nov 2002	0%	0%	0%	**12%**	**31%**	**19%**

Table 4.12: Learners setting goals related to tasks

The PAQ confirms that 73% of the learners used the journal writing to set goals for themselves to complete the project (Table 4.13). Not a single learner indicated that they did not set goals for themselves. Learners felt that the journal writing assisted them to achieve the goals that they had set for each period, as 73% of the learners agreed with this statement. A possible explanation of why 27% indicated that they were uncertain could be that they felt that they did not achieve all their goals every time, but did not want to be in total disagreement. In support of the above, an analysis of their journal writing indicates that many learners did not achieve all the goals that they had set for each period. Furthermore, it seems that learners could have

interpreted statement 4 in a similar manner, as 68% indicated that the journals had helped them, but 28% of the learners were uncertain. Thus the latter learners could have come to the conclusion that because they had not reached all of their goals every time, they could not indicate that the journals had not helped them at all. In the light of this ambiguity, it is recommended that the negative phrasing and word usage of statements should be reconsidered and carefully revised for future research.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PROJECT MANAGEMENT	41	I set goals for myself during the project.	6	0%	27%	73%
	36	I do not achieve the goals that I set for each period.	2	73%	27%	0%
	4	The Journal that I have completed every week did not help me at all.	2	68%	23%	9%

Table 4.13: Journal writing and Goal setting

In addition to the PAQ, learners were aware of the value of the journal writing as it assisted them to plan (setting their goals for each session), to decide whether they had achieved their goals, to identify what they had learned and also made them aware of the problems that they experienced and whether they were solved or not, with a view to future planning. This became evident when learners stated during interviews when they replied to questions related to goal setting, journal writing and planning that:

> *"Dit was eintlik vir my lekker, want jy weet miskien wat jy wil doen en die doelwitte wat jy wil stel. En dan kyk jy net op die blaadjie en dan weet jy dit is doelwitte wat jy gestel het."* (Learner 4) (Translation: It was actually nice, because you know what you want to do and the goals that you want to set. Then you look at the goals you have set on the paper and you know what your goals are).

> *" … dit help jou om vas te stel waar jou probleme lê en wat jy nog alles moet doen. As jy net hier inkom en begin werk, het jy nie eintlik 'n doel met wat jy wil bereik die dag nie. Jy skryf wat jy wil doen die dag en dan kyk jy of jy dit kan klaarmaak."* (Learner 6) (Translation: … it helps you to ascertain where you experience problems and what you have to do. If you just enter, you don't really have an aim that you do want to achieve for the day. You write what you want to do for the day and then you can see if you can finish it).

It was observed that some learners did not enjoy the completion of the journals at the start and end of each session in the integrated Computer Media Centre. This pattern was also evident

during interviews as learners replied that they found journal writing tiring, boring, annoying and something that wastes time. This was evident when they replied to the question; “Did you enjoy the journal writing?” that:

> *“Ek het begin moeg raak daarvoor want elke Vrydag was dit dieselfde en dieselfde en ek het later nie meer geweet wat om in te vul nie.”* (Learner 3)
> (Translation: I started to get tired completing the journal as it was the same procedure every Friday and later I did not know what to fill in).

> *“O, ek het nie eintlik daarvan gehou nie want dit is bietjie “boring” elke keer en dit het van ons tyd gemors, waar ons meer tyd kon gehad het.”* (Learner 2)
> (Translation: Oh, I did not really enjoy it, because it was a bit boring each time as it wasted our time because we could have had more time [to work on the project]).

Table 4.17 provides a summary of the relatedness between the critical-, specific outcomes and project management at the end of the time management section that starts below.

4.5 TIME MANAGEMENT SKILLS

4.5.1 INTRODUCTION

It is fair to say that most projects have a deadline by which the project must be completed. Thus learners have to be made aware that they do not have infinite time on their hands to complete a project. The deadline should be established early, as this this influence planning (Alessi & Trollip, 2001:530). To facilitate planning, Alessi and Trollip (2001) recommend that time management could start with the final deadline and then work backwards by setting interim deadlines.

4.5.2 MANAGING TIME: TIMELINES

Before the project started, learners were made aware of the importance of planning and time management. Time management is a skill that is taught at school from a young age in order to finish homework and projects on time. For preparation for assessment weeks at school, learners are taught how to plan in advance by setting time tables.

Although the median of statement 17 falls outside the defined criteria for inclusion (See Chapter 3, section 3.9 and 3.10), it was decided to include statement 17 as it provides evidence about their attitudes and thinking regarding timelines. The PAQ (Table 4.14) confirms that the creation of a timeline was not a high priority for the learners. Analyzing the responses of learners towards

timelines, 32% of the learners who completed the PAQ indicated that they did create a timeline to assist in planning. However, 50% of the learners indicated that they did not create a timeline.

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PROJECT MANAGEMENT AND TIMELINES	17	I created a timeline to assist me in planning to finish my project on time.	2.5	50%	18%	32%

Table 4.14: Time Management and Time line

From the above, it seems that not many learners were convinced about the value of creating a timeline, as only a small percentage responded positively. During interviews, only three learners replied "no" to the question: "Have you set up a time line at the start of the project to assist you in what you want to do during each session?" and replied to the question: "Why not?" in the following ways:

Learner 17: *"Ek weet nie. Ek het nie aan dit gedink nie"* (Translation: I don't know. I did not think about it).

Learner 6: *"Nie rerig nie, nee. … Ons het nog nie so ver gedink nie"* (Translation: Not really, no … We did not think that far [ahead]).

However, one learner indicated that he had not used a timeline at the start, but realized that it has value to assist one to stay on-task when he stated:

Learner 22: *"Later het ek dit gedoen, maar nie aan die begin nie want ek het nie toe agtergekom wat ek moet doen en nie moet doen nie."* (Translation: Later on I did it, but not from the beginning because then I had not realized yet what I had to do and what I didn't have to do).

4.5.3 THINKING ABOUT TIME WITHOUT CONSTRUCTING TIMELINES

The absence of timelines could create the impression that there was no thinking about time. However, TEP 1 indicates that the learners thought about procedures to keep them on schedule that could be taken to finish on time even before the project commenced. This was evident in their comments regarding to the question: "List the tasks that you would have to do to develop your presentation". They replied to this question that they would have to sacrifice time (work at other times), use their time efficiently and should not waste any time while in the computer room. Table 4.15 illustrates their comments:

STRATEGIES MENTIONED, BEFORE PROJECT HAS STARTED, TO FINISH ON TIME (IN TEP 1)	REPLIES FROM LEARNERS BEFORE PROJECT HAS STARTED
SPEND MORE TIME ON PROJECT	• *"Meer aan projek werk"* (Translation: Working more on project)
SACRIFICE TIME (WORK AT OTHER TIMES)	• *"Tyd opoffer"* (Translation: Sacrifice time) • *"Na ure werk"* (Translation: Working after hours) • *"Op naweke werk"* (Translation: Working during weekends) • *"Probeer pouses werk"* (Translation: Work during break times)
USE ALL ALLOCATED TIME DURING SESSIONS (USE AVAILABLE TIME EFFICIENTLY)	• *"Alle tyd wat jy het opgebruik"* (Translation: Use up all the time that you have)
MEET DEADLINES	• *"Almal moet hulle goed betyds reg hê"* (Translation: Everyone should have their things ready at the agreed-upon time)
DO NOT WASTE TIME	• *"Moet nie tyd mors nie"* (Translation: Do not waste time)

Table 4.15: Strategies to finish on time (TEP 1)

Likewise, interview data indicated that learners felt that they would be able to finish the project on time. Asked by the interviewer why they would be able to finish or what they would do to finish the project on time, they responded in the following ways (Table 4.16):

TRATEGIES MENTIONED TO FINISH ON TIME DURING PROJECT (INTERVIEWS)	REPLIES FROM LEARNERS DURING THE PROJECT
Concentrate	*"Omdat ek meer konsentreer daarop en wat ek kan doen… "* (Translation: Because I concentrate more and on what I want to do). [Learner 14]
Work as fast as possible: Speed is important	*" … want ek werk vinning en ek vorder vinnig"* (Translation: … because I work fast and progress quickly). [Learner 25]
Set goals	" … doelwitte stel. Dit doen vandag en dit volgende week. Ons moet dit klaarkry!" *(Translation: We will set goals. This we will do today and this next time. We must finish it) [Learner 20 & 21]*
Planned well in advance	*"Want alles is vooruit beplan. Ons kort net nog so 'n klein bietjie inligting en dan kan ons voluit werk. Ons gaan volgende week baie hard werk. Ons inligting sal dan al miskien klaar wees en dan gaan ons net alles op die plekke sit en dan is ons eintlik klaar"* (Translation: Because everything is planned in advance. We need only a little bit of information then we can work at full capacity. Our information would then be ready and then we are going to position it in the correct places and then we have actually finished it) [Learner 26] *"Omdat ek alreeds weet wat ek wil doen en ek het ook al klaar begin"* (Translation: Because I know what I want to do and I have started already) [Learner 1]
Planned final stages: Allocate time for each learner to work on the computers	*"Ons gaan nie volgende week in die biblioteek wees nie. Hierdie keer was Leerder 14 besig op die rekenaar, want sy kan nie op 'n ander rekenaar werk nie, en dan kan Leerder 17 nie op daai rekenaar werk nie, dan moet Leerder 17 ook hier werk en dan moet ons twee periodes deel. Ons moet dan net een periode werk sodat hy die ander periode kan werk"* (Translation: We are not going to be in the library next week. Learner 14 worked on the computer today and Learner 17 cannot work on the computer at the same time. Then we have to share the time in front of the computer. We have to work one period on the computer and Learner 17 during the next period). [Learner 15]
Work at other times	*"Ja meneer na skool was ons nog nie klaar met een van ons screens nie, en toe het ek gewag na die laaste klok [toe gaan ek aan met die projek]"* (Translation: Yes sir after school I have not yet completed one of our screens, then I waited until the last bell had gone and then continued with it) [Learner 7].
Work at other places	*"Meneer, ek sal by die huis of by my tannie werk"* (Translation: Sir, I will work at home or at my aunt's house) [Learner 2] *"… ek kan dalk by die huis nog prente gaan soek."* (Translation: maybe I can look for pictures at home) [Learner 25]
Limit off-task behaviour	*"Nie speel nie en nie praat nie, net werk"* (Translation: No playing and no talking, just work) [Learner 2]

Table 4.16: Strategies to finish on time

In a like manner, analysing their journals provided evidence that although learners did not think about or set up timelines, they were very aware of time-related issues during the project. An analysis of the journal writing confirmed that learners had thought about time management aspects. This is illustrated when Learner 21 in the Marine Life Group was absent, as her co-

worker (Learner 20) in the group wrote that: *"Ek dink aan Leerder 21, wanner gaan sy klaar kry, maar ek het reeds vir haar beplan"* (Translation: I think about Learner 21, when is she going to do her part [she is absent] but I have planned for her). Thus Learner 20 had thought about the impact that the absence of her co-worker would have on their project.

Similary, two learners from the Marine Life Group stated in their journals that they would also have to make up time, as they were not present, due to the flower-arrangement competition during the first session of the project.

In addition, two learners of the Dinosaur Group could not attend a special session during the holiday. These two learners were also aware that this extra session could have assisted them in their time management planning and wrote during the fourth session that their goals were to catch up on what they had missed.

During the last three weeks of the project, some groups started to finish their projects. During this period learners were very aware of the fact that time was starting to run out. When one of the learners in the Reptile Group was absent and missed the computer sessions for two weeks in a row, learners in that group became worried and reported during an interview that: *"Toe Leerder 4 siek was vir twee weke, het ons (ek en Leerder 1) gesukkel want dit was op die einde en Leerder 4 se taak was nie klaar nie. Toe ons by haar file ingaan was niks eintlik gedoen. Maar Leerder 1 het op die verkeerde screen ingegaan en toe maak ek dit reg, en toe Leerder 4 terugkom toe is alles weer verkeerd en toe kry sy weer die regte vel"* (Translation: When Learner 4 was ill for two weeks, we [Learner 1 and I] battled, because it was near to the end and Learner 4's task was not yet finished. When we opened her folder, not much had been done. But Learner 1 had opened the wrong screen. I fixed it and when she returned, everything was wrong, but then she found the correct piece of paper again). However, Learner 4 felt that they should have waited for her to come back and stated during an interview that: *"Hulle moes dit nie alleen gedoen het nie. Hulle moes vir my gewag het …"* (Translation: They should not have done it by themselves. They should have waited for me) but the group felt that they could not wait for her and had to continue in her absence as Learner 2 stated there was not enough time for them to wait for her to come back: *"Daar was ook nie genoeg tyd nie"* (Translation: There was also not enough time).

As the project continued, some learners voiced their concern that they would not be able to finish on time, as Learner 10 replied during an interview that he was thinking: *"Gaan ek ooit klaarkry hiermee, of wat moet ek nou hier doen en wat as dit nie uitwerk nie, ens."* (Translation: Will I ever finish this or what must I do here and what if it does not work out, etc.). Learner 22 confirmed the time problem when he wrote in his journal that*: "Ek het nie genoeg tyd om klaar te*

maak" (Translation: I do not have enough time to finish). The same learner, Learner 22, added to this during an interview that: *"Ek het gedink die tyd sal om wees en dan sal ek nie klaarkry nie, of ek sal per ongeluk vergeet om te 'save' en dan moet ek alles van vooraf begin"* (Translation: I thought that the time would have expired and I would not have finished or that I would forget to save and then I would have to start everything from scratch). Their sentiments were confirmed by Learner 20 when she wrote in her journal that she found the project: *"Lekker, maar sou graag nog langer wou werk"* (Translation: Enjoyable, but would like to work longer).

4.5.4 TIME CONSTRAINTS: WHAT CAUSED THEM?

A few learners had experienced problems with time; they were aware that time was running out and that some tasks took too much time. Tasks that were time consuming for some of the learners, were:

- Searching for information, pictures or photos
- Translating information
- Scanning pictures or photos and assistance to fellow learners
- Not enough computers available

The search process resulted in some learners progressing at the speed that they intended, as Learner 20 wrote in TEP 2 that: *"Leerder 21 het my gehelp om die nodige inligting te kry. Daar was ook 'n afdeling net oor haaie in die biblioteek. Partykeer kon ons nie gekry het wat ons wou nie en dit het ons agter gemaak"* (Translation: Learner 21 helped me to find the necessary information. There was a section exclusively about sharks in the library. Sometimes we could not find what we were looking for and this caused us to lose time).

Learner 19 wrote that: *"Tyd raak vinnig klaar en ek het ongeduldig begin raak"* (Translation: Time pass very quickly and I have started to become impatient). During interviews, the above sentiment was confirmed when Learner 22 stated that: *" … dan het ek soms net die inligting gekry en dan is die tyd om"*, Learner 10 that: *"dat ek in die tyd nie al die inligting kon kry wat ek wou hê nie"* (Translation: that I would not be able to find all the information in time that I was looking for) and Learner 9 added that: *"Ons het aan die begin nikse inligting gekry nie en toe na baie lank soek toe kom alles uit"* (Translation: In the beginning we did not find any information and after we had searched for a long time, then we located everything).

Translation of information from English to Afrikaans also caused that learners did not progress at the speed that they wanted to as Learners 5 and 23 wrote in TEP 2 that they found it difficult, since there were many difficult and new words that they had to contend with.

Scanning of pictures and giving assistance to other learners also added to time constraints, as there was only one computer connected to a scanner. It was observed that not all learners had the necessary skill to use the scanner effectively. Consequently, learners asked for assistance from two to three learners who knew how to use the scanner. As many learners left the pictures or photos that they wanted to be scanned until halfway through the project or near the end, this caused long queues at the scanner. Learners had to wait, and this lead to falling behind or not progressing as fast as they wanted to, as indicated by Learner 3 when she wrote in TEP 2*: "Daar was te veel kinders wat iets wou skan en ons moes te lank wag vir ons prente"* (Translation: There were too many learners who wanted to scan and we had to wait for a long time for our pictures to be scanned). This caused a problem for Learner 16 as she was asked to do the scanning for learners [she was very competent with scanning]. That this caused her annoyance, was evident when she wrote in the TEP 2: *"Kinders pla my die heel tyd. Kinders is ongeskik"* (Translation: Pupils hinder me the whole time. Children are ill mannered). Learner 20, also a very competent learner, was asked several times by other learners for assistance and this caused her to fall behind. She stated in the TEP of November 2003: *"Soms het kinders my te veel gevra dan raak ek kwaad want ek self nie klaar nie"* (Translation: At times the children asked to assist them too often, then I got angry because I had not yet finished).

As there were only 15 computers for 26 learners, this also created problems as every learner could not use a computer for a whole session of two hours per week. This led to learners not having enough time at the computer and led to careful planning and decision-making by learners. In response to the question, "Have you experienced any problems today? What if any?", Learner 15 voiced the following when she wrote in her journal: *"Om keuses te maak. Ek het nie baie tyd [om] voor die rekenaar te spandeer nie"* (Translation: [I had to make decisions] as I did not have too much time in front of the computer). Sometimes learners did not make sufficient use of the computers when they were available to them, as indicated by Learner 22 in TEP 2: *"Almal het altyd gewerk en as ons kans kry gryp die mense dit nie aan nie*" (Translation: Everyone always worked and when we get an opportunity, the people don't grab it).

4.5.5 PROJECT MANAGEMENT AND TIME MANAGEMENT SKILLS RELATED TO OUTCOMES

Table 4.17 provides a summary of the findings regarding project- and time management related to the critical and specific outcomes.

CRITICAL OUTCOMES	RESEARCH PROVIDES ANSWERS TO THESE QUESTIONS	SPECIFIC OUTCOMES: SELECT THE ONES TO BE ASSESSED
Organise and manage oneself and one's activities responsibly and effectively	**PROJECT MANAGEMENT SKILLS** Is there collective planning? What can I assess during collective planning process? • Some collective planning occurred. Learners need more assistance with collective planning. Do they set goals as a group? • Some goals were set in group context Do the learners set goals for themselves? • Learners have set goals in their journal writing for themselves. Individual planning a high priority. **TIME MANAGEMENT SKILLS** Can the learners effectively plan with timelines? • Learners need more assistance with timelines and time management • Learners did not create timelines, but thought about time and time constraints How do the learners manage time? • Concentrate • Work as fast as possible • Set goals • Planned well in advance • Allocate time for each learner to work on computer • Work at other times • Work at other places • Limit off-task behaviour	**LANGUAGES** SO 4 Learners access process and use information from a variety of sources and situations • AC6 Organisational skills are applied • AC12 The ability to integrate new information into existing knowledge • AC13 To apply newly acquired knowledge **SCIENCE** SO 1 To use acquired skills to investigate phenomena associated with the Natural sciences • AC3 Launch a plan of action • AC4 Collect data • AC12 Put together a plan of research action **TECHNOLOGY** SO 1 Understand and apply the technological process to solve problems and satisfy needs • AC3 Develop a design

Table 4.17: Critical Outcomes & Specific Outcomes that could be achieved during planning: Project Management and Time Management

4.6 DESIGN SKILLS (ORGANISATION AND PRESENTATION SKILLS)

4.6.1 INTRODUCTION

Topic selection and searching for information are important when one embarks on constructing a hypermedia design project. However, learners also have to decide how to (1) plan the layout or mapping of the design, (2) organise, segment and sequence the information that they wanted to use in an understandable way, (3) represent and present the information, (4) hyperlink information and (5) attract the audience's attention by thinking about the impact of one's product (Carver *et al.*, 1992; Lehrer, 1993; Lehrer *et al.*, 1994).

4.6.2 SEGMENTATION AND SEQUENCING OF INFORMATION TO MAKE IT UNDERSTANDABLE

It became evident that projects require a great deal of mental effort, as 96% of the learners agreed to this (Table 4.18). That learners also have to think a lot while busy with a project is evident, as 77% agreed with this proposition in the PAQ (Table 4.18). However, only 68% indicated in the PAQ that they think a lot about ideas during the project (Table 4.18). Although the 77% is less than the result of the other statement in the same Table (96%), this still indicates that one has to think a great deal. A possible explanation for this difference (the 32% who are uncertain) could be that learners reasoned that they do think a lot about ideas, but that this thinking occurs mainly before the project commences.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
MENTAL EFFORT & CONNECTING	75	I do not concentrate a lot while busy with my project.	2	96%	4%	0%
	19	I don't really have to think much when I develop a project.	2	77%	18%	5%
	81	I think a lot about ideas when I do a project.	6	0%	32%	68%

Table 4.18: Mental Effort and Connecting of ideas – Thinking, Concentration and Ideas

In the PAQ, 73% of the learners indicated that they had tried to design their links in their projects in such a way that people can easily make connections between headings (Table 4.19). A closer inspection of the data revealed that some of the learners who were uncertain, were those who either did not work on the computer (Learner 3 and 5) or learners who worked in pairs (Learner 15 with Learner 16 and Learner 20 with Learner 21). Thus those who did not work on the computer could not agree or disagree, as they were not involved with linking. With regard to the learners who worked in pairs, it is possible that only one of them did the linking. The negative wording of the statement could also have played a role, so I suggest that the wording be adjusted to read, "I have worded my headings in such a way that people can easily make connections between these headings and what is about to follow".

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PRESENTING & CONNECTING	22	I have designed my links in such a way that people cannot easily make connections between the headings.	1	73%	27%	0%

Table 4.19: Mental Effort and Connecting of ideas

In a similar way, 68% of the learners indicated in the PAQ (Table 4.20) that they try to present their information in such a way that their prospective audience would easily understand what their topic is about. Linking information and presentation of information seems to be an important aspect for learners, as a very similar result was reported in the PAQ. In a like manner, 64% of the learners felt that projects should help people to find connections among ideas (Table 4.20) indicating that presentation and understanding are related.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PRESENTING & CONNECTING	82	I do not try to present my information in such a way that my audience would easily understand what the topic is about.	2	68%	23%	9%
	56	Presentations should help people find connections among ideas.	6	0%	36%	64%

Table 4.20: Presenting & Connecting –Understanding and connecting ideas

Although learners tried to design their links to assist people to make connections, the order in which they wanted to arrange their headings were easy for only 59% of the learners as indicated by the PAQ (Table 4.21).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
MENTAL EFFORT & CONNECTING	11	It's hard to know in what order to put my ideas.	2	59%	36%	5%

Table 4.21: Mental Effort and Connecting of ideas

A possible explanation why some learners did not find it difficult to sequence their information could be that they had used headings similar to those that their sources had used. This is evident as Learner 22 replied during an interview to the question, "Had you decided beforehand [on what to include] or had you consulted the sources first?" that: *"Ek het eers gekyk in die bronne en toe kry ek dit en so"* (Translation: I first looked in the sources and then I found it and so on). He also stated that he had asked his friends for their input. This is confirmed by Learners 20 and 21 during an interview when they stated: *"Ons het half-en-half gedink wat is die*

belangrikste om in te sit … " (Translation: We had decided more-or-less what would be the most important things to include) but also added that pictures assisted them when they added that*: " … en watter prentjies pas by wat"* (Translation: … and what pictures goes together with what).

The 36% of learners, who were uncertain (Table 4.21), could possibly have thought that it is sometimes difficult to decide in what order to sequence their ideas, but that such is not always the case. Interpretation of the interview data suggested that learners struggled sometimes with sequencing, as Learner 21 replied that she battled to divide the *"sharks"* topic. She did, however, state that she eventually succeeded.

On the whole it seems that the learners have learned that sequencing information is an important aspect when one has to design a project. This was indicated by Learner 2 during an interview when he replied that: *"Ons het geleer hoe om die goed agtermekaar te sit, soos nou die inhoud, eetgewoontes en habitat, dan begin ons met eetgewoontes en dan moet ons na habitat toe gaan"* (Translation: We have learned how to sequence things, for example the content, eating habits, habitat. You start with eating habits and then you continue with habitat).

4.6.3 IMPORTANCE OF VISUAL MATERIAL IN PRESENTATION

According to Keller (1983), the attention-grabbing capability of a design is of great importance, or its ability to arouse and to sustain curiosity (Malone & Lepper, 1987). Healy argues that current learners are immersed in a visual culture hence they may have developed different habits of mind or as he (1990:13) states "Kid's brains must be different" from those of previous generations. As a result, learners would prefer visually interesting material to plain text from books. Two of the learners supported Healy's argument when they provided reasons during an interview for their inclusion of visual material:

> Learner 12: *"Ek is self 'n [jong] kind, maar ek weet kinders is lui om te lees. Hulle hou mos van TV kyk en daai ding [die projek] is amper soos 'n TV en dan kliek hulle en hulle kyk dit, dan kry hulle ook die inligting"* (Translation: I am also a [young] child, but I know that children are lazy to read. They like to sit in front of the television and this thing [project] is quite similar to a television and then you click and you watch, then you would find the information).

> Learner 10: *"Om dit meer interessanter te maak. As jy die hele tyd na 'n blaai vol getikte inligting kyk raak dit partykeer 'n bietjie vervelig om te kyk daarna, maar as daar meer videos [clips] en prentjies in is, is dit meer exciting om te kyk daarna"* (Translation: To make it much more interesting. If you have to look at a page of information in front of you

that just contains typed text, then it sometimes gets a bit boring, but if there are more video clips and pictures included it becomes very interesting).

As a result one would think that learners would think about visual material and its importance when they have to plan a project as well as while they are busy with the project. Be that as it may, an analysis of TEP 1 indicates that only 27% of the learners mentioned that finding visual material (pictures, photos, illustrations, video clips, etc) would be an important task. At the same time one has to bear in mind that TEP 1 was completed before the project started and that learners did not think about visual impact at that stage, before they were immersed in the project. Journal writing concurred with TEP 1 as goals related to visual material were only mentioned 11 times. Examples of these goals, were as follows:

- Hyperlinked pictures of pulleys (Learner 6)
- Search and view for appropriate video AVI clips (Learner 11)
- Scan pictures plus rounding off (Learner 12)
- To add more pictures (Learner 10)

Although searching for pictures, photos or AVI video clip files were not readily mentioned as goals in their journals, it was observed at the same time that learners regularly visited the AVI video clip and photo gallery that was made available to them on the server. High interest in visual material occurred after learners saw the effectiveness of an AVI video clip that was inserted by Learner 14 when she started to ask for comments about her visual material. This created interest and spurred learners to experiment with the AVI video clip files. It was also observed that learners listened and looked at the video clips, inserted the clips, edited them and also asked other group members and teacher about the effectiveness of the AVI video clips or picture files. A possible explanation concerning why this was not frequently set as a goal could have been that learners only started to search for visual material on the computer after they saw what Learner 14 had done and at that stage their goals for that day were already written down.

Yet, why did learners not indicate more frequently during the project that finding pictures or illustrations were goals? Again a possible explanation could be that they found plenty of visual material while searching for information and did not have to search for it as Learner 20 stated in TEP 2 that: *“Prente was nie moeilik om te kry. Daar was omtrent 'n prent in elke boek”* (Translation: It was not difficult to find pictures. There was a picture in nearly every book). Or alternatively they decided upon which pictures to include when they decided upon what the headings would be so that these pictures would compliment the heading and information on the page. Another explanation could be that they searched for visual material, but did not set it as a specific goal; they just searched for visual material at any point while they were busy with the

project. Analysing the journals provided evidence for this argument. During the session of 8 November 2003, not one learner wrote that finding visual material was a goal. However, a closer analysis of the journals indicated that three learners wrote that they had found searching for pictures to be easy. Thus, this confirms that learners undertake many tasks during a session that they do not necessarily set as a goal at the start of a session.

In contrast to TEP 1 and the journals, TEP 2 that was completed after the project ended, indicates a significant increase in the importance of visual material in a project from 27% in TEP 1 to 58% in TEP 2. The importance had thus more than doubled.

Analysing their projects, it was found that visual material had to be important, as every project had a great deal of visual material. To support the finding that visual material was important to learners, the PAQ indicates that 91% of the learners felt it to be important to use visual material in their projects (Table 4.22). In addition, it was observed that Learner 18 had drawn a picture of a peacock and scanned it, as the picture that he had found was not to his liking and he probably wanted to personalize his project. It was also observed that learners copied and pasted pictures and photos from the Encarta multimedia encyclopedia into their projects. This evidence can confirm that learners regard visual material as important.

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PRESENTATION	34	I usually just write/type information about my topic and do not include pictures photos or AVI video files.	1	91%	9%	0%

Table 4.22: Presentation of information in visual format – Its importance

In a like manner, though slightly lower, the PAQ indicates that 73% of the learners felt it to be important to use visual material in their projects as (Table 4.20). A possible explanation for the lower percentage of statement 8 could be that some learners interpreted this statement as important, but that they did not always find appropriate visual material. If they had answered that it was not important, it would have meant that it was never important and hence they refrained from selecting this option in the PAQ. To support this argument, the Sea Travel Group mentioned that one point of concern to them was the fact that they could not find any AVI video files to insert when they stated: *"Dat daar geen video's is vir ons nie"* (Translation: That there are no AVI video files available for us).

In support of the above, it was observed that not all learners were able to use the scanner. The scanner was also connected to one computer and thus learners had to wait for an opportunity, as many learners wanted to scan. Learner 3 confirmed this when she commented: *"Daar was te*

veel kinders wat iets wou skan en ons moes te lank wag vir ons prente [om 'gescan' te word]" (Translation: There were too many learners that wanted to scan and we had to wait for a long time for our pictures [to be scanned]).

An analysis of the PAQ (Table 4.23) indicated that 68% of the learners often asked themselves about the best way to present an idea, confirming the importance of visual material for learners in their projects. A possible explanation for learners indicating that they were uncertain, could be that they don't often think about the best way to present an idea, but would rather write (or type) the text first and then only insert a picture to support their writing. Thus it is recommended that in future research, one should include this question also as part of the interview questions and explore their comments regarding this further, in order to analyse the participants' thinking.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PRESENTATION & VISUAL MATERIAL	8	I think it is important to use illustrations, pictures, photos or AVI Video files in my project.	6	0%	27%	73%
	12	I often ask myself about the best way to present an idea, like, should I use a graph, photo, picture, animation, colour or just write about it.	6	0%	32%	68%

Table 4.23: Presentation of information in visual format – Its importance

In conclusion, interview data supported the importance of visual material for learners. Reasons that they presented were as follows as indicated in Table 4.24:

IMPORTANCE OF VISUAL MATERIAL (INTERVIEWS)	REPLIES FROM LEARNERS DURING THE PROJECT
CREATES INTEREST (NOT BORING)	• To make it more interesting. *("Om dit meer interessant te maak … ")* (Learners 2, 5 & 17) • It makes it not boring *(" … want dan is dit nie net so boring nie")* (Learners 2 & 17)
RELATES TO TOPIC	• It is related to the topic, it portrays examples of what is written about *("Dit is 'n goeie voorbeeld van hoe die arend sy prooi gevang het")* (Learners 10 & 17)
ASSIST AUDIENCE WITH UNDERSTANDING	• People know what is going on *("[Mense] hulle weet wat aangaan")* (Learner 5) and it shows more. It shows how the shark attacks and what it attacks *("Dit wys meer. Dit wys hoe die haai aanval en wat hy aanval")* (Learners 20 & 21)

Table 4.24: The importance of visual material

4.6.4 PLANNING AND MAPPING THE DESIGN

Storyboarding is a technique that assists learners to plan their computer screens in rough in advance on paper. This was not something that they had done before.

The designing of screens in rough on paper was a very important task as this was rated with making notes on what you read, as to be the most important. Seventy-three percent of the learners indicated that drafting their screen design on paper was very important. The PAQ confirms this, as 77% of the learners responded that they design screens on cards before they design it on computer, in both the positive and negative phrasing of the statement (Table 4.25).

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PLANNING & DESIGN OF PRESENTATION	18	I design most of my screens first on cards before I design my screens on the computer.	7	18%	5%	77%
	55	I design my screens directly on the computer without designing them on paper.	2	77%	14%	9%

Table 4.25: Planning and Design of Presentation - First on cards or on computer?

It is important to note that not all people design and plan in the same way. Hence there will be some learners who will design directly on the computer and design and plan as they go along (Turkle & Papert, 1991; Kafai, 1996). This was evident in the PAQ, as 9%of the learners had indicated that they did not design on paper (Table 4.25).

Journal entries confirmed the importance of designing and planning screens in rough on paper, as it was mentioned 27 times as a goal during the first four weeks of the project. During and after the third week of the project, more learners started to set goals related to designing screens on the computer, as indicated in Table 4.26 below:

WORKING DATE	# OF LEARNERS SETTING GOALS STATING THAT THEY WANT TO DESIGN ON COMPUTER	% OF LEARNERS SETTING GOALS STATING THAT THEY WANT TO DESIGN ON COMPUTER
13 Sept 2002	2	8%
18 Sept 2002	4	15%
27 Sept 2002	8	31%
11 Oct 2002	15	58%
18 Oct 2002	13	50%
25 Oct 2002	9	25%
08 Nov 2002	16	62%
15 Nov 2002	11	42%
29 Nov 2002	3	12%

Table 4.26: Percentage of learners indicating that they want to design on computer

During the interviews, it became evident that the learners regarded storyboarding as an important task when they were asked how they had done their planning. Learner 6 responded that the designing and planning on paper made the designing process on the computer easier as one knows more or less what it should look like, when he stated: *"Op blaadjies meneer … Sodat wanneer ons by die rekenaar kom, ons nie hoef te sukkel nie"* (Translation: On pages sir … When we work on the computer, we don't have to struggle). In a like manner Learners 20 and 21 replied: *"op blaadjies asof dit 'n slide is. Dan beplan ons presies hoe dit gaan lyk min of meer. Wel, ons vind dit makliker so en dan weet ons dadelik wat ons wil doen [wanneer ons op die rekenaar ontwerp]"* (Translation: on pages as if it is a slide. Then we plan more or less how it is going to look. We find this easier and then we know immediately what we want to do [when we design on the computer]). Likewise, Learner 14 responded that she had done most of her planning on rectangular cardboard paper that was provided to them, as this made it easier and in a similar manner, Learner 26 added that he had done his planning on paper as it acted as a type of a summary.

In addition, Learner 22 added that while they design, they think about where they should place and position pictures and text on their screens, when he stated during an interview that: *"Ek het 'n prentjie geteken en gesê hier kom 'n prentjie van 'n seeperdjie en onder het ek geskryf en in die middel het ek gesê inligting oor seeperdjies wat baie interessant is, en waar moet mens kliek en dan het ek dit geskryf, en later het ek in meer diepte ingegaan"* (Translation: I have drawn a picture and said to myself here I must place a picture of a seahorse and below I have written and in the middle I placed more interesting information about seahorses and indicated where a person must click and then I have written it and later I went into more depth).

Learner 4 also used paper for planning and designing her screens, but developed a novel technique in order to manage what she still had to do. After each screen was completed, she threw away the paper with the roughly designed screen on it. This assisted her to know how many screens she had left to do.

The Bird Group, however, decided to appoint one person as a project manager (Learner 14). This learner brought a file to school in which all the learners of the Bird Group filed their completed screens and summaries. This assisted them when they had to verify something that they had done. This became evident during an interview with Learners 15 and 16 when they stated: *"Ons doen dit op klein groen blaadjies, en dan beplan ons ons 'screens'. Leerder 14 het hierdie leêr waarin sy al ons goeters hou waar ons en Leerder 18-hulle ons goeters hou. Dit is 'n leêr wat ons nie meer gebruik nie. Ons hou al ons goeters daar dan kan ons elke keer weer teruggaan daarna toe"* (Translation: We design on small green pages and then we plan our screens. Learner 14 has this file in which she keep all our stuff, in which she keep our and Learner 18 and the others' stuff. It is an old file that we don't use anymore. We keep all our stuff there in order to go back to it whenever we need to). The planning followed by Learner 4 of the Reptile Group and Learner 14 and her Bird Group are similar to what Turkle and Papert (1991) refer to as of *"Hard-Thinkers"*: planning very well in advance.

However, not all learners designed their screens in rough on paper. Although Learner 2 stated that one of his group members, Learner 1, did not design his screens on paper, Learner 1 contested this during an interview. He acknowledged that he did not design it on the pieces of cardboard paper that were provided, but had used an alternative medium: a book in which he summarised the information. Then he knew what he wanted to do and did not have to bring his book to class: *"Ek doen dit in my boekie in die klas … Ek skryf dit neer en dan som ek dit op, dan hoef ek nie my boekie saam te bring nie"* (Translation: I do it in my book in class … I write [my information] then I summarise, then I don't have to bring my book). However, summarising does not mean design, hence it seems that Learner 2 was correct after all. In spite of Learner 1's comment, it was observed that Learner 1 did not bring his book to class and just started to design on computer. He designed and worked on a number of screens during the first day and hyperlinked a few screens to each other.

In a like manner, Learner 13 indicated that his group did not do the whole design on paper, except for Learner 10, when he replied that: *"Ons het maar baie min op papiere gewerk, behalwe Leerder 10, sy het omtrent als op papiere gedoen voor sy gewerk [ontwerp] het. Ek alleen het net geskryf wat is die screen se naam en ek het blokkies gemaak en gesê waarheen ek dit gaan link"* (Translation: We have worked very little on paper, except for Learner 10, she

designed virtually everything on paper before she started to work [design]. I only wrote the name [heading] of each screen on the paper and made a block which indicated where I am going to link it to). This way of designing is characteristic to what Turkle & Papert (1991) would refer to as *"soft-thinking"* or *"bricolage"* : planning on the way.

On the other hand, one learner indicated that he did not start to design on paper, but decided to do so later during the project. This was evident when Learner 22 replied during an interview to the question whether he had designed his screens on paper, that: *"Nie heeltemal aan die begin nie, maar in die helfte van die ding het ek begin sukkel en toe het ek, ja"* (Translation: Not in the beginning, but in the middle of the thing [project] I started to struggle and then I did [design on paper], yes). This indicates that both 'hard-thinking' and *bricolage* can indeed coexist in one person as suggested by Kafai (1996).

Designing screens on paper in rough did not necessarily have the effect that the finished design on computer looked the same as the rough design on paper, as learners made alterations when they designed on the computer. These alterations were made as learners thought that it would improve their design and make it appear neater, as Learner 17 stated that: *"Die kaartjies het bietjie rof gelyk. Dit was nie netjies nie en ek het netjieser op die skerm gewerk"* (Translation: The [design on] cards looked a bit rough. It was not neat and I worked neater on the screen [it looked neater and clearer]).

4.6.5 HYPERLINKING ACTIVITIES AND PROBLEMS: HOW INFORMATION IS ORGANISED AND LINKED?

Learners felt that it was important to be skilled in the use of Microsoft *Frontpage*, the weblike design software package used for designing their hypermedia projects, as 77% indicated this in the PAQ (Table 4.27).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
COMPETENCE IN SOFTWARE	85	I do not think it is important to know *Frontpage,* the software that I use to design my project with, well.	2	77%	14%	9%

Table 4.27: Competence in Design software - *Frontpage*

During the project, the teacher demonstrated and coached the learners several times about linking, what it means and how to do it on computer. Learner 26 explained the linking concept clearly when he stated that: *"Link beteken jy stel dit saam. As jy op die woord kliek wat gelink is, gaan hy na 'n volgende skerm wat jou meer inligting van daardie woord gee"* (Translation: Linking means that you compile something. When you click on the word that is linked, you are

taken to the next screen that provides more information about the word that you have clicked on).

Two weeks into the project, it was observed that the hyperlinking that was completed at that stage consisted of clicking on a blue-text-only-underlined-link (Example: HABITAT) that would take the user to the linked screen. The user was then *"forced"* to go back to the main screen again to start the browsing process from the homepage. There was not an always-visible-navigation menu. Learner 1 used blue-text-only-underlined-links from the start (session 1), without an always-visible-navigation menu to show all possible links in his design of each screen. His links appeared to be linking the following or previous screen.

However, not all learners used blue-text-only-underlined-linking that only hyperlinked between the following or previous screens. This became evidents when Learner 14 approached the teacher and voiced the concern that she was not happy with the display format of her links, as a way of navigation. She asked whether different methods were available for navigation and the linking of screens (pages). The idea of an always-visible-hyperlink-navigation menu with hover buttons was introduced, based on the suggestion of Shneiderman (cited in Borsook, 1997) to create an encyclopeadia-like structure. According to Shneiderman (ibid.) an encyclopeadia structure hopefully avoids the problem of feeling lost. It was observed that many learners asked Learner 14 for assistance with hyperlinking and used the always-visible hyperlink navigation command bar structure: making the same hyperlink navigation bar structure visible on every page. The problem of being "lost in hyperspace", wandering freely from node to node without being able to get back (Borsook, 1997:731), is overcome by using this navigational method.

Equally important, not all learners used hover buttons for linking, but the majority still opted for blue-text-only-underlined-links, although all the links were displayed on every page to assist with navigation.

In the PAQ (Table 4.28) more than half of the learners (55%) indicated that they had done their hyperlinking of screens and concepts on the computer only after they had finished designing all their screens on the computer.

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PRESENTING AND LINKING	13	I link my screens and concepts on the computer only when I have finished designing all my screens.	6	27%	18%	55%

Table 4.28: Presentation and Linking - When do they link?

It was observed that Learner 1 was the exception to the rule as he had started with his designing and hyperlinking on the computer during the first week of the project and continued to do so throughout the project.

Analysing the journals indicated that 38% of the learners set goals regarding hyperlinking during the first seven weeks of the project. During the last two weeks, 38% of the learners indicated that hyperlinking was their goal. Hence, the fact that the same number of learners indicated the importance of linking in a smaller time frame, shows that more learners had been involved in linking towards the end, concurring that hyperlinking of the various screens, concepts and pictures was left to near the end of the project.

In addition, further analysis of their journals indicated that 65% of the learners during the last three weeks of the project, mentioned that they experienced problems with hyperlinking on the computer, whereas 23% indicated during the first seven weeks of the project that they had experienced problems with hyperlinking on the computer. This confirmed that hyperlinking was a computer activity left to the last part of the project, as more and more learners experienced problems related to linking. It was observed that the linking difficulty was related to learners not being skilled enough to do it on the computer: not knowing the functions in the particular package, *FrontPage*.

The interviews confirmed that learners experienced problems with hyperlinking and left it close to until the end of the project. This became evident when Learners 15 and 16 stated that: *"Ons ervaar probleme met links"* (Translation: We experience problems with linking [on the computer]). Learner 4 added: *"Want ek is nou eintlik klaar. Ek moet nog net die "links" maak dan is ek heeltemal klaar"* (Translation: Because I have actually completed it. I just have to make the links then I am completely finished).

Despite their difficulties with linking, it was very important to them that their users would be able to navigate with ease through their projects,as indicated by 82% of the learners in the PAQ (Table 4.29).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PRESENTING & CONNECTING	28	I think it is not important for people to navigate easily through my project.	1	82%	14%	4%

Table 4.29: Presenting & Connecting – Ease of navigation

Interviews confirmed that learners felt that their prospective audience should be able to easily understand their topics, make connections among ideas and navigate easily. This was

mentioned by Learners 20 and 21 when they stated that: *"Ons maak maklike 'links' sodat die mense nie deurmekaar raak nie en sit dieselfde inligting by dieselfde opskrif en dat alles sin maak"* (Translation: We design the links in such a way that they are easy and that people do not become confused. We place the related information at the related heading [screen] and try to portray it in such a way that it makes sense).

4.6.6 MAINTAINING INTEREST OF AUDIENCE: HOW?

Analysing the PAQ indicated no references regarding the audience were made, as there was no related median with a score of 1, 2, 6 or 7. Likewise, an analysis of interviews during the project initially indicated that learners did not think about their prospective audience. This was evident when learners responded to the question whether they thought about anyone during the project with a NO. Reasons for this was that they concentrated too much, were too focused on the activity and enjoyed it too much to think about people. Learner 26 replied to the above-mentioned question that: *"Ek is nou gefokus op hierdie sekere diere … "* (Translation: I am now focused on some of these animals). Learner 6 and 8 confirmed this when they stated: *"Want ons is IN hierdie projek IN. As ons werk, dan werk ons"* (Translation: Because we are into this project. If we work, then we work). It seems that thinking about other people would take their concentration away from their project as Learner 4 replied: *"Want dan trek dit ons aandag die hele tyd af … "* (Translation: Because then it would distract our concentration).

However, a deeper analysis of the interviews indicated that learners did not ignore their audience, but had thought about them. This became evident when Learner 17 stated: *"Jy kan nie iets leliks doen nie, want daarna is jou naam in die modder"* (Translation: You cannot do something that is not interesting [ugly], because then you reputation would be on line [in the mud]) and added that you would have to think whether: *"Sal die mense daarvan hou of nie"* (Translation: Will the people like it or not). In a like manner Learner 11 confirmed his view point as she stated: *"Ek het meestal gedink wat die mense gaan dink van die projek … "* (Translation: I have thought most of the time about what the people would think about the project …). This clearly indicates that some learners thought about their audience and hence were reflective practioners, a term used by Schön (1987).

Consequently, during the design process, aspects that could influence the interest of the audience were thought about. This became evident during the interviews. Readability, colour usage, page layout and picture quality were important concerns when learners designed their interfaces. The interface should also be inviting, according to Learners 20 and 21.

Clarity was also viewed as being important, but the interface should, according to Learner 14, not be designed in such a way that it hurts the eye, and when the user views it the colour

contrast should be clear. Backgrounds should be designed in such a manner that they compliment the font usage, as Learner 25 stated: *"Meneer, as die backgrounds blou is, dan moet jy nie in blou skryf nie"* (Translation: Sir, if the backgrounds are blue, then one must not write [type] in blue). He continued to say that it is important that background colour usage and the colour of video clips compliment each other.

Additionally, Learners 15 and 16 suggested that they could have enlarged the size of their headings. Learners 20 and 21 thought that words of importance that they wanted to highlight, could have been changed into a different colour, with a view to attracting more attention and adding a frame with an applicable picture to dull white pages. Likewise, Learner 2 agreed that it is important to ensure whether the picture is suitable for the screen on which it is to be inserted as he stated: *"As dit dieselfde is en of dit pas. As ek oor habitat doen, kan ek nie 'n prent oor giftigheid inplak nie"* (Translation: Whether it is similar or whether it fits. If I do something about the habitat, then I cannot insert a picture about poisonious). Similarly, Learners 6 and 8 mentioned that descriptions (captions) could be added to their pictures to enhance their screens and to attract attention, a viewpoint that was also supported by Learner 26.

Furthermore, Learner 26 added that it is important to decide whether pictures are needed or not and that designers must have enough information for their users. Picture size could also be altered as Learner 4 stated that pictures could be enlarged for greater attention grabbing. In addition, Learner 26 added that the grabbing and holding of attention is an important aspect, or as he put it: *"Om die mense aan te trek na my slides toe en dat hulle nie sommer sal uitgaan nie, maar sal inbly en dit lees"* (Translation: To attract the people to the slides [project screens] in order to keep them there [and keep them from leaving the page] at this point).

It was observed that the screens of learners did not contain too much information. Asked why this was the case, Learner 12 responded that children are lazy, they don't want to read and he should know, he added, as he himself is a child. Learner 10 added that if the pages contain too much information, then it becomes boring, but if it contains too little it could also influence readers not to read it: *"Ek het nie te veel inligting ingesit nie, want ek wou nie hê daar moet te veel inligting wees dat die mense nie wil lees nie en dat dit te erg lyk nie, maar wou ook nie te min doen sodat dit glad nie aandag trek nie"* (Translation: I did not include too much information, because I did not want there to be too much information that would cause people not to read, but I also did not want to have too little that would cause people not to read at all). Learner 17 confirmed this argument when he stated that people do not want to read all of the time, they also want to look: *" … die mense wil seker nie heeltyd lees nie. Hulle wil ook kyk"* (Translation: …the people do not want to read the whole time. They also want to look). This illustrates Healy's

(1990) view that the learners and readers in our current society are different from previous generations as they are more interested in visual material than merely text following text.

To make it as understandable as possible to the audience, learners suggested that they had used words that people would easily understand as Learner 10 stated: *"Ek het woorde gevat wat die meeste mense verstaan. Ek het nie lang en lelike [moeilike] woorde gebruik nie"* (Translation: I have used words that the majority of people would understand. I did not use long and difficult words). Learner 22 added that he made it understandable by using himself as a hypothetical reader, when he stated: *"As ek dit nie kan verstaan sal die mense wat dit lees dit ook nie verstaan nie en dan gaan dit een groot gemors wees en dan sal dit ook nie lekker uitwerk nie"* (Translation: If I do not understand it, then it is likely that the audience who would read it would also not understand and then we have a right royal mess, as it won't work as it was intended to work).

4.6.7 DESIGNS SKILLS RELATED TO OUTCOMES

Table 4.30 below, provides a summary of the findings about design, presentation and organizational skills and relates them to the critical and specific outcomes.

CRITICAL OUTCOMES	RESEARCH PROVIDES ANSWERS TO THESE QUESTIONS	SPECIFIC OUTCOMES: SELECT THE ONES TO BE ASSESSED
• Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made. • Work effectively with others as a member of a team, group, organisation, and community. • Organise and manage oneself and one's activities responsibly and effectively • Collect, analyse, organise and critically evaluate information • Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation	**DESIGN, PRESENTATION & ORGANISATIONAL SKILLS** What does the segmentation and sequencing of information require? • Concentration • Thinking a great deal • Thinking about ideas • Designing links in such a way that connections among ideas can be easily understood How important is visual material in their hypermedia presentation? They prefer: • Including visual material instead of just plain text • Using AVI files, pictures already on computer and scanned images Where do learners plan their design? • Storyboarding: plan and design screens in rough on paper • Screens on computer do not necessarily look similar to those designed on paper	**LANGUAGES** SO 1 Understand and apply the technological process to solve problems and satisfy needs • AC8 Reasoned arguments about interpretation of meaning are developed SO 4 Learners access, process and use information from a variety of sources and situations • AC6 Organisational skills are applied • AC8 Reasoned arguments are developed in the course of applying information • AC9 The results of the information search and processing are presented SO 5 Learners understand, know and apply language structures and conventions in context • AC1 Knowledge of grammatical structures and conventions is applied to structure text • AC2 Incorrect and/or inappropriate language usage by self and others is edited

	How do they plan? • One group used one learner as project manager. The other groups planned mainly individually What can be deduced from planning? • Not all learners plan in the same way, as every person is unique and thinks differently. Some planned on paper before they started and others designed and planned on the computer from the start. What can be deduced from the navigational structure? • Learners wanted all hyperlinks to be visible at all times • Hyperlinking was left to be done near the end • Learners experienced difficulty with hyperlinking What about the prospective audience? • Learners did not ignore their audience, but thought more about their work: they concentrated and stayed focused. • Readability, colour usage, page layout, size of headings and fonts and picture layout were important • Designed in such a way that audience do not want to leave screens immediately by not having too much information on screens and by including visual material – attention grabbing • Used words that are easily understandable	SO 6 Learners use language for learning • AC1 Different styles and terminology suited to the demands of a particular learning area are used • AC2 Learning strategies are evaluated and adapted according to the demands of the task • AC3 Language is used to refine ideas and solve problems • AC4 Language is used to talk about learning • AC5 The ability to transfer terminology from one language to another is demonstrated SO 7 Learners use appropriate communication strategies for specific purposes and situations • AC1 Appropriate medium of communication is chosen (pictures, AVI files, text, etc to convey meaning) • AC4 Evidence of planning, drafting and checking is produced • AC5 Evidence of mastered skills is demonstrated **TECHNOLOGY** SO 1 Understand and apply the technological process to solve problems and satisfy needs • AC3 Develop a design **SCIENCE** SO 1 To use acquired skills to investigate phenomena associated with the Natural sciences • AC6 Communicate findings • AC15 Communicate a deduction

Table 4.30: Critical Outcomes & Specific Outcomes that could be achieved during the design, organization and presentation phase

4.7 REFLECTION ON AND EVALUATING THE PROJECT

4.7.1 INTRODUCTION

Feedback on the project appears from a number of sources. For example, from the browser software one would only be able to ascertain whether the links work, what the project would look on screen, whether there are any pictures or video files that are not being displayed, etc. The teacher, group members and other learners (peers), on the other hand, could view the project and make their recommendations from a user's perspective. It is thus important to discuss what kind of feedback was obtained and how it can be interpreted.

4.7.2 FEEDBACK FROM SOFTWARE

Learners felt that it was important to test, at regular intervals, how a browser such as Microsoft Internet Explorer would display their project in order to make revisions should it be deemed necessary. These revisions refer, for example, to links that do not work and pictures that might not be displayed. Learners felt that this was very important as this was ranked in the TRP as one of the five most important tasks that designers had to do while they were busy designing a hypermedia project. Likewise in the PAQ (Table 4.31), 73% indicated the importance of browser testing, what the design looks like, confirming the result of the TRP.

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
EVALUATION & REFLECTION	37	I regulary test how my project would look in order to fix any mistakes.	6	9%	18%	73%

Table 4.31: Evaluation and Reflection – Testing of project to fix mistakes

Similarly the interviews confirmed that learners used Microsoft *Internet Explorer*. This became evident when Learner 9 replied to a question, "Where do you test your design", that: *"Ons het op Internet Explorer getoets"* (Translation: We have tested it with Internet Explorer). In addition, Learner 13 from the same group, went on to say that: *"Ons het dit elke keer getoets as ons gedink het daar is 'n fout"* (Translation: We had tested it each time when we thought that there could have been an error) confirming that testing was done to rectify errors. Regular feedback during the design process is important (Lehrer, 1993 and Liu, 2002) as this assists learners to revise the design and/or structure of their project in order to improve it.

4.7.3 FEEDBACK FROM LEARNERS

Feedback for improvement was not limited to software only. Learners also made use of their fellow group members, other children in class (peers) and even the teacher to test their projects and to make recommendations. This is illustrated by the PAQ (Table 4.32) in which 77% of the learners indicated that feedback from people to assist them in changing and/or improving their

designs was important. Similarly, 73% of the learners also indicated in the PAQ that they felt it was important for other learners in class to give advice about their projects, supporting the findings above.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
EVALUATION & REFLECTION	46	I do not use feedback (hints and critique) from other persons to improve or change my presentation.	2	77%	18%	5%
	71	I think that it is important that other learners in class look at my project to give advice.	6	4%	23%	73%

Table 4.32: Evaluation and Reflection – Feedback, improvement and advice from other learners

Additionally, evidence from the interviews supported the view that learners assisted each other to make revisions. This was evident when Learner 6 stated: *"Ons het mekaar se werk deurgekyk om te kyk of alles reg werk"* (Translation: We tested each other's work to check whether everything works OK) and Learner 22 added: *"Ek het vir ander kinders gevra of dit reg is, en ek het gekyk na hulle voorstellings en wanneer meneer vir ons gesê het om iets te doen, het ek dit probeer verbeter"* (Translation: I have asked other learners whether they think it is correct and then I have looked at their recommendations and when Sir made suggestions, I tried to improve on them). Hence, feedback can be obtained from group members, other learners in class (peers) and the teacher (Lehrer, 1993; Lehrer *et al.*, 1994).

4.7.4 REVISING AND IMPROVING THE DESIGN DURING THE PROJECT

Corrections and changes to pages were made on a regular basis. This was normally done whenever learners thought that there could be a problem, when they completed a screen and sometimes when they entered the class to check whether everything was still working:

> Learner 9 said: *"Sodra ons klaar is met 'n blaai, 'n 'screen', dan het ons gaan kyk, en dan gekyk of dit werk en deur alles gegaan en ook gekyk of ons kan teruggaan en is dit dan nog reg"* (Translation: When we completed a page, a screen, then we checked and saw whether it worked and then we went through everything [all the screens] and then checked whether we could go back to ascertain if everything was still working)

In a like manner, journal writing provided evidence that learners had made many changes to their designs. Learner 10 wrote that one of her goals was to check whether everything worked well in her project, a goal that was also set by Learners 1 and 11. During the last three weeks of the project, it was stated 19 times by learners that they wanted either to edit (round off) their projects, correct mistakes on their screens or correct their spelling in their presentations. This seems to indicate that revising their project was important to them.

4.7.5 THINKING ABOUT REVISING AND IMPROVING THE DESIGN AFTERWARDS

In the PAQ, 77% of the learners indicated that after they had completed a project, they thought a lot about how they could improve it in the future (Table 4.33).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
EVALUATION & REFLECTION	51	After I have completed the project, I think a lot how I could improve it in future.	6	5%	18%	77%

Table 4.33: Evaluation and Reflection – Thinking of improving the design in the future

Interview data supported the above as Learner 13 responded that he felt good about his design, but that he wanted to improve it as he now knew more about designing: *"Goed meneer, maar … net 'n klein bietjie slegter … Want nou het ek meer goed geleer op die rekenaar en nou wil ek weer teruggaan en wat ek geleer het weer gaan doen. Ek wil die 'fonts' verander en ek wil die inligting verander"* (Translation: Well sir, but just a bit bad also. Because I have learned more things on the computer and I want to go back and do those things that I have learned. I want to change the fonts and I want to change [update] the information). The data indicates that learners had been involved in reflection, editing and revising their projects. Be it as it may, it is recommended that for future research, more emphasis should be placed on how well the browser and learner feedback assisted them and in what ways. Likewise, questions pertaining to what kind of editing and changes occurred frequently, should also be included. Questions to these issues could be included during interview planning and in the weekly journals.

4.7.6 REFLECTION AND EVALUATION SKILLS RELATED TO OUTCOMES

Table 4.34 below, provides a summary of the findings regarding evaluation and feedback related to the critical and specific outcomes.

CRITICAL OUTCOMES	RESEARCH PROVIDES ANSWERS TO THESE QUESTIONS	SPECIFIC OUTCOMES: SELECT THE ONES TO BE ASSESSED
• Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made. • Work effectively with others as a member of a team, group, organisation, community. • Organise and manage oneself and one's activities responsibly and effectively • Collect, analyse, organise and critically evaluate information • Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation	**EVALUATION / REVISION SKILLS** What sources of feedback have been used? • Feedback from software, such as browsers, at regular intervals • Feedback from learners (peers) and teacher What is the function of this feedback? • To assist with improvement of design to make the necessary revisions When are revisions made? • When learners thought there could be a problem • When a screen was completed • When they entered the class Do learners think a lot about revising and improving the design? • Some thinking about revising and improving occurred	• ALL OUTCOMES THAT HAVE BEEN MENTIONED TO THIS POINT IN TABLE 4.9, TABLE 4.17, TABLE 4.30 and TABLE 4.34

Table 4.34: Critical Outcomes & Specific Outcomes that could be achieved during the evaluation, reflection and revision phases

4.8 COLLABORATION

4.8.1 INTRODUCTION

Learners were encouraged to work in groups and to use one another to assist in whatever possible way. Collaboration was not something new to the grade 6 learners, as it is a teaching technique that is frequently used in the school, where this research was done.

4.8.2 PERCEPTIONS OF WORKING WITH OTHER LEARNERS AND CONFLICT SITUATIONS: HOW HAD OUR LEARNERS RESPONDED?

In both TEP 1 and TEP 2, 77% of the learners indicated that collaboration was an important aspect of this project. From TEP 1 and TEP 2 it seems that they had known and comprehended what was expected of them in a collaborative approach (Table 4.35).

TASK ELICITATION OF AUGUST 2002	TASK ELICITATION OF NOVEMBER 2002
BE SUPPORTIVE AND ASSIST	**BE SUPPORTIVE AND ASSIST**
• *"Wees hulpvaardig"* (Translation: Be helpful) [Learner 5] • *"Samewerking"* (Translation: Cooperation) [Learner 2] • *"Ek moet help"* (Translation: I have to assist) [Learner 3] • *"Ek moet my kant bring"* (Translation: I have to do my share) [(Learner 10] • *"Ondersteuning gee"* (Translation: Provide support) [Learner 13]	• *"Mekaar help"* (Translation: Assist one another) (Learner 7 & 9) • *"Beplan saam"* (Translation: Plan collectively) [Learner 9] • *"Help groeplede as ek klaar was"* (Translation: Assist other group members when I have finished) [Learner 14] • *"Ander kinders help, raad gee"* (Translation: Assist other learners, give advice) [Learner 20] • *"Samewerking"* (Translation: Cooperation) [Learner 1,4, 12, 20, 22 & 26]
NO FIGHTING: LIMIT CONFLICT	**NO FIGHTING: LIMIT CONFLICT**
• *"Moenie Baklei nie"* (Translation: Do not fight) [Learner 5, 10 & 22] • *"Goeie maniere met mekaar hê"* (Translation: Good manners with one another) (Learner 18) • *"Nie 'bossy' wees nie"* (Translation: Don't be bossy) [Learner 10 & 22]	• NO REFERENCE
LISTENING	**LISTENING**
• *"Luister wat groep sê"* (Translation: Listen to what the group has to say) [Learner 3] • *"Almal 'n kans gee"* (Translation: Each one should have an opportunity) [Learner 11) • *"Luister na ander"* (Translation: Listen to the others) [Learner 23]	• NO REFERENCE
ASK FOR HELP	**ASK FOR HELP**
• *"As jy sukkel, moenie bang wees om hulp te vra"* (Translation: If you find something difficult, do not be afraid to ask for help) [Learner 5 & 22] • *"Vra vriende om te help"* (Translation: Ask friends for assistance) [Learner 2]	• *"Vra hulp om rekenaar en hiperlink te doen"* (Translation: Ask for help on computer and hyperlinking) [Learner 22]
YOU MAY DISAGREE	**YOU MAY DISAGREE**
• *"As jy nie saamstem met ander sê so*" (Translation: If you do not agree with others, say so) [Learner 5] • *"My standpunte hou"* (Translation: Keep my point of view) [Learner 10]	• *"Steek vas met mekaar" and "Elkeen 'n ander idee"* (Translation: Conflict. Each one has his own idea) [Learner 7] • *"Saam keuses maak"* (Translation: Making decisions collectively) [Learner 9 & 20]

Table 4.35: TEP 1 and TEP 2 referring to collaboration

The PAQ also seems to illustrate that learners had worked well together as 68% stated that they exchanged ideas with their group and 64% believed that they would accomplish more as a group than as solitary workers (Table 4.36).

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
COLLABORATION	47	I really exchange ideas with the other members of the project team.	6	5%	27%	68%
	74	Overall, we accomplish more as a team than I could working alone.	6	0%	36%	64%

Table 4.36: Collaboration – Exchanging ideas and accomplishment as a team

Observational notes portrayed a picture of learners that had worked well together, most of the time. Similarly, journal writing confirmed that learners thought about how they could assist people (collaborate) where possible. Goals pertaining to collaboration, included the following:

- To assist people (Learner 13)
- To assist a friend with his work (Learner 13)
- Assist Learner 12 to complete the typing (Learner 10)

Yet, despite the received impression that learners had worked well together, conflict had emerged at some stages. An analysis of the journals confirmed that the learners in the Dinosaur Group had experienced conflict throughout the project. In fact, learners in the Dinosaur Group made fourteen references to conflict in their journals during the project:

> Learner 11: *"Leerder 13 maak my naam sleg die hele tyd. Elke keer as ek iets voorstel, antwoord hulle [groep] nee, die manier is beter [hulle s'n]"* (Translation: Learner 13 is negative about me the whole time. Every time when I suggest something, they answer [group], "No, this way is better" [theirs]).
>
> Learner 12: *"Iemand [Leerder 11] het nie saamgewerk nie"* (Translation: Someone [Learner 11] did not cooperate.

Learner 13 also caused conflict as Learner 10 wrote that: *"Ja, Leerder 13 is ongeskik met my as ek hom vra om te help"* (Translation: Yes, Learner 13 is impolite if I ask him to assist). It seems thus that Learner 13 and 11 were causing conflict in the Dinosaur Group. The Marine Life Group experienced problems with Learner 24 as he was playing and falling behind. Learner 26 wrote in his TEP of November 2002 that: *"Leerder 24 wat net gespeel het"* (Translation: Learner 24 plays all the time) and Learner 20 confirmed this when she wrote *"Net Leerder 24 het agtergeraak. Hy wil nie saamwerk en het omtrent nog nie begin"* (Translation: Only Learner 24 fell behind. He does not want to cooperate and has not really started). The TEP of November 2002 provided

evidence of the kind of behaviour that caused conflict as learners had written what had hindered them. This is summarised in Table 4.37:

TASK ELICITATION 2 OF NOVEMBER 2002	
PLAYING, NOT WORKING	**TALKING TOO MUCH IN GENERAL**
• *"Leerder 24 wat nie sy werk kon doen nie, want hy was stadig en was nie baie lus om inligting te soek nie"* (Translation: Learner 24 that did not do his work, because he is too slow and he did not want to search for information) [Learner 26] • *"Sy [Leerder 11] werk nie so dan hou sy ons uit die werk uit"* (Translation: She [Learner 11] does not work and then she keeps us from working) [Learner 12]	• *"Die kinders het te veel gepraat"* (Translation: The children talk too much) [Learner 25] • *"Gepratery en geraas"* (Translation: Talkativeness and noise) [Learner 24]
MAKING JOKES	**LAUGHING**
• *"Ek het te veel grappe gemaak"* (Translation: I made too many jokes) [Learner 13]	• *"Leerder 5 wat die heeltyd lag"* (Translation: Learner 5 who laughs all the time) [Learner 26]
ASKING FOR TOO MUCH ASSISTANCE	**TALKING TO MUCH TO A PERSON**
• *"Kinders kom pla my heeltyd [om te 'scan']"* (Translation: Children bother me the whole time [to scan]) [Learner 16] • *"Mense het ons gepla"* (Translation: People bothered [disturbed] us) [Learner 8] • *"Soms het kinders my te veel gevra dan raak ek kwaad want ek is self nie klaar nie"* (Translation: Sometimes the learners asked me too much for assistance, then I become angry, because I have not finished myself) [Learner 20]	• *"Leerder 18 het my gepla met al sy stories"* (Translation: Learner 18 hindered me with all his stories) [Learner 14] • *"Leerder 18 het die hele tyd met my gepraat"* (Translation: Learner 18 talked to me the whole time) [Learner 21]
DO NOT WANT TO ASSIST	**DOING HIS/HER OWN THING**
• *"Ek het Leerder 1 gevra om my te help en hy het geweier"* (Translation: I asked Learner 1 for assistance, but he refused) [Learner 2] • *"Toe ek Leerder 13 vra (nadat hy Leerder 10 gehelp het) om te 'link' toe se hy nee"* (Translation: When I asked Learner 13 [after he had helped Learner 10] he refused) [Learner 11]	• *"As Leeder 11 nie wou saamwerk nie" and "As Leerder 11 vooruit gewerk het en die seuns ongeskik was"* (Translation: When Learner 11 did not cooperate and when Learner 11 worked ahead and the boys were ill-mannered) [Learner 10]
DISAGREEMENT	**FEELINGS TOWARDS GROUP MEMBERS**
• *"Ons is nogal goeie vriende" but "Steek vas met mekaar"* (Translation: We are good friends, but we have differences) [Learner 7]	• *"Nie een van my vriendinne was in my groep nie en dat ek nie van Leerders 13 of 12 gehou het nie"* (Translation: Not one of my friends was in my group and I did not like Learners 13 and 12) [Learner 11]
FALLING BEHIND	**NOT MAKING USE OF OPPORTUNITIES**
• *"Ons het nie baklei. Net Leerder 24 het agtergeraak. Hy wil nie saamwerk en het omtrent nog nie begin"* (Translation: We did not fight. Only Learner 24 fell behind. He does not want to cooperate and has not really started) [Learner 20]	• *"Almal het altyd gewerk en as ons kans kry gryp die mense dit nie aan nie"* (Translation: Everybody always worked [on the computers] and when we had a chance to do so, then some did not make use of this opportunity) [Learner 22]
PRESSURE OF A GROUP MEMBER	
• *"Leerder 1 het my die hele tyd gejaag omrede ek inligting soek en nie werk doen nie"* (Translation: Learner 1 rushed me the whole time because I searched for information and did not work [on the computer]) [Learner 2]	

Table 4.37: TEP 2 referring to problems experienced during collaboration

Learners had to deal with conflict management. Asked during interviews how they dealt with this, learners replied that they waited until the tempers had cooled a bit and then discussed the

problems in a reasonable way as Learner 22 stated: *" … wanneer hulle afgekoel het, het ons dit uitgepraat soos normale mense"* (Translation: … when they had cooled down, we discussed it as normal human beings would do) and Learner 10 added: *"Ons het met mekaar gepraat om te kyk wat sou die beste wees. Ons het gesê: 'As jy nie gaan saamwerk nie, gaan jy dit moeilik maak vir ons almal' "* (Translation: We discussed it to ascertain what would be the best. We said, "If you do not want to cooperate, then you make it difficult for everyone").

Instead of managing and dealing with conflict each time, they tried to prevent this. This was done by trying to prevent making uncalled for remarks or insulting comments to group members, as illustrated by Learner 22 who stated that: *"Ons praat wel met mekaar en probeer nie slegte goed sê oor die ander kinders nie, want dan kom daar baie konflik"* (Translation: We talk to one another and try not to make bad remarks about other children, because then conflict emerges). Learner 17 of the Bird Group stated that they did not exclude or ban a learner when he or she would cause problems, but would rather tell such a learner that she or he was still welcome, hoping that that learner would re-think his or her behaviour.

Despite the conflict, learners responded during interviews that they had enjoyed working in groups. Learner 2 (Table 4.37 above), who was sometimes unhappy about the behaviour of Learner 1 in his group, stated that he still enjoyed working together in his group when he stated that: *"Dit was nogal lekker saam met Leerder 1-hulle"* (Translation: It was quite enjoyable with Learner 1 and the group). Despite the conflict in the Dinosaur Group, Learner 10 stated that it was not too bad in the end. Learner 11, whose name was mentioned several times as the one who was causing conflict, even wrote in her journal that despite all the trouble, she still enjoyed the project.

4.8.3 WORKING ALONE OR IN GROUPS: HOW DO LEARNERS RESPOND?

As a result of the evidence above, portrayed in section 4.8.2, it seems that learners had responded very favourably towards collaboration and group projects. The majority of learners (59%) felt that working with others made projects better (Table 4.38). In a like manner, 59% indicated that they would rather work in a group than alone. Similarly 55% indicated that collaboration in groups made projects better.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
COLLABORATION	72	Overall I feel positive about working with others on a project.	6	5%	36%	59%
	69	I would rather work alone than working in a group.	2	59%	36%	5%
	66	Working in groups really makes projects better.	6	9%	36%	55%

Table 4.38: Collaboration – How do learners feel about working with others on a project and does it make doing projects better?

Interviews confirmed that learners felt positive about working in a group as learners can assist one another when something is not clear, assist one another when someone does not understand something and thus support each other. Learner 22 stated that*: "Sê nou ek verstaan iets nie, dan verstaan iemand anders dit dalk beter"* (Translation: If I do not understand something, maybe someone else understands it better) and Learner 10 added: *" … daar is baie meer ondersteuning en as iemand iets meer weet as wat jy weet, dan kry jy meer help"* (Translation: … there is much more support and if someone knows more than you, then you can receive more assistance).

Although the majority (77% in TEP 1 and TEP 2) favoured collaboration in doing projects, it was expected that a much higher percentage of learners would have responded more positively towards working with other learners on projects in the PAQ. Likewise, it was expected that the attitude towards group projects would be much more positive, as group work may assist in making projects easier or even better. The question that arose was: Why isn't a higher percentage of the learners inclined to be more positive towards projects and collaboration? The TEP data seems to be in conflict with the PAQ data. However, this needs to be carefully interpreted. If 77% indicate before and after the project that collaboration is important, this would not necessarily have to imply that collaboration went smoothly during this particular project. It could just indicate that learners feel positively about collaboration and groups in general. As this kind of project and its environment was new to the learners, this could have contributed to the lower percentages in the findings, as learners had not yet adjusted to the context and the problems that they might experience in this new context. Although they might not have enjoyed collaboration and group projects in this instance as much (and indicated 'as much' at the same time in the PAQ), this does not imply that they won't enjoy it in future when they are more used to this environment (context). Analysing the data, TEP 2 might provide a further explanation. A closer inspection of TEP 2 in Table 4.37 indicates that learners had experienced several problems with other learners such as:

- Some learners played too often
- Too much talking in general
- Laughing and jokes
- Learners that do not want to cooperate
- Some learners that fell behind with their section of the work
- Some learners frequently ask other learners for assistance and hinder them in the process
- Disagreements between learners

Hence, these reasons above, could have influenced learners to respond in the way that they have done.

In spite of all the lower than expected results regarding collaboration, it seemed that the majority of learners chose a topic of interest to them rather than being influenced by friends to choose the same topic in order to be allocated to the same group. This was illustrated in the PAQ, as 68% indicated that friends did not influence the topic that they had decided upon (Table 4.39).

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
COLLABORATION	57	I have chosen the same group as my friends, because I would like to work with them.	2	68%	27%	5%

Table 4.39: Collaboration – Deciding on a group

This statement could also have been categorised under decision making skills.

4.8.4 WHO DO THEY ASK FOR ASSISTANCE AND WHY?

Observation indicated that learners had worked together and assisted each other whenever possible. An analysis of the journal writing indicated that during the nine sessions of the project, the names of 21 learners who were approached for assistance were mentioned. This indicates that of the 26 participants, only 5 learners were not asked for assistance. However, it was still possible that everyone assisted everyone, but that some names were not written in the journals as learners could have forgotten to write the names. The interviews confirmed that learners had assisted each other and were not hesitant to ask for help when they could not do something, struggled with something or were unsure about something. They normally asked the teacher, friends who were knowledgeable or a person who was perceived to be an expert about the aspect that they were in need of assistance. As Learner 22 and 17 stated: *"Ek het vir die ander maats in die groep gevra of vir Meneer gevra"* (Translation: I asked the fellow group members or Sir), *"Ek het gevra vir my groep maats of vir meneer, of vir enige iemand"* (Translation: I asked

my group members, or Sir or anyone else) and *"Die een wat die meeste weet in die groep nogal"* (Translation: The one that is the most knowledgeable in the group).

4.8.5 LEARNING FROM COLLABORATION

The PAQ (Table 4.40) indicates that 73% of the learners would ask another learner for assistance when they did not understand something or did not know what to do. In the PAQ (Table 4.40) 64% of the learners also indicated that they would ask an expert in their class to assist them when they are in need of assistance. Some 64% of the learners indicated in the PAQ (Table 4.40) that they would rather ask someone for assistance when they don't understand something than try to find it out for themselves.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
COLLABORATION & INDIVIDUALISATION	21	When I have a problem, I would ask someone who is an expert in my class to assist.	6	9%	27%	64%
	42	When I don't understand what to do, I ask another learner for help.	6	4%	23%	73%
	43	When I don't understand something, I would rather try and find out for myself than asking for help.	2	64%	32%	4%

Table 4.40: Collaboration – Asking for assistance

From the journal writing, TEP 2 and the interviews conducted; learners indicated that they had learned the following from one another:

- To support and advise each other
- To take one another's feelings into consideration
- To teach one another computer skills
- To edit content, language and spelling
- To discuss problems
- To manage conflict
- To bear with one another and to be friendly and understandable
- Not to think about oneself all the time
- To work as a team

To conclude, the life skills that learners have learned during the collaboration process, are best summarised by the following learners from interview data (Table 4.41):

INTERPERSONAL SKILLS LEARNED	INTERVIEW DATA
Friendly group relationships	*"Ek het geleer ons moet almal vriendelik wees met mekaar anders gaan dit nooit uitwerk nie, maar as jy vriendelik is met almal dan sal hulle jou help as jy sukkel en as hulle sukkel dan kan jy weer vir hulle help"* (Translation: I have learned that you must always be friendly with one another, otherwise it is not going to work, but if you are friendly with everyone then they would help you when you struggle and when they struggle then you could help them) [Learner 22]
Do not think just about yourself. Think about other people too.	*"Ek leer dat jy nie altyd kan kry wat jy wil hê nie, jy moet ook kyk wat ander mense wil hê en kyk wat die beste sal wees vir hulle en vir die ander en vir jou"* (Translation: I have learned that you cannot always get it your way, you must also take into consideration what other people want and then decide what the best will be for them and then the other and for yourself) and *"Ek dink ons het geleer om beter as 'n groep saam te werk en beter konflik te hanteer"* (Translation: I think we have learned to work better together as a group and how to improve our conflict management). [Learner 10]
Fighting does not solve problems.	*"Ek het geleer die probleme gaan nie altyd weggaan as jy net die hele tyd baklei nie"* (Translation: I have learned that problems won't just disappear if you are going to fight all the time). [Learner 11]
Personal problems should not influence your work	*Ek het ook geleer dat jy nie moet dat jou persoonlike lewe inmeng met jou skoolwerk nie"* (Translation I have also learned that you should not let your personal life influence your school work). [Learner 11]
Praise one another, do not criticize the whole time	*"Wat ek geleer het, dit help nie om mekaar af te trek en mekaar te beskuldig nie. As jy ander voorstoot dan help dit"* (Translation: What I have learned, it does not help to pull each other down and to accuse one another. If you praise more, this would assist).) [Learner 13]

Table 4.41: Interpersonal skills learned from interview data

In spite of collaboration not being a new experience for this group of learners, it appears that collaboration assisted learners in perceiving and experiencing the project as enjoyable. Learner 9 indicated this when he stated that: *"Dit was nogal lekker, want ons het in groepe saamgewerk en saam besluit en saam inligting gesoek en alles saam gedoen"* (Translation: It was rather enjoyable, because we have worked in groups and decided collectively and searched collectively for information and we have done everything together). Being able to receive assistance from a capable person made the class experience different, as indicated by Learner 22 when he stated that: *"… partykeer weet mens nie hoe om op die rekenaar te werk nie en dan kan mens mekaar help"* (Translation: … sometimes you don't know what to do on the computer and then we can help one another). Equally important, it seems that collaboration assisted in motivating learners to finish their projects as Learner 4 stated that: *"My groep het my gemotiveer. Hulle het gesê: 'Doen dit', dan was dit kwaai, want dan was dit klaar en dan hoef jy nie meer daaroor te stress nie"* (Translation: My group have motivated me. They said, 'Do this', sometimes it was difficult, but then it was completed and then you don't have to stress about it anymore).

4.9 INTEREST AND MOTIVATION

4.9.1 INTRODUCTION

It had been mentioned in a previous section that the creation of a computer hypermedia project in which grade 6 primary school learners were the designers, was a first at the research site. Throughout the project, the learners' interest and motivation was high.

4.9.2 PERCEPTIONS ABOUT PROJECTS

It seems that learners enjoy projects in general. An analysis of the PAQ (Table 4.42) revealed that 91% of the learners indicated that they found projects not boring. In support of this, 73% of learners indicated that they like to work on projects (Table 4.42). The high percentage thus seems to indicate that learners have a positive perception towards projects. At the same time there is a 18% difference between the two statements in Table 4.42 below. A possible explanation for the 18% difference could be that the learners had interpreted that statement 14 referred to this hypermedia design project and that statement 54 referred to any other projects. Hence, this would then indicate that learners felt very positive about the hypermedia design project as illustrated by their response to statement 14. This analysis was supported by interview data which indicated that learners experienced the hypermedia project as more exciting, interesting and enjoyable than normal classes. This was confirmed by Learner 15 and 16 during an interview, but they also added that they enjoyed the searching for information and learned additional things during the learning process as they stated that: *"Dit is interessant en ons leer baie nuwe goed. Lekker om die inligting te soek"* (Translation: It is interesting and we learn many new things. I find it enjoyable to search for information).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
INTEREST & MOTIVATION	14	I think projects are boring.	1	91%	5%	4%
	54	I like to work on projects.	7	4%	23%	73%

Table 4.42: Interest and Motivation – Attitudes towards projects

On the other hand, with reference to statement 54, it seems that they did not feel negative towards other kind of projects, but seem to rather like those where computers are involved. This was evident in an interview when Learner 22 stated that: *"Maar nou kan jy dit in skooltyd doen en ook op die rekenaar"* (Translation: But now you can do the work during school time and you can also do it on the computer).

4.9.3 WHY HAVE LEARNERS ENJOYED THE HYPERMEDIA PROJECT?

Learners were given a wide range of topics in the Museum that they could decide upon. In the PAQ (Table 4.43) 91% of the learners indicated that they had chosen a topic that they were interested in. This could have assisted in supporting their positive feelings of ownership towards completed projects, as 91% indicated this in the PAQ.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
INTEREST & MOTIVATION	59	I have chosen a topic that I am not interested in.	1	91%	9%	0%
	1	When I'm done with a project, I often feel like it's mine.	7	0%	9%	91%

Table 4.43: Interest and Motivation: Interest towards topic and completed project

Analysing their journals provided supportive evidence that learners enjoyed the project as many wrote how they feel and experience it. Examples of their comments follow below:

- Very positive and like it (Learner 6)
- *"Baie lekker, geniet dit baie"* (Translation: Very enjoyable, enjoy it very much) (Learner 7)
- *"Lekker & interesting"* (Translation: Enjoyable and interesting) (Learner 15)
- *"Dit is 'grovee', 'osem', 'cool' en 'spif' "* (Translation: It is groovy, awesome, cool and spiff) (Learner 12)
- *"Baie 'cool' !"* (Translation: Very cool) (Learner 4)

The classes during the project were experienced as being different. The PAQ confirmed that learners had experienced this project as different as they did not have to listen to the teacher all the time. This was indicated by 86% of the learners (Table 4.44).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
INTEREST & MOTIVATION	3	Doing projects sure beats listening in class.	7	5%	9%	86%

Table 4.44: Interest and Motivation – Listening in class

Interviews confirmed the above-mentioned sentiment that learners felt that what they enjoyed was that they did not have to listen to the teacher all the time as was the case during normal classes. This became evident when Learners 6 and 8 stated that: *"Ons hoef nie net te luister wat die meneer vir ons sê nie, ons kan ons eie ding doen"* (Translation: We don't just have to listen what the teacher tells us, we can do our own thing).

In addition, they did not receive any homework for the project and could do that was required during school hours, as illustrated by Learner 22 when he replied during an interview that: *" … want normale klas moet jy net luister en luister en dan moet jy die goed by die huis gaan doen. Maar nou kan jy dit in skooltyd doen en ook op die rekenaar"* (Translation: … because in our day-to-day classes you must just listen and then you must complete the work at home. But now you can do the work during school time and you can also do it on the computer).

In a like manner, the freedom that they had experienced in class, also contributed to their experience of the class as being different, as they had more freedom to move around freely and could visit the library at any time while they were busy with a project session. Learner 12 stated: *"Gewoonlik sit ons net en skryf en hier kon ons, nou nie eintlik doen wat jy wil nie, maar jy kon gewees het waar jy wou"* (Translation: Normally we have to sit and write and now during the project we could not really do whatever we wanted to do, but you could have been [moving around] wherever you wanted to). Learner 10 confirmed this when she stated that: *"Jy kon na die biblioteek toe gaan en deur boeke blaai en jy kon meer dinge doen, jy hoef nie eenkant te gesit en die hele tyd gewerk het nie"* (Translation: You could go to the library en page through the books and you could do more things, you don't have to sit at one place the whole time while you worked).

Reading the last part of the reply of Learner 10 might create the impression that learners did not have to work much during the project. Yet, the PAQ suggests that learners felt that projects involve hard work, as 64% indicated that they agreed with this statement (Table 4.45).

DESIGN SKILL	STATEMENT NUMBER	STATEMENT	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
INTEREST & MOTIVATION	31	Projects are a lot of hard work.	6	5%	31%	64%

Table 4.45: Interest and Motivation – Hard work

In addition, when Learner 10 was asked what she meant by her statement that they did not have to work the whole time, she replied that: *"Ja, [jy] het gewerk, maar as jy nodig gehad het vir meer inligting, kon jy net opstaan en na die biblioteek toe gaan of op die Internet gekyk het"* (Translation: Yes, you worked, but should you have needed more information you could just get up and walk to the library or you could search on the Internet). This could indicate that she had enjoyed the freedom of working at her own pace on things that she thought were necessary at a specific time, but it could also imply that she had enjoyed the project in such a way that she did not experience it as work, but rather experienced it as play and experienced optimal flow, [based on the theory of Csikszentmihalyi (1990)]. That the project involved a lot of work and that learners were busy most of the time, was evident when Learner 11 stated that: *"Ek het gedink*

die klas het heeltemal anders gereageer, hulle het baie inligting gesoek en was die hele tyd besig" (Translation: I thought that the class had responded totally differently, they had searched a long time for information and were busy for the whole time). Analysing their journals provides evidence to support the view that the project was indeed hard work. This became clear when Learner 8 wrote: *"Baie lekker, maar mens moet hard werk"* (Translation: Very enjoyable, but you have to work hard).

Working not only with pen and paper as in class, but also having the computer at one's disposal to use as a tool, also increased enjoyment. It was also experienced as being different from normal class, as they did not have to use pen and paper all the time. They could use other sources (tools) and were not limited to using books all of the time. They could search for information in books and on the computer as Learner 17 stated: *"Ons werk gewoonlik in die klas met pen en papier. Hierso is ons nou op rekenaars"* (Translation: Normally we work in class with pen and paper. Here we work on computers).

The response of Learner 17 above might create the impression that the learners did not use pen and paper during the project. However, observation data as well as interview data, clearly indicated that learners summarised some of the information and made draft screen designs. Thus, learners did use pen and paper during the project.

In the PAQ, 86% of the learners indicated that they enjoyed projects as a way of learning about a subject (Table 4.46). This could possibly be attributed to the fact that learners experience learning knowledge content by doing a project, as different and possibly, as new. The difference is attributed to different mental effort when learners are engaged in projects, as 86% responded very positively in the PAQ that they remember more about a topic when they have done a project.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
INTEREST & MOTIVATION: MENTAL EFFORT	48	I remember more about a topic when I have done a project.	7	14%	0%	86%
	35	I really enjoy projects as a way of learning about a subject.	6.5	0%	14%	86%

Table 4.46: Interest and Motivation: Mental effort – Remembering and new ways of learning

Interview data confirmed the interpretation above, as it provided evidence that project work assisted certain learners to learn and improve understanding of the information as the learners had used different skills. This was evident when Learner 15 and 16 stated that: *"Wel in die klas kry jy jou inligting en jy moet dit leer. Hier moet jy dit soek, en jy tik dit en aan die einde van die*

dag ken jy dit beter. Ek ken al die goeters wat ons geskryf het en dit" (Translation: In class you receive your information [notes] and you have to learn it. Now you have to search for it and you type it and at the end of the day you then also know it better). Learner 2 supported their view that it made learning easier when he added that: *"Dit is makliker om hierdie goed te verstaan as wat ek in die klas verstaan"* (Translation: It is easier to understand these things [information] than the work in class). The project was experienced as interesting and exciting as it made learning more practical, suggesting that this does assist with learning and remembering and hence enjoying projects as a way of learning about a subject. This was illustrated when Learner 6 reported that: *"Ons het meer praktiese goed gedoen"* (Translation: We have done more practical things). Likewise, the journal writing confirmed that learners had improved their understanding and retention of information.

Considering how their prospective audience would respond to their work, also created excitement and interest as indicated by Learner 17 when he stated that he felt: *"Nogal opgewonde. Ek wil weet of mense daarop gegaan het en daarvan gehou het"* (Translation: Quite excited. I want to know whether the people have used the project and whether they have liked it).

The idea of going to the Bayworld Museum, a different place from the normal classroom, motivated a learner to participate as she stated that: *"Ek wou heel eerste net eers Museum toe gaan, want dit was opwindend en anders. Later toe besluit ek ek wou nie die projek eintlik gedoen het nie"* (Translation: At first I just wanted to go the Museum, because it was exciting and different. Later I had decided that I did not really want to participate in the project) but added that she had changed her mind and decided to participate as she thought that this project could attribute to her future growth. This is evident when Learner 5 commented that: *" … maar toe het ek weer van plan verander, want dit sou my help in die lewe, eendag as ek groot is want dan weet ek hoe om navorsing te doen ens."* (Translation: … but then I have changed my mind again, because it [the project] would assist me in life one day when I am older because then would know how to do research and so forth).

The novelty effect of being able to work on the computer could have also played a part in the enjoyment process as Learner 22 stated that: *"Ek hou baie van projekte. As dit net skryf is en niks prente nie, net soos om 'n brief te skryf, dan hou ek nie daarvan nie, maar as dit op die rekenaar gedoen kan word, en jy kan prente en goed insit, sal dit baie lekker wees"* (Translation: I really like projects. If you just have to write just like writing a letter and you may not include pictures, then I don't like it, but if you may do it on computer and you can insert pictures, then it would be very enjoyable). However, from the above, novelty may not have been the only reason

for enjoyment, but the inclusion of pictures in projects to make them more visually interesting, could have also played a role as learners could insert clipart or scanned images.

In a like manner, a similar perception regarding excitement is found when Learner 8 remarked that he found it exciting as it was the first time that they had done such a project and Learner 10 added, when she explained that she enjoyed it: *"Want dit was die eerste keer wat ek ooit 'n projek op die rekenaar gedoen het, dit was die langste wat ek op die rekenaar gewerk het"* (Translation: Because it was the first time that I have ever done a project on a computer, it was the longest that I have worked on the computer). The only time when she experienced the project as boring was when there were not enough computers available.

In conclusion: It would seem to appear that enjoyment or *"optimal flow"* was very high for all. However, two learners (Learner 3 and 5) complained in their journals that the project was too much for them. A possible explanation could be that they were scared of the computer and lacked the skills. This is supported during a formal and informal interview when Learner 5 stated that: *"Ek is bietjie skrikkerig want ek is bang ek doen iets verkeerd maar ek weet ook nie hoe alles lekker werk nie"* (Translation: I am a bit jittery, because I am afraid that I will do something wrong, but I also don't know well how the computer works) and Learner 3 went on to say that: *"Ek weet nie waar om alles te kry op die rekenaars nie, en ek weet ook nie baie goed hoe om met rekenaars te werk nie"* (Translation: I don't know where to find everything on the computers and I don't know how to use the computer well). Their behaviour is supported by theories of Blumenfeld *et al.* (1991) and Csikszentmihalyi (1990).

4.9.4 ANALOGY: CAN YOU COMPARE THIS PROJECT WITH SOMETHING ELSE?

That this hypermedia project concept where learners design screens was something new and different to them, was underlined by the PAQ in which 91% of the learners indicated that this project was not similar to other projects (Table 4.47). Looking at the results of statement 80: "I experience this computer class where I design my project as similar to other classes where I do not work on the computer" in the PAQ might portray a contradiction to the results of statement 84, as only 55% of the learners indicated that they do not agree. However, this could have been possible, as the learners might not have understood this long worded statement. Adding 55% of the learners that disagree and the 36% who were uncertain, would have totalled 91%, the same result as reported by statement 84.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
INTEREST & MOTIVATION	84	This multimedia project in which I design screens, is similar to other projects that I have done.	1	91%	9%	0%
	80	I experience this computer class where I design my project as similar to other classes where I do not work on the computer.	2	55%	36%	9%

Table 4.47: Interest and Motivation - Analogy

During the interviews, it also became evident that learners experienced this hypermedia design project as something different as Learner 14, 15 and 16 replied that it could be compared to something such as Microsoft Encarta or Microsoft Oceans, suggesting that this is not something ordinary, or in the words of Learner 15 and 16: *"Met half soos Encarta of ander programme. As jy hier kliek dan gaan jy daarnatoe ens."* (Translation: Nearly as Encarta [a multimedia encyclopedia] or other software. If you click here, then you would go somewhere else, etc.) but added that: *"Daar is een spesifieke een wat baie dieselfde is. Ek kan nou nie die naam onthou nie. Ag nee, ons het hom by die huis. En daai Ocean View"* (Translation: There is one specific one that is very much alike. I cannot remember its name now. O no, we have it at home. And that Ocean View [Microsoft Oceans]). Learner 12 even compared it to watching television when he stated that: *"Ek is self 'n [jong] kind, maar ek weet kinders is lui om te lees. Hulle hou mos van TV kyk en daai ding [die projek] is amper soos 'n TV en dan kliek hulle en hulle kyk dit, dan kry hulle ook die inligting"* (Translation: I am also a [young] child, but I know that children are lazy to read. They like to sit in front of the television and this thing [project] is quite similar to a television and then you click and you watch, then you would find the information).

In contrast to the above, learners replied that it was not possible to compare this project with anything else, as it was something new, something that they had not done before. This was indicated by Learner 26 when he stated that: *"Ek het nog nie so iets soos hierdie gedoen nie"* (Translation: I have not done anything like this) and Learner 25 added: *"Nee meneer, ek kan nie aan iets dink om dit te vergelyk nie. Dit is iets nuuts vir my meneer. Ek het nog nooit eintlik iets soos "links" en goeters gemaak nie"* (Translation: No sir, I cannot think about something to compare it with. It is something new to me Sir. I have never before made something like these links [hyperlinks] and other things). Learner 4 added that this was a first for the school as she was not aware that such a project had been done in this school before.

Similar to Learner 25 and 26 above, Learner 11 commented that it was different, as it was not done on the usual A3 size posters, something they have used often to create and present their projects. The tools that they had used were different. At the same time it was also different in the sense that the results were not presented only to fellow learners or just the teacher, but that the

audience was wider, as the head of the Bayworld Museum was invited, and each one had an opportunity to explain to her what they had done and how they had. This became evident when Learner 11 commented that: *"Dit is heeltemal verskillend, want as jy 'n taak doen, doen jy dit gewoonlik op 'n groot A3 en verduidelik dit dan aan die klas. Maar nou het ons dit op die rekenaar gedoen en ons het dit nie vir die klas verduidelik nie, maar vir die tannie van die museum verduidelik"* (Translation: It is totally different, because when you do a project, then you normally do it on a A3 size poster and you present and explain it to the class. But now we have done it on computer and we did not explain it to the class, but we have explained it to the aunty [lady] from the museum).

In conclusion: It seems that novelty played a role in creating interest and in motivating learners. Evidence indicates that learners said that being able to use a new tool such as the computer instead of using the normal pen, paper and books in class created interest. Learners found it difficult to compare this project with something that that they had done before, as only three learners thought that it was similar to a multimedia encyclopeadia. It would be interesting to see how the same group of learners would respond and articulate their experience and perceptions in the near future if they are exposed to similar computer projects at school. Alternatively, a group of learners could be identified from an early age at a school and similar computer projects could be implemented at certain intervals, accompanied with research data gathering tools. Would they still be so positive? Future research might just provide us with other perceptions.

4.9.5 THE TEACHER: HOW IS HE EXPERIENCED AND WHAT WAS HIS ROLE?

Learners experienced the role of the teacher as different. They preferred the role of the teacher during this project more than was the case in normal class. This becomes evident in the PAQ, as 82% indicated that they preferred they way the teacher interacts with them during this project (Table 4.48). They did not feel that projects were just a way for teachers to do less, as 73% disagreed with this statement in the PAQ.

DESIGN SKILL	STATEMENT NUMBER	STATEMENTS	MEDIAN SCORE	% of Learners disagree	% of Learners uncertain	% of Learners agree
PERCEPTIONS ABOUT TEACHERS	27	I like the way in which my teacher works with us more in normal classes than during this project.	1	82%	9%	9%
	77	Projects are just a way for teachers to do less.	2	73%	27%	0%

Table 4.48: The Learner perceptions about the teacher

Yet, the interviews portrayed a picture of discipline similar to the normal class condition as Learner 4 stated that the teacher was sometimes a bit strict: *"Partykeer was mnr. D bietjie kwaai"* (Translation: Mr D was strict sometimes) but Learners 20 and 21 added that this was not

really the case when they stated: *"Hy was nie kwaai nie of streng nie"* (Translation: He was not strict). It was felt that the teacher was more lenient as Learner 12 stated that: *"Hy was dieselfde met die dissipline, maar dit is soos 'n hond aan 'n leiband, hy het ons meer skiet gegee"* (Translation: His discipline was as normal. But it was like a dog on a leash, he was more lenient). This could indicate that they felt positive towards the leniency regarding discipline. They did not have much time to be naughty, as one had only a certain amount of time to complete the project. Learner 20 and 21 stated that: *"Ons het self aangegaan, almal moet hulle eie ding doen. Jy het nie eintlik genoeg tyd om stout of raserig te wees nie"* (Translation: We continued on our own, everyone had to do their part. You did not really have enough time to be naughty or to be too loud).

The teacher was experienced as a helper and supporter as Learner 4 stated: *"Hy help ons baie. As ons nie weet wat om te doen nie, kan ons hom vra en dan help hy ons"* (Translation: He helped us a lot. If we did not know what to do, we could ask him and then he assisted us) and Learner 2 concurred when he replied: *"Mnr het ons baie gehelp en Mnr was hulpvaardig"* (Translation: Sir helped us a lot and Sir was helpful).

In addition, his role was not to do the work for them or to take over when a problem arose, his role was to assist and to provide verbal guidance and the learners had to solve the problem using his and other people's guidance. This is evident as learners commented that:

> Learner 26: *"Hy lei my deur die stappe"* (Translation: He leads me through the different steps [to be able to do something])
>
> Learner 14: *"Hy is jou leiding, hy help jou met goed wat iemand anders jou nie mee kan help nie"* (Translation: He leads you, he helps you with those things with which someone else cannot help you)
>
> Learner 6 and 8: *"Help ons as ons foute het. En meneer gee ons idees"* (Translation: Helped us when we made mistakes. And Sir gave us ideas)
>
> Learner 4: *"Hy sê niks, hy sê net dit lyk beter, of partykeer wat jy nie weet nie, as daar 'n spelfout is en partykeer sal hy vir jou 'n beter idee gee"* (Translation: He said nothing, he just said that something looked better or sometimes he would say something that you did not know, for instance when there is a spelling error and sometimes he would provide you with a better idea) and added: *"Die onderwyser het altyd vir ons gesê, hy het ons eintlik nooit gehelp deur dit te doen nie, maar hy het ons altyd gehelp. Hy sal net vir ons sê wat om te doen en dan moes ons dit doen"* (Translation: The teacher always answered us, he did not help us by doing it for us, but he always assisted us. He would

just tell us what to do then we had to do it [ourselves]).

Learner 5: *"Hy wou eintlik meer gehad het ons moet self leer om dit te doen, soos as ons groot is en ons het so 'n besigheid of iets, dan weet ons hoe om dit te doen. As ons gesukkel het, sal hy ons gehelp het. Hy het ons gesê wat om te doen, maar het nooit op die rekenaar self gewerk nie"* (Translation: He actually wanted us to learn by doing it by ourselves, because when we are bigger [adults] and we have a business of something, then we would know what to do. When we struggled, he would assist us, but he did not work on the computer).

As a result, the responses of the learners seem to indicate that the principles of the cognitive apprenticeship model (Brown, Collins & Duguid, 1989) have been implemented and realized during this project.

4.10 CONCLUSION

It becomes evident that the learners had to use and develop various skills during the project. A short summary of the skills and their relation to the research questions, follow in chapter 5, based on the ideas of Jonassen (1996) and Jonassen, Peck and Wilson (1999).

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APPENDIX A: APPLICATION LETTER TO BAYWORLD

Laerskool Mount Pleasant Primary School

Milner Street
Port Elizabeth
6001
Tel: 041-3672973
E-Mail: departementshoof@xsinet.co.za

PO BOX 15067
Emerald Hill
Port Elizabeth
6001

The Director
Bayworld
PO BOX 13147
Humewood
6013

June 2002

Dear Sir / Madam

PROJECT FOR MASTERS DEGREE

I would like to enquire whether the museum (Bayworld) would be interested to assist us with the following project, that would be part of my thesis for my Masters Degree in Information Technology and Education.

Research has shown that when hypermedia/multimedia authoring systems are being used as cognitive tools, the major thinking skills that learners need to use as designers include project management skills, research skills, organization and representation skills, presentation skills and reflection skills.

Objectives of Research

The objective of this research project is to expose grade 6 learners to a design project in which they would create a hypermedia version of some of the aspects in the Port Elizabeth Museum to assist learners from our own and other schools in order to obtain new skills and construct new knowledge constructions.

Context of research

Mount Pleasant Primary school in Port Elizabeth has been using their computer lab with 15-networked computers for a year.

The creation of an interactive hypermedia package in the Mount Pleasant Primary computer laboratory by 25 grade 6 learners to simulate what can be seen at the museum, providing textual information and visual and audio media to enhance it, could be used to assist our own learners, learners from schools which do not have transport or which are too far away, but do have a computer or two capable of running a created hypermedia application of the museum. In the process or learners who are involved in the project could obtain valuable skills, develop new knowledge constructions and in the process develop a hypermedia package that could be useful for other learners from our school as well as learners fro other schools.

We think that a problem that the museum experience is that it cannot accommodate all the senior grades of all the schools. All schools that do want to attend the museum do not have the means of transport or some are simply just to far from the museum. We hope that this project could assist eventually that more learners are exposed to the museum in a different way.

Mount Pleasant is a school that has embarked on an outreach programme to disadvantage communities regarding computer training. This project is part of the outreach and we hope that we could assist the museum in making it more accessible in another way through this project.

What we require
We would have access to:

- A staff member or two that is willing to be interviewed by our learners.
- A staff member or two that is willing to assist or who could be the contact person to arrange things for example visits that need to be confirmed / booked.
- To be able to take photographs to be used in the hypermedia construction process.
- To be given assistance if learners require certain information on displays in some of the halls in the museum.
- Access free of charge (if possible) when we visit to take the photographs, interview staff and do our planning.

What we offer

I hope that we could involve the newspapers to give publicity for the museum, school and the project.

We hope that we can become partners with you in education and that this request would be receive your favourable consent.

Should you wish, you can communicate via e-mail, phone or cellular phone to me regarding anything else that you need to know. This contact information is printed below.

Regards

Andre du Plessis
departementshoof@xsinet.co.za
0837984947

APPENDIX B: LETTER OF CONSENT TO PRINCIPAL

Laerskool Mount Pleasant Primary School

Milner Street
Port Elizabeth
6001
Tel: 041-3672973
E-Mail: departementshoof@xsinet.co.za

PO BOX 15067
Emerald Hill
Port Elizabeth
6001

18 Julie 2002

Geagte Skoolhoof

NAVORSINGSPROJEK

WAAROM DIE PROJEK?

Ek is tans besig met my Meestersgraad in Opvoedkunde, Onderwys en Inligtings-tegnologie. Die eerste gedeelte rakende teorie en navorsingsmetodologie het ek reeds suksesvol voltooi en geslaag. Hierdie projek is die finale fase vir my tesis om die graad te verwerf.

PROBLEME WAT DIE MUSEUM ERVAAR

Die Museum in Port Elizabeth, Bayworld, ondervind probleme. Sommige van die probleme is as volg:

- Te min personeel en ruimte vir klasse
- Die museum kan nie te veel klasse toelaat op ‘n keer nie, want die museum is nie so groot nie.
- Nie alle skole kan na die museum kom nie, daar is te veel.
- Sommige skole kan nie na die museum kom nie, want hulle het nie vervoer nie.
- Baie skole is te ver van Port Elizabeth af om die museum te kan besoek.
- Daar was al sprake dat die museum dalk moet sluit as daar nie genoeg geld beskikbaar is nie.

VRAAG

- Kan skole of leerders wat rekenaars het nie die museum op ‘n ander wyse besoek nie?

MOONTLIKE OPLOSSINGS

Hierdie leerders kan toegang verkry deur ‘n hipermediamodel te ontwerp op rekenaar.

ETIEK

Ek belowe die volgende:

- Alle inligting is vertroulik en sal nie gebruik word om enige deelnemer enigsins te benadeel nie.
- Elke leerder sal ‘n fiktiewe naam kry, sodat sy/haar naam nie in my tesis verskyn nie. So skakel ek enige negatiewe verwysings uit, sou dit nodig wees.

HOE VERSAMEL EK INLIGTING?

Die inligting word versamel deur die volgende metodes:

- Observasie
- Onderhoude met leerders
- Vraelyste wat hulle moet beantwoord
- Ontwerpe op papier gedurende die projek
- Geskrewe Refleksie / Nabetragting deur leerders
- Video
- Eindproduk

WAT WORD VAN DIE LEERDER BENODIG?

Jy moet die volgende doen en daaroor besluit:

- Jou ouers moet die projek deurlees en hul toestemming gee deur die aangehegte brief te teken.
- Jy moet die projek deurlees asook die brief wat jou ouers moet teken, en dan ook teken om aan te dui dat jy wil deelneem. Jy word nie verplig om deel te neem nie.
- Jy verbind jou daartoe om jou samewerking te gee en die opdragte te voltooi.
- Jy mag enige tyd ophou om aan die projek te werk as jy nie daarmee wil aangaan nie. Die enigste voorwaarde is dat jy ‘n kort briefie aan my, as onderwyser, en jou groep moet skryf waarom jy nie meer wil voortgaan nie.

HOE WORD DIT MET DIE UITKOMS BASEERDE ONDERWYS KURRIKULUM GEÏNTEGREER?

Dit word met die volgende leerareas:

- Afrikaans
- Engels
- Wetenskap en Tegnologie
- Menslike en Sosiale Wetenskappe
- Lewensoriëntering
- Kuns en Kultuur

IMPLEMENTERING

Leerders sal hulle gewone onderrig ontvang en rekenaarsentrum toe gaan soos wat ingedeel is op die skoolrooster. Indien dit noodsaaklik sou wees aan die einde daarvan, sou ons moontlik ‘n dag of twee in die sentrum wou spandeer om die laaste probleme uit te sorteer. Ons hoop egter dat dit nie sal nodig wees nie.

Dus, is die projek nie net navorsing nie, maar daar gaan gepoog word dat die leerder (die kind) ‘n geleentheid kry om van die uitkomstes te probeer bereik. Dit beloof om baie genotvol te wees: iets nuuts!

Graag verneem ek van u of dit in orde sal wees.

Die uwe

A. du Plessis

APPENDIX C: LETTER OF CONSENT TO PARENTS

Laerskool Mount Pleasant Primary School

Milner Street
Port Elizabeth
6001
Tel: 041-3672973
E-Mail: departementshoof@xsinet.co.za

PO BOX 15067
Emerald Hill
Port Elizabeth
6001

18 Julie 2002

Liewe Ouers

NAVORSINGSPROJEK

WAAROM DIE PROJEK?

Ek is tans besig met my Meestersgraad in Opvoedkunde, Onderwys en Inligtings-tegnologie. Die eerste gedeelte rakende teorie en navorsingsmetodologie het ek reeds suksesvol voltooi en geslaag. Hierdie projek is die finale fase vir my tesis om die graad te verwerf.

PROBLEME WAT DIE MUSEUM ERVAAR

Die Museum in Port Elizabeth, Bayworld, ondervind probleme. Sommige van die probleme is as volg:

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- Die museum kan nie te veel klasse toelaat op ‘n keer nie, want die museum is nie so groot nie.
- Nie alle skole kan na die museum kom nie, daar is te veel.
- Sommige skole kan nie na die museum kom nie, want hulle het nie vervoer nie.
- Baie skole is te ver van Port Elizabeth af om die museum te kan besoek.
- Daar was al sprake dat die museum dalk moet sluit as daar nie genoeg geld beskikbaar is nie.

VRAAG

- Kan skole of leerders wat rekenaars het nie die museum op ‘n ander wyse besoek nie?

MOONTLIKE OPLOSSINGS

Hierdie leerders kan toegang verkry deur ‘n hipermediamodel te ontwerp op rekenaar.

ETIEK

Ek belowe die volgende:

- Alle inligting is vertroulik en sal nie gebruik word om jou as deelnemer enigsins te benadeel nie.
- Elke leerder sal ‘n fiktiewe naam kry, sodat sy/haar naam nie in my tesis verskyn nie. So skakel ek enige negatiewe verwysings uit, sou dit nodig wees.

HOE VERSAMEL EK INLIGTING?

Die inligting word versamel deur die volgende metodes:

- Observasie
- Onderhoude met leerders
- Vraelyste wat hulle moet beantwoord
- Ontwerpe op papier gedurende die projek
- Geskrewe Refleksie / Nabetragting deur leerders
- Video
- Eindproduk

WAT WORD VAN DIE LEERDER BENODIG?

Jy moet die volgende doen en daaroor besluit:

- Jou ouers moet die projek deurlees en hul toestemming gee deur die aangehegte brief te teken.
- Jy moet die projek deurlees asook die brief wat jou ouers moet teken, en dan ook teken om aan te dui dat jy wil deelneem. Jy word nie verplig om deel te neem nie.
- Jy verbind jou daartoe om jou samewerking te gee en die opdragte te voltooi.
- Jy mag enige tyd ophou om aan die projek te werk as jy nie daarmee wil aangaan nie. Die enigste voorwaarde is dat jy ‘n kort briefie aan my, as onderwyser, en jou groep moet skryf waarom jy nie meer wil voortgaan nie.

HOE WORD DIT MET DIE UITKOMS BASEERDE ONDERWYS KURRIKULUM GEÏNTEGREER?

Dit word met die volgende leerareas:

- Afrikaans
- Engels
- Wetenskap en Tegnologie
- Menslike en Sosiale Wetenskappe
- Lewensoriëntering
- Kuns en Kultuur

IMPLEMENTERING

Leerders sal hulle gewone onderrig ontvang en rekenaarsentrum toe gaan soos wat ingedeel is op die skoolrooster. Indien dit noodsaaklik sou wees aan die einde daarvan, sou ons moontlik ‘n dag of twee in die sentrum wou spandeer om die laaste probleme uit te sorteer. Ons hoop egter dat dit nie sal noig wees nie.

Dus, is die projek nie net navorsing nie, maar daar gaan gepoog word dat die leerder (die kind) ‘n geleentheid kry om van die uitkomstes te probeer bereik. Dit beloof om baie genotvol te wees: iets nuuts!

Graag verneem ek van u of dit in orde sal wees.

Die uwe

A. du Plessis

APPENDIX D: WEEKLY JOURNAL FORM

JOURNAL (Joernaal)

NAME: _____ DATE: _____
(NAAM) (DATUM)

AT START OF PERIOD (Aan die begin van die periode)

1. What goals are you setting for today? What do you want to do today? (Wat is jou doelwitte vir vandag? Wat wil jy vandag doen of bereik?)

AT END OF PERIOD (Aan einde van die periode)

2. What have you done today? Have you achieved your goals? Why or why not? (Wat het jy vandag gedoen? Het jy jou doelwitte bereik? Waarom het jy of waarom het jy nie jou doelwitte bereik nie?)

3. Did you find something easy today while busy with the project? If YES, what did you find easy today while busy with the project? (Was enigiets vandag vir jou maklik? Indien Ja, wat was maklik vandag terwyl jy met die projek besig was?)

4. Have you experienced any problems today? What problems have you experienced today while busy with the project, if any?
(Het jy enige probleme vandag ondervind? (Was enigiets moeilik vandag vir jou? Indien wel, watter probleme het jy ondervind of wat was moeilik?)

5. Was the problem solved? How? (Is die probleem of probleme opgelos? Hoe?)

6. Who or what assisted, if anyone, in solving the problem? (Wie of wat het jou gehelp om die probleem of dit waarmee jy gesukkel het, op te los?)

7. Anything that you want to write about what you have experienced or how you feel about the project today or so far? Anything that you have learned today? (Enigiets waaroor of waarvan jy wil skryf oor die projek vandag of tot dusver? Skryf hier neer hoe jy voel of wat jy dink of ervaar. Enigiets wat jy vandag geleer het?)

APPENDIX E: TASK ELICITATION 1 AUGUST 2002 (TEP 1)

TASK ELICITATION PROCEDURE
TAAK PROSEDURES

NAME:		**GENDER:**	BOY	GIRL

DATE:	

A. List the tasks that you had to do to develop your presentations below.
(Lys die take wat jy dink jy sal moet doen om die produk goed te kan ontwerp.)

B. List or write the steps that you took to decide on a topic. (Lys of skryf die stappe neer wat jy gevolg het om hierdie onderwerp te kies.)

C. Explain why you have decided on this topic. (Verduidelik waarom jy die onderwerp gekies het.)

APPENDIX F: TASK ELICITATION 2 NOVEMBER 2002 (TEP 2)

NAME OF LEARNER: _____ DATE: _____
(Naam van leerder) (Datum)

GENDER: _____
(Geslag)

When we do something like a project, we really do a number of things, like find the information that we put into the project, and so on. Please think about all the different things or tasks that were important for you to do so that you could complete your project. These tasks should include things that you did both on and off the computer. And they should be what YOU DID, not what you think should have been done.
(Wanneer ons iets soos 'n projek aanpak of doen, doen ons 'n klomp dinge ssos om byvoorbeeld inligting te soek wat ons in die projek moet sit, ens. Dink asseblief aan al die verskillende dinge of goed wat vir jou belangrik was en wat jy moes doen om jou projek of taak te kon voltooi. Die take sluit in dinge wat jy voor (op die rekenaar) asook weg van die rekenaar gedoen het. Dit is die take of dinge wat JY GEDOEN HET, nie wat jy moes doen en nie gedoen het nie.)

Please write the names of the tasks or the things that you did below. (Skryf asseblief die name van die take of dinge wat jy moes doen, hieronder.)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

For each task, write down the STRATEGIES or THINGS that HELPED you to accomplish or complete this task. For example, "I asked Kosie how to do this [name it]."
Skryf neer by elke taak die Strategieë of dinge wat jou gehelp het om taak of die projek te voltooi). 'n Voorbeeld is bv. "Ek het vir Kosie gevra hoe om dit [noem dit] te doen."

STRATEGIES or THINGS that HINDERED me to complete this task. For example, "I could not understand [name it] …"
(Strategieë of dinge wat my gehinder het om die taak of projek te voltooi). 'n Voorbeeld is bv. "Ek kon nie verstaan hoe om [noem dit] te doen nie …"

Taak 1

HELPED/HELP_____

_____

_____

_____

HINDER _____

_____

_____

Taak 2

HELPED/HELP_____

_____

_____

_____

HINDER _____

_____

_____

The same open-ended response sheet was used for tasks 1 to 12

APPENDIX G: INTERVIEWS SEPTEMBER 2002 TO NOVEMBER 2002

INTERVIEW: DESIGNING

ONTWERPERSONDERHOUD

NAME:		GENDER:	BOY	GIRL

DATE:	

LINK WITH SKILLS AS DESIGNERS	PROCESS of Hypermedia Design	MAJOR THINKING SKILLS AS DESIGNERS

Search / Selection	TRANSFORMING / TRANSLATING	Research Skills

1. **Watter tipe of soort inligting het jy al gekry?**
   Waar het jy dit gekry?
   Hoe het jy dit gekry of verkry?
   What kind of information have you found? Where did you find it? How did you find it?

2. **Wat doen jy met die inligting wat jy gekry het? (Som jy op? Hoe som jy op?)**
   Do you make summaries of your located information? How do you go about to do it?

3. **Hoe verseker jy dat jou inligting wat jy gevind het akkuraat, waar en relevant is? (Relevant beteken dat dit by jou onderwerp pas.)**
   How do you decide whether your information is accurate, truthful and relevant?

4. **Hoe het jy besluit wat om in jou aanbieding of projek te sit?**
   How did you decide what to put into your presentation?

Design / Arguments / Purpose	TRANSFORMING	Organization & Representation Skills

5. **Waar trek jy nou met jou aanbieding? (Hoe ver is jy?)**
   What's the status of the presentation? (How far are you?)
   Wat is nuut of anders as die laaste keer toe jy daaraan gewerk het?
   What's new or different since the last time you worked on it?
   (Hoekom het niks verander nie?)

6. **Waar doen jy die beplanning of uitleg van jou projek wat jy ontwerp?**
   Waarom doen jy die beplanning op die manier?
   Waarom nie op papier of kaartjies nie?
   Waarom doen jy dit liewers op die rekenaar van die begin af?
   Where do you do or go about planning the design? Why in this way? Why not on paper/screen/cards first?

7. **Wat dink jy is belangrik wanneer jy die "interface" en "screens" ontwerp?**
   Waarop konsentreer jy dan?
   Hoe kon jy dit anders gedoen het sodat dit anders of beter lyk?
   What is important when you design your screens and interface?
   Why do you design your screens in such a way? (fonts, backgrounds, pictures, etc.)
   How else could you have done it?

Structure / Connections or Links / Arguments	PLANNING / TRANSFORMING	Organization & Representation Skills

8. **Wat is die verskillende dele waaruit jou projek bestaan?**
   Hoe die verskillende dele verband met mekaar? (Hoe is hulle "gelink" of kan hulle "gelink" word?
   What are the different parts of your presentation? How are they related?

9. **Waarom het jy besluit om jou skerms of inligting op die skerm(s) (screens, files) so te "link" of in die spesifieke orde te plaas? (Verwys na hele projek of een bepaalde screen)**
   So why did you decide to segment / order / sequence / link your presentation in such a way? (Referring to whole presentation OR this current screen)
   Kon jy dit op 'n ander manier gelink het? Hoe? Wys asseblief vir my en verduidelik.
   Could you have linked the parts in another way? How? Show me and explain.

10. **Waarom het jy besluit om ……. deel te maak of in te voeg?**
    Hoe kon jy dit anders gedoen het om dieselfde inligting of boodskap oor te dra?
    Why did you decide to include … ? How else could you have done it? (To convey the same message?)

Project Management	PLANNING / TRANSFORMING	Project Management Skills

11. **Dink jy jy sal die projek binne die toelaatbare tyd kan voltooi? Waarom sê jy Ja of waarom NEE?**
    Would you be able to finish this project in time? Why, why not?

    Hoe gaan jy maak om te verseker dat jy nie oor die tyd gaan nie of nie betyds klaar is nie?
    Watter prosedures of maniere gaan jy volg om te verseker dat jy betyds kan klaar wees?
    How have you gone about to ensure that you will finish in time? What procedures have you followed or strategies have you put in place?

Analogy	EVALUATING	Organization & Representation Skills

13. **Soos wat anders is die projek? Met wat kan jy die projek vergelyk?**
    What else is this project like? To what else could you compare your project?

Audience / Organization	TRANSFORMING / EVALUATING / REVISING	Evaluating/ Reflection Skills

14. **Dink jy aan enige iemand wanneer jy besig is tydens jou projek se ontwerp?**
    Do you think about anyone while designing your project?

15. **Oor wat of wie dink jy en hoekom? OF Waarom dink jy nie aan enigeiemand nie?**
    Who or what do you think of and why? OR Why don't you think about anyone?

16. **Hoe organiseer of struktureer jy jou inligting sodat mense dit maklik kan volg op die skerm en van skerm tot skerm?**
    How are you organizing or structuring it so someone can follow it?

17. **Sal iemand anders, soos jou klasmaats byvoorbeeld, iets kan leer wanneer hulle na jou finale voltooide projek kyk?**
    Will someone else (like your classmates) be able to learn from your presentation?

18. **Wat laat jou dink dat hulle iets sal leer OF Waarom sal hulle nie iets kan leer nie? (Het jy probeer om die inligting in jou projek maklik verstaanbaar te maak? Indien Ja, waarom en hoe? Indien Nee, warom nie?)**
    What makes you think so? Not think so? (Have you tried to make the work on this project more understandable? I yes why and how, if no, why not?)

Interest	EVALUATING	Evaluating/ Reflection Skills

20. **Geniet jy die projek? Wat is vir jou lekker of geniet jy in die projek? (Is dit al?) Waarvan hou jy nie? Verduidelik.**
    What do you like about this project? Dislike? Why?

21. **Wat is moeilik vir jou? (Watter probleme ervaar jy?)**
    Wat is maklik vir jou? Waarom?
    What do you find hard? Easy? (Problems experienced)

22. **Is hierdie manier van leer dieselfde of anders as hoe jy in jou klas gewoonlik leer? Verduidelik.**
    Watter rol speel jou onderwyser(s)? Hoe is jou onderwyser(s) tydens die projek?
    Is this experience the same as or different than learning in the regular classroom? Explain. What role did they teachers play in this project? How have you experienced him?

23. **Dink jy aan enigiets anders wat niks met die projek te doen het terwyl jy in die klas met die projek besig is? Waarom? Waarom nie?**
    Do you often think of other things not related to the project when busy with this project? Why, Why not?

Learning & Skills Summary	EVALUATING / REFLECTING ON SKILLS	All Skills

24. **Het jy enigiets geleer tydens die projek?**
    Wat het jy geleer?
    Hoe het jy dit geleer?
    Have you learned anything during this project? Explain in your own words how do you learn these things.

25. **Wat beskou jy as kennis?**
    Het hierdie projek jou siening van kennis verander? Verduidelik.
    What is your view of ‘What Knowledge is”? Has this project changed your view of knowledge? How / Why or why not?

26. **Sou jy so projek soos hierdie kon doen sonder om ‘n rekenaar te gebruik? Verduidelik.**
    Could you have done this project without using a computer? Explain.

APPENDIX H: TASK RANKING PROCEDURE (TRP)

TASK RANKING LIST / RANGSKIKKING VAN TAKE

NAME:		**GENDER:**	BOY	GIRL

DATE:	

You have had more or less 16 hours (8 visits of 2 hours each to the computer and media center) to complete a multimedia presentation about a topic that you have chosen in the museum. Suppose further that you would have been evaluated or assessed on the quality of your presentation, and on how much your classmates or someone else can learn from it about the topic.

The following is a list of things that you could have done during the project. Given a deadline, it was obvious that you cannot spend the same amount of time on all of the tasks. For example: To built a car, two of the tasks might be:

- Draw a design of the car.
- Decide on the colour to paint the car.

Because it is difficult to construct a car "on the fly" without designing it by drawing, I might rank the "Draw a design" task higher than the "Decide on the colour to paint the car". Both are important, but given a limited amount of time, I would decide to spend more time on the drawing a design part. It is more important to have a design of the car than a colour scheme.

Read each of the tasks below. After you have read them, decide which 6 tasks are the most important. Write them down in the space that follows the table.

Decide then which 6 tasks are the least important. Write them in the space that follows the table.

Later when you are asked to do so, you will rank them.

Jy het ongeveer 16 ure (8 besoeke van 2 ure elk in die rekenaarsentrum en biblioteek) gehad om jou multimedia aanbieding te ontwerp oor 'n onderwerp wat jy gekies het toe jy by die museum was. Kom ons sê verder dat indien jy geassesseer sou word oor die kwaliteit van jou ontwerp en hoe goed jou klasmaats of iemand anders met behulp van jou ontwerp kan leer oor jou onderwerp, wat dink jy sou die belangrikste take wees om te doen?

Hieronder sal jy 'n table sien. Dit is 'n lys van take wat sou kon oorweeg het om te doen in die 8 weke wat verby is. Jy is bewus daarvan dat daar 'n tydsbeperking gekoppel is aan die projek. Dit is duidelik dat jy nie dieselfde hoeveelheid tyd aan elke item in die lys kan spandeer nie.

Voorbeeld: Om ‘n motor te bou, kan twee van die take wees:

- Teken ‘n ontwerp van die motor.
- Besluit watter kleur jy die motor gaan verf.

Omdat dit moeilik is om ‘n motor te bou sonder om dit eers te teken, mag ek die “Teken ‘n ontwerp van die motor” as belangriker beskou as “Besluit watter kleur jy die motor gaan verf”. Albei is belangrik, maar omdat my tyd min en beperk is, sal ek dalk besluit dat dit beter sal wees as ek meer tyd bestee aan die ontwerp va die motor. Dis belangriker om ‘n ontwerp te hê van die motor as die kleur van die motor.

Lees die onderstaande tabel. Kies dan die 6 take wat jy as die belangrikste beskou wat mens moet doen om so ‘n projek aan te pak en te kan voltooi. Skryf dit in die spasie wat na die tabel gevind sal word. Wanneer jy klaar is, skryf dan die 6 take wat jy as die minste belangrik beskou neer in die ander spasie wat ook volg na die tabel.

Eers daarna sal jy hulle rangskik wanneer jy daarvoor gevra word.

TASKS / TAKE

1	Interviewing someone about your topic. Voer met iemand ‘n onderhoud wat kennis oor jou onderwerp het.
2	Searching for books with information about your topic with the card catalogue. Soek vir boeke met inligting oor jou onderwerp in die kaartkatologus van die biblioteek.
3	Going to the library Om na die biblioteek toe te gaan.
4	Using the Internet to find information. Gebruik die Internet om inligting te soek.
5	Thinking about the best way to present an idea. Dink aan die beste manier om ‘n idee of verduideliking van iets aan te bied.
6	Learning how to use Frontpage multimedia web design software. Leer die gebruik van Frontpage multimedia webontwerp sagteware.
7	Deciding on how two cards or screens are related or connected to each other. Besluit hoe twee kaartjies of skerms verband hou met mekaar en hoe jy hulle kan “link”.
8	Thinking about your audience who will be using your project while you are busy designing the project. Dink aan die kinders of mense wat jou projek gaan gebruik terwyl jy besig is met die ontwerp.
9	Designing screens on paper or cards. Ontwerp en teken skerms van aanbieding op papier of kaartjies.
10	Preview some examples of Internet web designs that are related to your topic. Kyk na ‘n paar voorbeelde van Internet ontwerpe webblaaie wat oor dieselfde onderwerp as jou projek is.

11	Revise your presentation so that it can be improved. Bring veranderinge aan aan jou ontwerpte aanbieding sodat jy dit kan verbeter.
12	Insert AVIVideo files into project. Voeg AVI Video leers in projek.
13	Designing screens on Computer. Ontwerp van skerms direk op rekenaar.
14	Discuss with team what additional information to include. Bespreek met span watter ander inligting nog benodig word.
15	Designing screens on direct on Computer without designing it first on paper. Ontwerp van skerms direk op rekenaar sonder om dit eers op papier te ontwerp.
16	Scanning photos or pictures. Skandeer (scan) foto's of prente.
17	Making sounds or seach for sounds. Maak klanke of soek klanke.
18	Using the electronic encyclopedia on CD ROM such as Encarta, Compton, etc. Gebruik die elektroniese gerekenariseerde ensiklopedie op CD ROM soos Encarta, Compton, ens.
19	Testing presentation in browser for example in Internet Explorer to see whether there are any problems such as links that are not working or pictures that have disappeared. Toets ontwerpte aanbieding in 'n webblaaikyker (web browser) soos Internet Explorer om te toets of alle links werk en of daar nie foto's is wat dalk verwyn het nie..
20	Making backgrounds. Maak agtergronde.
21	Taking or compiling notes on what you read. Neem of maak eie notas van wat jy lees.
22	Getting someone to try out the presentation. Kry iemand om jou aanbieding te toets hoe goed dit werk
23	Making animation clips Maak beweegbare animasie prentjies.
24	Make sure that your fonts, backgrounds and colours are the same throughout the project on all screens Sorg dat fonts, agterdronde en kleure dieselfde is regdeur jou projek op elke skerm.
25	Making the graphics and other illustrations very colourful. Maak die grafika en ander material baie kleurvol.
26	Creating a timeline for completion of the project. Tydlyn of tydsindeling word opgestel of bespreek om te help met die beplanning vir die voltooiing van die projek.

Task no. Taak se no.	LIST THE 6 TASKS THAT YOU THINK ARE THE MOST IMPORTANT ACCORDING TO YOU. (Write down also the first five words of the task) LYS DIE 6 TAKE WAT DIE BELANGRIKSTE IS HIERONDER VOLGENS JOU MENING. (Skryf ook die eerste 5 woorde neer van die taak)	RANK NOW FROM MOST IMPORTANT TO LEAST IMPORTANT. A 1 INDICATES MOST IMPORTANT. RANGSKIK HULLE NOU VAN NB TOT MINDER NB HIERONDER. 'N 1 WYS DIS DIE MEESTE BELANGRIK

Task no. Taak se no.	LIST THE 6 TASKS THAT YOU THINK ARE THE LEAST IMPORTANT ACCORDING TO YOU. (Write down also the first five words of the task) LYS DIE 6 TAKE WAT DIE MINSTE BELANGRIKSTE IS HIERONDER VOLGENS JOU (Skryf ook die eerste 5 woorde neer van die taak)	RANK NOW FROM LEAST IMPORTANT TO LEAST IMPORTANT. A 1 INDICATES LEAST IMPORTANT. RANGSKIK HULLE NOU VAN MINDER NB TOT MINSTE NB HIERONDER. 'N 1 WYS DIS DIE MINSTE BELANGRIK.

APPENDIX I: REFLECTION / EVALUATION FORM

REFLECTION / EVALUATION

GROEP SE NAME: _____
(NAMES OF GROUP MEMBERS)

ONDERWERP VAN GROEP (GROUP TOPIC): _____

DATUM (DATE): _____

1. Het julle dit geniet? Wat het julle geniet? (Did you enjoy it? What did you enjoy?)

_____

_____

_____

_____

_____

_____

_____

_____

2. Wat het julle nie geniet nie? (What did you not enjoy?)

_____

_____

_____

_____

_____

_____

_____

_____

AANBEVELINGS / EVALUASIE DEUR ANDER AAN EINDE VAN PROJEK (RECOMMENDATIONS / EVALUATION BY OTHER AT END OF PROJECT

GROEP SE NAME: _____
(NAMES OF GROUP MEMBERS)

ONDERWERP VAN GROEP (GROUP TOPIC): _____

DATUM (DATE): _____

EVALUEER DIE GROEP SE PROJEK (EVALUATE ANOTHER GROUP)

1. Watter aspekte / dinge is goed volgens jou of die groep? [What aspects/things are done well (good) in the finished project? (Evaluate another group's project)]

_____

_____

_____

_____

_____

_____

2. Watter aspekte / dinge verdien aandag volgens jou of die groep? Hoe kan dit verander word? [What aspects deserve attention in their design? How can it be changed? (Evaluate another group's project)]

_____

_____

_____

_____

_____

_____

OOR JUL EIE PROJEK, NIE GROEP S'N NIE REGARDING OWN PROJECTS (NOT ANOTHER GROUP'S!!!)

3. Watter probleme het julle ondervid? Kon julle dit oplos? Hoe? [What problems did you experience? Could you solve it? How?]

_____

_____

_____

_____

_____

_____

_____

_____

4. Wat het jy alles gedurende die projek geleer? Vertel vir ons. [What did you learn during this project? Tell us about it.]

_____

_____

_____

_____

_____

_____

_____

_____

5. Hoe het jy verseker dat alles goed werk in jou aanbieding terwyl jy besig was? [How did you go about to ensure that everything works well in your project?]

_____

_____

_____

_____

_____

_____

6. Sal jy volgende keer as jy weer so projek aanpak dit dieselfde doen? Indien NEE, wat sou jy verander of anders doen volgende keer? [Would you do the project (similar one) in the same way next time? If NO, what would you change or do differently next time?]

_____

_____

_____

_____

_____

_____

APPENDIX J: GROUP-INTERVIEWS MARCH 2003 SET 2 (SEMI-STRUCTURED)

INTERVIEW: AFTER PROJECT WAS COMPLETED

1. How did you experience the class? Was it different than normal? How was it different? How does it differ from other projects?

2. To what/with what can you compare this project?

3. Why did you not enjoy the journal writing?

4. How did you experience the following?
   - Computer class
   - This type of learning. Is this different or the same from the type of learning that you are used to?
   - The teacher
   - Your group members

5. Where have you done most of your designing? Why?

6. How did you find/experience the design?

7. Who did not do a lot of designing or working on the computer? Why did you not do a lot of work or designing on the computer yourself?

8. Any problems experienced while designing? Explain.

9. Who made the front page / cover page for your group? Why he/she/they? Why were he/she chosen?

10. Why have you inserted pictures?

11. Why have you inserted AVI files?

12. How did you make sure that your design works well? Explain. (Why/Why not have you not tested your design regularly?)

13. Have you thought about anything while designing? Have you thought about your audience? Why/why not?

14. Was there any division of tasks? If yes, how did you divide the tasks? How did you go about deciding what each one has to do? Were there any choices?

15. What skills did you learn or developed during this project?

    - Organisational
    - Research
    - Planning & Time management
    - Evaluation & Reflection (from your own and group member's work)
    - Design skills & Computer skills
    - Collaboration & Team work
    - Motivational skills (confidence, on-task, concentration, interest)

16. Did you experience any problems or difficulties? With what did you experience problems?

17. What problems did you experience related to: How did you solve it?
    - Organisation
    - Research
    - Planning & Time management
    - Evaluation & Reflection (from your own and group member's work)
    - Design skills & Computer skills (linking?????)
    - Collaboration & Team work
    - Motivational skills (confidence, on-task, concentration, interest)

18. What was easy regarding?
    - Organisational
    - Research
    - Planning & Time management
    - Evaluation & Reflection (from your own and group member's work)
    - Design skills & Computer skills
    - Collaboration & Team work
    - Motivational skills (confidence, on-task, concentration, interest)

19. What recommendations do you have for others or yourself if they or you should have to do the same kind of design project?

20. Do you think that this project have benefited you in any way? Explain? (For now, future)

21. Did you enjoy the project? Why or why not? (Boring or interesting?) What was boring or interesting?

22. What is your feeling towards computers? Why?

23. What do you think is the 5 most important things that you have to do or think about when you do such a design project? Explain your decision/choice.

24. What do you think are the 5 least important things to do or think about while you do/participate in such a design project? Explain your decision/choice.

APPENDIX K: INTERVIEWS MARCH 2003 (SET 3)

INDIVIDUAL INTERVIEWS: MARCH 2003

1. Why have you decided on this topic?
2. How did you go about to decide what you have or needed to do? What gave you trouble regarding this?
3. Did you use the Internet to search for information? Why / Why not? Problems experienced with Internet?
4. What planning did you do? Explain?
5. Were the journals of any value? Explain?
6. How do you feel about the goal setting in the journals?
7. Did you experience any time problems? Explain why/why not?
8. How did you plan to finish on time?
9. Have you created a time line to finish your project? Why or why not?
10. Did you allocate any times to certain parts? What times did you allocate and why?
11. How do you decide what to include on your presentation/screen/design on computer?
12. While designing on cards, did you create screens or just summarized?
13. Did your design looked like the design you made on cards?
14. How did you decide to present your information?
15. Explain why you decided to present this project in this way?
16. How did you decide to segment or sequence information to make it more understandable?
17. How did you decide to link your information?
18. Role of pictures/AVI video files?
19. Did you divide the tasks in your group? (Assign roles?) How did you go about dividing your tasks?
20. How did you try to maintain the interest of your viewers/audience?
21. Will readers/users like using your program? Why or why not?
22. Why would they like it? Not like it?
23. Would people learn from this? Why?
24. How do you feel about your design? Why?
25. Have you enjoyed it? Why/Why not?
26. Why did you decide to choose this group (topic)?
27. Do you think this project have benefited you in any way? Why? Why not? (Future????)
28. How do you feel about projects?
29. How do you feel about this project?
30. How do you feel after you have completed a project?
31. How did you keep interest in the project?

32. Is this different from normal class? Why?
33. Is this project important to you? Why or why not?
34. Have you been committed? Why or why not?
35. How did you feel about the people in your group? Why?
36. What problems did your group experienced? Conflict? Why? How solved?
37. Have you solved your group problems? How did you solve it?
38. What do you do when you don't understand something or don't know how to do it? Why do you do that?
39. Would you rather work alone in such a project or in a group? Why?
40. Who did you ask for assistance? Why him/her?
41. What have you learned about working with each other?
42. How did you address teamwork?
43. Did you meet? When? Why? Why not?
44. How did you dealt with learners not in line with your group's goals?
45. How did you ensure that everyone works well together?
46. What kind of questions or things went through your mind while busy with the project?
47. Do you concentrate a lot? Anything that hindered your concentration?
48. Have you revised anything in your project? Why? Why not? When did you revise?
49. Did you change a lot of things? Why/Why not?
50. When did you make changes? Why did you make changes? What influence you to make changes?
51. How did you evaluate the quality of your project? Any feedback? From whom? Why?
52. Would you do this project the same way next time? Why / Why not? What would you change? Why?
53. How do you feel about your design?
54. Did you develop any new knowledge through interaction with group members?
55. Do you have learned a lot of content? Why/Why not?

APPENDIX L: PROJECT ASSESSMENT QUESTIONNAIRE (PAQ)

PROJECT ASSESSMENT QUESTIONNAIRE

NAME:		**GENDER:**	BOY	GIRL

DATE:	

DIRECTIONS: We sometimes learn in school by doing projects. We would like to know more about what kinds of things you do when you do a project and how you feel about doing them.

Please look at each sentence below and tell us how well it describes what you usually do when you do a project or a presentation for class. Circle the answer that fits best. Please complete as honestly as possible. Complete all the questions. There are no wrong or right answers. It is up to you to tell us how well each statement describe what you do.

INSTRUKSIES: Ons leer somtyds in die skool deur projekte te doen. Ons wil graag meer te wete kom aangaande die dinge wat jy doen of waarmee jy besig is wanneer jy besig is met ‘n projek en hoe jy voel wanneer jy daarmee besig is.

Kyk na elke stelling hieronder en vertel ons hoe goed dit jou beskryf waneer jy besig is met ‘n projek. Omkring die nommer langs die stelling wat jou die beste beskryf. Voltooi deur so eerlik as moontlik met jouself te wees. Voltooi asseblief al die vrae. Daar is geen verkeerde of korrekte antwoorde nie. Dit hang van jouself af hoe goed jy vir ons jouself gaan beskryf wanneer jy besig is met ‘n projek.

I like cats very much. Ek hou baie van katte.

Beskryf my glad nie						**Beskryf my baie goed**
1	**2**	**3**	**4**	**5**	**6**	**7**
Does not describe me at all						**Describes me very well**

1	Wanneer ek ‘n projek voltooi het, voel dit vir my asof dit my eie is. When I’m done with a project, I feel like it’s mine.	**Beskryf my glad nie** … **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** … **Describes me very well**
2	Ek dink nie aan hoe maklik ander mense wat my projek sal gebruik, dit sal ondervind of ervaar nie. I usually don’t think about how easy my presentation will be for the people who would use it.	**Beskryf my glad nie** … **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** … **Describes me very well**
3	Dis beter om projekte te doen as om in die klas te sit en luister. Doing projects sure beats listening in class.	**Beskryf my glad nie** … **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** … **Describes me very well**
4	Die Joernaal wat ek elke week moes voltooi het, het my glad nie gehelp nie. The Journal that I have completed every week did not help me at all.	**Beskryf my glad nie** … **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** … **Describes me very well**
5	Dis nogal vir my moeilik om te besluit wat die onderwerp regtig beteken. It is often hard for me to decide what the topic means.	**Beskryf my glad nie** … **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** … **Describes me very well**

6	Ek gebruik baie tyd om inligting vir my projek te soek. I spend a lot of time finding information for the project.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
7	Ek dink baie daaraan hoe ek my idees makliker verstaanbaar kan maak vir ander mense. I think a lot about how to make my ideas easier to understand for other people.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
8	Ek dink dit is belangrik om illustrasies, prente, foto's of AVI video files in my projek te gebruik. I think it is important to use illustrations, pictures, photos or AVI Video files in my project.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
9	Ek dink baie daaraan of ander mense wat my projek gebruik, iets daaruit sal leer. I think a lot if people, who would use my project, will learn from it.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
10	Ek is so besig met my projek dat ek gereeld vergeet om met die tyd tred te hou (Weet nie eers hoe laat dit is nie.) I often lose track of time when I am working on a project.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**

11	Dis moelik om te besluit in watter volgorde ek my sub-hofies van my onderwerp moet rangskik. It's hard to know in what order to put my sub-headings.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
12	Ek vra myself gereeld wat die beste manier is om 'n idée voor te stel byvoorbeeld sal ek 'n prentjie, foto, beweging, AVI Video file of kleur gebruik om dit beter uit te druk. I often ask myself about the best way to present an idea, like, should I use a photo, picture, animation, AVI video file, colour or just write about it.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
13	Ek link my verskillende skerms (screens) wat ek ontwerp het eers aan die einde wanneer ek al my skerms klaar ontwerp het. I link my screens and concepts on the computer only when I have finished designing all my screens.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
14	Ek dink projekte is vervelig. I think projects are boring.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
15	Ek leer meer wanneer ek 'n projek doen as met ander maniere van leer. I learn more when I do a project than with other types of learning.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**

16	Ek dink nie baie aan die mense wat my projek gaan gebruik wanneer ek besig is om te ontwerp op die rekenaar nie. I do not think a lot about the people who would use my design project while I am busy with the design process on the computer.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
17	Ek stel ‘n tydlyn op om my te help om die projek binne die tyd tot my beskikking te voltooi. I created a timeline to assist me in planning to finish my project on time.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
18	Ek ontwerp my skerms (screens) eers op kaartjies of papier voordat ek begin om my skerms op die rekenaar te ontwerp. I design my screens first on cards before I design my screens on the computer.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
19	Ek hoef nie regtig hard te dink wanneer ek ‘n projek ontwerp of ontwikkel nie. I don’t really have to think much when I develop a project.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
20	Wanneer ek ‘n probleem ondervind sal ek slegs vir my beste vriend of vriende vra om my te help. When I have a problem, I would just ask my best friend(s) for help.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**

21	Wanneer ek ‘n probleem het sal ek vir iemand wat ‘n expert (baie daarvan weet) in my klas vra om my te help When I have a problem, I would ask someone who is an expert in my class to assist.	**Beskryf my glad nie** — **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** — **Describes me very well**
22	Ek het my links so ontwerp dat mense nie maklik verbande of konneksies tussen die opskrifte en sub-hofies sal kan maak nie. I have designed my links in such a way that people cannot easily make connections between the headings or sub-headings.	**Beskryf my glad nie** — **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** — **Describes me very well**
23	Dit is vir my baie maklik om hyperlinks op die rekenaar te maak tussen die verskillende skerms. I found it easy to make links or hyperlinks on the computer among the different screens.	**Beskryf my glad nie** — **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** — **Describes me very well**
24	Ek was nie bekommerd dat ek my projek betyds sal voltooi nie. I was not worried that I would not finish on time with my project.	**Beskryf my glad nie** — **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** — **Describes me very well**
25	Ek dink nie baie daaraan hoe ek my skerms (screens) kan verbeter terwyl ek besig is om op die rekenaar te ontwerp nie. I do not think a lot how I can improve my screens on the computer when I design.	**Beskryf my glad nie** — **Beskryf my baie goed** **1 2 3 4 5 6 7** **Does not describe me at all** — **Describes me very well**

26	Ek dink ek sal volgende keer wanneer ek weer so ‘n hypermedia projek soos hierdie moet doen of aanpak, dit weer op dieselfde manier doen. I think that I would plan and design a hypermedia project like this in the same way next time when I have to do a similar project.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
27	Ek hou meer van die manier of wyse waarop my onderwyser in die gewone klas met ons werk as in die rekenaarklas gedurende die projek. I like the way in which my teacher works with us more in normal classes than during this project.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
28	Ek dink dit is nie belangrik vir mense om maklik deur my projek te kan navigeer (navigate) nie. I think it is not important for people to navigate easily through my project.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
29	Ons bespreek baie wat elkeen se taak in die groep is en wat elke persoon moet doen. We discuss a lot in our team what each person should do.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
30	Ek moet baie dink oor watter inligting eit my bron moet neem om te gebruik in my projek. I have to think a lot about exactly what information to take from a source to be used in my project.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**

31	Projekte is baie harde werk. Projects are a lot of hard work.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
32	Ek dink baie aan hoe dinge of inligting verband hou met mekaar. I think a lot about how things or information are connected in my project.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
33	Ek maak notas oor die inligting wat ek lees uit in my bronne. I make notes about the content that I read from my sources.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
34	Ek tik of skryf gewoonlik slegs my inligting oor my onderwerp en voeg nie prente of foto's in nie. I usually just write type information about my topic and do not include pictures or photos.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
35	Ek geniet projekte as 'n manier om meer van 'n onderwerp te leer. I really enjoy projects as a way of learning about a subject.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**

36	Ek bereik nie my doelstellings wat ek elke periode neerskryf nie. I do not achieve the goals that I set for each period.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
37	Ek toets gereeld hoe my projek lyk sodat ek foute (dinge wat nie reg werk nie) kan regmaak sodat dat goed sal werk. I regulary test how my project would look in order to fix any mistakes.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
38	Ek het gedink aan maniere of planne wat my sou kon help om die projek betyds te voltooi. I thought about what I could do to finish on time with my project.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
39	Ek het nie baie nuwe dinge of goed geleer tydens die projek nie. I did not learn lots of new things during this project.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
40	Ons het baie beplanning gedoen in ons groep om te bepaal wat ons alles moet doen. We have done a lot of planning in our group about what we should do.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**

41	Ek stel doelwitte vir myself tydens die projek. I set goals for myself during the project.	**Beskryf my glad nie** / **Beskryf my baie goed** **1** **2** **3** **4** **5** **6** **7** **Does not describe me at all** / **Describes me very well**
42	Wanneer ek nie verstaan hoe om iets te doen nie, vra ek vir ‘n ander leerder in my klas vir hulp. When I don’t understand what to do, I ask another learner for help.	**Beskryf my glad nie** / **Beskryf my baie goed** **1** **2** **3** **4** **5** **6** **7** **Does not describe me at all** / **Describes me very well**
43	Wanneer ek iets nie verstaan nie of nie weet hoe om iets te doen nie, sal ek liewer self probeer uitvind hoe om dit te doen as om vir iemand anders te vra om my te help. When I don’t understand something, I would rather try and find out for myself than asking for help.	**Beskryf my glad nie** / **Beskryf my baie goed** **1** **2** **3** **4** **5** **6** **7** **Does not describe me at all** / **Describes me very well**
44	Ek dink gereeld aan die mense wat my projek gaan gebruik wanneer ek besig is om die skerms (screens) op die rekenaar te ontwerp. (Wat hulle opinie van my projek gaan wees). I often think about my audience when I am busy to design my screens (What their opinion of my presentation will be).	**Beskryf my glad nie** / **Beskryf my baie goed** **1** **2** **3** **4** **5** **6** **7** **Does not describe me at all** / **Describes me very well**
45	Ek dink gereld daaraan hoe ek my ontwerpte skerms (screens van projek) kan verbeter. I often think how I could improve my screen designs.	**Beskryf my glad nie** / **Beskryf my baie goed** **1** **2** **3** **4** **5** **6** **7** **Does not describe me at all** / **Describes me very well**

46	Ek gebruik nie terugvoering of evaluering (wenke en kritiek) van ander mense om sodoende my ontwerp te verbeter nie. I do not use feedback (hints and critique) from other persons to improve or change my presentation.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
47	Ek deel en ruil idees gereeld uit met die ander lede van my groep. I really exchange ideas with the other members of the project team.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
48	Ek onthou meer van ‘n onderwerp wanneer ek ‘n projek daaroor gedoen het. I remember more about a topic when I have done a project.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
49	Wanneer ek besig met ‘n projek is, bly ek gefokus en konsentreer ek, my aandag word nie maklik afgetrek nie. When I am busy with a project, I stay focused and my attention is not easily distracted.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
50	Ek dink gereeld wat die beste manier is om ‘n idee oor te dra. I often think about the best way to get an idea across clearly.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**

51	Nadat ek my projek voltooi het, dink ek nogal baie hoe ek my projek in die toekoms kan verbeter. After I have completed the project, I think a lot how I could improve it in future.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
52	Ek gebruik bronne soos boeke en tydskrifte baie vir my projek om inligting te soek. I use resource materials like books or magazines a lot to find information for my project.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
53	Ek ondervind dat ek al die inligting wat ek versamel kan gebruik. I find that I can use every bit of information that I collect.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
54	Ek hou daarvan om aan projekte op rekenaar te werk. I like to work on projects on the computer.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**
55	Ek ontwerp my screens direk op die rekenaar sonder dat ek dit eers rofweg op papier ontwerp. I design my screens directly on the computer without designing them on paper.	**Beskryf my glad nie** | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | **Describes me very well**

56	Aanbiedings moet probeer om mense te help om konneksies te maak tussen idees. Presentations should help people find connections among ideas.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
57	Ek het dieselfde groep gekies waarin my vriende is omdat ek saam met hulle wil werk. I have chosen the same group as my friends, because I would like to work with them.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
58	Ek dink gereeld aan ander dinge wat niks met die projek verband hou nie terwyl ek besig is om te werk aan my projek in die rekenaarkamer. I often think about other things not related to the project when we are busy in the computer room with the project.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
59	Ek het ‘n onderwerp gekies waarin ek nie belangstel nie I have chosen a topic that I am not interested in.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**
60	Ek dink nie dit is belangrik dat kleure, fonts en backgrounds dwars deur my projek op die rekenaar dieselfde moet wees nie. I think it is not important that colours, fonts and backgrounds be consistent within a hypermedia project.	**Beskryf my glad nie** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **Beskryf my baie goed** **Does not describe me at all** | **Describes me very well**

61	Ek gebruik die biblioteek om inligting te soek vir my projek. I use the library to search for information to use in my project.	**Beskryf my glad nie** | **2** | **3** | **4** | **5** | **6** | **Beskryf my baie goed** **1** | **7** **Does not describe me at all** | **Describes me very well**
62	Ek gebruik die Internet om vir inligting te soek wat ek benodig vir my taak. I use the Internet to search for information.	**Beskryf my glad nie** | **2** | **3** | **4** | **5** | **6** | **Beskryf my baie goed** **1** | **7** **Does not describe me at all** | **Describes me very well**
63	Ek hou daarvan om aan projekte te werk waar ek nie die rekenaar mag gebruik of daarop mag werk nie. I like to work on projects where I am not allowed to use or work on the computer.	**Beskryf my glad nie** | **2** | **3** | **4** | **5** | **6** | **Beskryf my baie goed** **1** | **7** **Does not describe me at all** | **Describes me very well**
64	Ek dink gereeld of my inligting wat ek bymekaargemaak of gevind het akkuraat, betroubaar en waar is. I often think whether the information that I have gathered is accurate, reliable and truthful.	**Beskryf my glad nie** | **2** | **3** | **4** | **5** | **6** | **Beskryf my baie goed** **1** | **7** **Does not describe me at all** | **Describes me very well**
65	Ek weet nooit waar om goeie inligting vir my projek te kry of te soek nie. I never know where to find good information for my project.	**Beskryf my glad nie** | **2** | **3** | **4** | **5** | **6** | **Beskryf my baie goed** **1** | **7** **Does not describe me at all** | **Describes me very well**

66	Om in ‘n groep saam te werk, maak die doen van projekte vir my beter en makliker. Working in groups really makes projects better and easier	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
67	Ek dink dis belangrik dat ‘n mens onderhoude met ander mense moet voer om inligting te kry wat my sal kan help met my projek. I think it is important to Interview someone to get information in order to assist me with my project.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
68	Ek ontdek dat ek ook in my vryetyd wanneer ons nie in die rekenaarklas of biblioteek is nie, tyd aan my projek bestee. I find myself working on the project during my free time.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
69	Ek verkies om liewer alleen te werk as om in ‘n groep te werk. I would rather work alone than working in a group.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
70	Ek het baie veranderinge aan sommige van my skerms (screens) gemaak nadat ek skerms voltooi het. I have made a lot of changes to some of my screens after I have completed it.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**

71	Ek dink dis belangrik dat ander leerders in my klas na my projek moet kyk om my raad te gee hoe ek dit kan verbeter. I think that it is important that other learners in class look at my project to give advice for improvement.	**Beskryf my glad nie** — **1** — **2** — **3** — **4** — **5** — **6** — **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**
72	Oor die algemen voel ek positief daaroor om saam met ander leerders aan ‘n projek te werk. Overall I feel positive about working with others on a project.	**Beskryf my glad nie** — **1** — **2** — **3** — **4** — **5** — **6** — **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**
73	Ek dink gereeld of mense wat my projek sal lees of gebruik, dit bruikbaar en interessant sal vind. I think a lot about whether the reading or using of my presentation will be meaningful and interesting for someone else.	**Beskryf my glad nie** — **1** — **2** — **3** — **4** — **5** — **6** — **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**
74	Oor die algemeen sal ons meer gedoen kan kry as ‘n groep saam as wat ek kan doen as ek heeltemal alleen werk. Overall, we accomplish more as a team than I could working alone.	**Beskryf my glad nie** — **1** — **2** — **3** — **4** — **5** — **6** — **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**
75	Ek hoef nie baie te konsentreer terwyl ek besig is met my projek nie. I do not concentrate a lot while busy with my project.	**Beskryf my glad nie** — **1** — **2** — **3** — **4** — **5** — **6** — **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**

76	Ek het baie konflik in my groep ervaar. I have experienced a lot of conflict in my group.	**Beskryf my glad nie** — **1** **2** **3** **4** **5** **6** **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**
77	Projekte is net ‘n manier vir onderwysers om minder te doen. Projects are just a way for teachers to do less.	**Beskryf my glad nie** — **1** **2** **3** **4** **5** **6** **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**
78	Projekte is vir my moeilik omdat ek nie altyd weet wat om dadelik te begin doen nie. I find doing projects difficult because I don’t always know what to do right away.	**Beskryf my glad nie** — **1** **2** **3** **4** **5** **6** **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**
79	Wanneer ons in ‘n groep werk, ondervind ek dat almal die heletyd praat, maar bitter min word regtig gedoen. When I work in a group, I often find that everyone keeps talking but very little really gets done.	**Beskryf my glad nie** — **1** **2** **3** **4** **5** **6** **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**
80	Ek ervaar hierdie rekenaarklas waar ek besig is om my projek te ontwerp, dieselfde as in die ander klasse waar ek nie op die rekenaar werk nie. I experience this computer class where I design my project as similar to other classes where I do not work on the computer.	**Beskryf my glad nie** — **1** **2** **3** **4** **5** **6** **7** — **Beskryf my baie goed** **Does not describe me at all** — **Describes me very well**

81	Ek dink baie aan idees wanneer ek ‘n projek doen. I think a lot about ideas when I do a project.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
82	Ek probeer nie om my inligting op ‘n maklike verstaanbare manier aan te bied vir my gebruikers wat my projek op die rekenaar gaan gebruik nie. I do not try to present my information in such a way that my audience would easily understand what my topic is about.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
83	Die inligting wat ek kry het gewoonlik niks te make met my onderwerp nie. The information that I usually find has nothing to do with my topic.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
84	Hierdie rekenaarprojek waar ek my eie multimedia skerms ontwerp is nes alle ander projekte wat ek al gedoen het. This multimedia project in which I design my screens, is similar to other projects that I have done.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**
85	Ek dink nie dis belangrik om die rekenaarprogram, Frontpage, goed te ken en te kan gebruik om my projek daarmee te ontwerp nie. I do not think that it is important to know Frontpage, the software that I use to design my project with, well.	**Beskryf my glad nie** | | | | | | **Beskryf my baie goed** **1** | **2** | **3** | **4** | **5** | **6** | **7** **Does not describe me at all** | | | | | | **Describes me very well**

APPENDIX M: CODING

CODING SYSTEM

Coding of Interviews, Journals, Observational notes and Evaluation and Reflection Sheet

Learning from project?
- Can Project without computer be done?
- SKILLS NEEDED FOR SUCH A PROJECT
- LEAST IMPORTANT

Journal
- Journal Negative
- Journal Positive

Collaboration, Teamwork & New Skills
- Work alone or in group?
- Learned from collaboration
- Problems with Collaboration/Team
- Who assist who?

Design & Computer Skills
- Finish
- Changes in Design from last time
- Planning / Goals
- Screen Layout & Design
- Audience
- Scan
- Backgrounds & Colour
- Computer Skills
- Software Competence
- Easy/Confident
- Problems/Lacking/Difficult/Problems
- Mapping/Layout on cards or computer
- Deciding how to segment/sequence info (make understandable)
- Linking of Info / Organised
- Interest of audience/viewers
- Represented/Layout

Evaluation & Reflection Skills
- Finding Easy (Journal)
- Problems with Eval/Reflect
- Evaluate/assess process or project
- Revising design

Motivational Skills
- Finding Easy (Journal)
- Different from normal class
- Analogy
- Role of teacher
- Experience / Enjoy / Feel
- Feeling
- Problems Motivational
- Off-Task Behaviour*
- Confidence

CODING SYSTEM

Coding of TASK ELICITATION AUG 2002 (TEP 1)

Collaboration Skills
- Assistance: Who can help?
- Teamwork/Work Together with friends/group
- Parents Assist

Design & Computer Skills
- Audience
- Colour
- Computer Skills (Tech)
- Create Backgrounds
- Draw Pictures
- Scan Pictures or Photos
- Screen Design & Mapping on Cards/Paper
- Screen Design & Mapping on PC
- Software Competence

Evaluation & Reflection Skills
- Motivational Skills
- Concentration
- Confidence
- On-Task Behaviour

Planning & Project Management Skills
- Brainstorming
- Goal Setting
- Planning
- Timeline & Time management & Work at other times

Research Skills
- Books
- Electronic Encyclopedia
- Find Pictures or Photos
- Internet
- Library for info
- Listen for Info or Instruction
- Museum
- Reading
- Select Info / Search Info / Research
- Writing, Summurization & Note Taking

Coding of TASK ELICITATION NOV 2002 (TEP 2)

Collaboration Skills
- Teamwork: Work together with friends/group
- Parents assist
- Assistance: Who can help?

• Interest • Concentration • On-Task Behaviour Planning & Project Management Skills • Finding Easy (Journal) • Planning • Problems Planning & Proj Management • Brainstorming • Working where? • Statemen Finishing project: Creation of Timeline for completion • Assigning roles • Allocating resources and time / Timeline / Working times • Goal setting • Problems experienced Research Skills • Library • AVI Video Files • Finding Easy Today (Journal) • Accuracy&Reliability • Finding Photos or Pictures • Reliability • Video • Electronic Encyclopdia • Problems Research Skills • Internet • Select Topic • Museum • Read • Write, summurize, note taking & translations • Interview • Searching for Info/Select Info / Research • Determine nature of the problem / How research should be organi • Posing thoughtful questions • Analyze&Interpret Info for pattern making	Design & Computer Skills • Audience • Colour • Computer Skills (Tech) • Create Backgrounds • Draw Pictures • Linking/Hyperlinks • Scan Pictures or Photos • Screen Design & Mapping on Cards/Paper • Screen Design & Mapping on PC • Software Competence Evaluation & Reflection Skills • Motivational Skills • Concentration • Confidence • On-task Behaviour Planning & Project Management Skills • Brainstorming • Goal setting • Planning • Timeline & Time management & work at other times • Research Skills • Books • Electronic Encyclopedias • Find Pictures or Photos • Internet • Interview • Library for Info • Listen for Info or Instruction • Museum • Reading • Select Info / Search Info / Research • Select Topic • Video • Writing, Summurization & Note Taking & Translations

Coding of Project Assessment Questionnaire (PAQ)

1	When I'm done with a project, I often feel like it's mine.	MENTAL EFFORT	MOTIVATIONAL
2	I usually don't think about how easy my presentation will be to be use by others.	PRESENTING	AUDIENCE
3	Doing projects sure beats listening in class.	INTEREST	MOTIVATIONAL
4	The Journal that I have completed every week, did not help me at all.	PLANNING	ORGANISATIONAL
5	It is often hard for me to decide what the topic means.	MENTAL EFFORT	PROJECT MANAGEMENT
6	I spend a lot of time finding information for the project.	SEARCHING	
7	I think a lot about how to make my ideas easier to understand for other people.	MENTAL EFFORT	AUDIENCE
8	I think it is important to use illustrations, pictures, photos or AVI Video files in my project.	PRESENTING	AUDIENCE
9	I think a lot if people who would use my project, will learn from it.	MENTAL EFFORT	AUDIENCE
10	I often lose track of time when I am working on a project.	PLANNING	PROJECT MANAGEMENT
11	It's hard to know in what order to put my ideas.	CONNECTING	
12	I often ask myself about the best way to present an idea, like, should I use a graph, photo, picture, animation, colour or just write about it.	PRESENTING	AUDIENCE
13	I link my screens and concepts on the computer only when I have finished designing all my screens.	PRESENTING	CONNECTING
14	I think projects are boring.	INTEREST	MOTIVATIONAL
15	I learn more when I do a project than with other types of learning.	CONNECTING	LEARNING
16	I do not think a lot about the people who would use my design project while I am busy with the design process on the computer.	PRESENTING	AUDIENCE

17	I created a timeline to assist me in planning to finish my project on time.	PLANNING	PROJECT MANAGEMENT
18	I design most of my screens first on cards before I design my screens on the computer.	PLANNING	PRESENTING
19	I don't really have to think much when I develop a project.	MENTAL EFFORT	
20	When I have a problem, I would just ask my best friend(s) for help.	COLLABORATION	
21	When I have a problem, I would ask someone who is an expert in my class to assist.	COLLABORATION	
22	I have designed my links in such a way that people cannot easily make connections between the headings.	CONNECTING	
23	I found it easy to make links or hyperlinks on the computer.	PRESENTING	
24	I was not worried that I would not finish on time with my project.	PLANNING	PROJECT MANAGEMENT
25	I do not think a lot how I can improve my screens on the computer when I design.	MENTAL EFFORT	AUDIENCE
26	I think that I would plan and design a hypermedia project like this in the same way next time when I have to do a similar project.	PLANNING	REFLECTION
27	I like the way in which my teacher works with us more in normal classes than during this project.	INTEREST	
28	I think it is not important for people to navigate easily through my project.	PRESENTING	AUDIENCE
29	We discuss a lot in our team what each person should do.	PLANNING	PROJECT MANAGEMENT
30	Often I have to think a lot about exactly what information to take from a source.	MENTAL EFFORT	SEARCHING
31	Projects are a lot of hard work.	INTEREST	
32	I think a lot about how things or information are connected in my project.	CONNECTING	

33	I make notes about the content that I read.	SEARCHING	
34	I usually just write type information about my topic and do not include pictures photos or AVI video files.	PRESENTING	
35	I really enjoy projects as a way of learning about a subject.	INTEREST	
36	I do not achieve the goals that I set for each period.	PLANNING	PROJECT MANAGEMENT
37	I regulary test how my project would look in order to fix any mistakes.	PRESENTING	EVALUATION
38	I thought about what I could do to finish on time with my project.	MENTAL EFFORT	PROJECT MANAGEMENT
39	I do not have learned lots of new things during this project.	REFLECTION	
40	We have done a lot of planning in our group about what we should do.	PLANNING	PROJECT MANAGEMENT
41	I set goals for myself during the project.	PLANNING	PROJECT MANAGEMENT
42	When I don't understand what to do, I ask another learner for help.	COLLABORATION	
43	When I don't understand something, I would rather try and find out for myself that asking for help.	INDIVIDUALIZATION	COLLABORATION
44	I often think about my audience when I am busy to design my screens (What their opinion of my presentation will be).	AUDIENCE	
45	I often think how I could improve my design.	MENTAL EFFORT	PRESENTATION
46	I do not use feedback (hints and critique) from other persons to improve or change my presentation.	REFLECTION	AUDIENCE
47	I really exchange ideas with the other members of the project team.	COLLABORATION	
48	I remember more about a topic when I have done a project.	MENTAL EFFORT	
49	When I am busy with a project, I stay focused and my attention is not easily distracted.	INTEREST	ON-TASK BEHAVIOUR

50	I often think about the best way to get an idea across clearly.	PRESENTING	MENTAL EFFORT
51	After I have completed the project, I think a lot how I could improve it in future.	REFLECTION	
52	I use resource materials like books or magazines a lot.	SEARCHING	
53	I find that I can use every bit of information that I collect.	SEARCHING	
54	I like to work on projects.	INTEREST	
55	I design my screens directly on the computer without designing them on paper.	PRESENTING	PLANNING
56	Presentations should help people find connections among ideas.	CONNECTING	
57	I have chosen the same group as my friends, because I would like to work with them.	COLLABORATION	
58	I often think about other things not related to the project when we are busy in the computer room with the project.	MENTAL EFFORT	ON-TASK BEHAVIOUR
59	I have chosen a topic that I am not interested in.	INTEREST	
60	I think it is not important that colours, fonts and backgrounds be consistent within a hypermedia project.	PRESENTING	
61	I use the library to search for information.	SEARCHING	
62	I use the Internet to search for information.	SEARCHING	
63	I like to work on projects where I am not allowed to use or work on the computer.	INTEREST	
64	I often think whether the information that I have gathered is accurate, reliable and truthful.	SEARCHING	MENTAL EFFORT
65	I never know where to find good information for my project.	SEARCHING	
66	Working in groups really makes projects better.	INTEREST	COLLABORATION

67	I think it is important to Interview someone to get information.	SEARCHING	
68	I find myself working on the project during my free time.	INTEREST	PROJECT MANAGEMENT
69	I would rather work alone than working in a group.	INDIVIDUALIZATION	COLLABORATION
70	I have made a lot of changes to some of my screens after I have completed it.	PRESENTING	REFLECTION
71	I think that it is important that other learners in class look at my project to give advice.	REFLECTION	EVALUATION
72	Overall I feel positive about working with others on a project.	COLLABORATION	
73	I think a lot about what reading or using my presentation will be for someone else.	AUDIENCE	PRESENTING
74	Overall, we accomplish more as a team than I could working alone.	COLLABORATION	
75	I do not concentrate a lot while busy with my project.	MENTAL EFFORT	
76	I have experienced a lot of conflict in my group.	COLLABORATION	
77	Projects are just a way for teachers to do less.	MENTAL EFFORT	INVOLVEMENT
78	I find doing projects difficult because I don't always know what to do right away.	INTEREST	PLANNING
79	When I work in a group, I often find that everyone keeps talking but very little really gets done.	COLLABORATION	
80	I experience this computer class where I design my project as similar to other classes where I do not work on the computer.	INTEREST	
81	I think a lot about ideas when I do a project.	MENTAL EFFORT	
82	I do not try to present my information in such a way that my audience would easily understand what the topic is about.	AUDIENCE	PRESENTING
83	The information that I usually find has nothing to do with my topic.	SEARCHING	

84	This multimedia project in which I design screens, is similar to other projects that I have done.	INTEREST	ANALOGY
85	I do not think it is important to know Frontpage, the software that I use to design my project with, well.	PRESENTING	COMP SKILLS