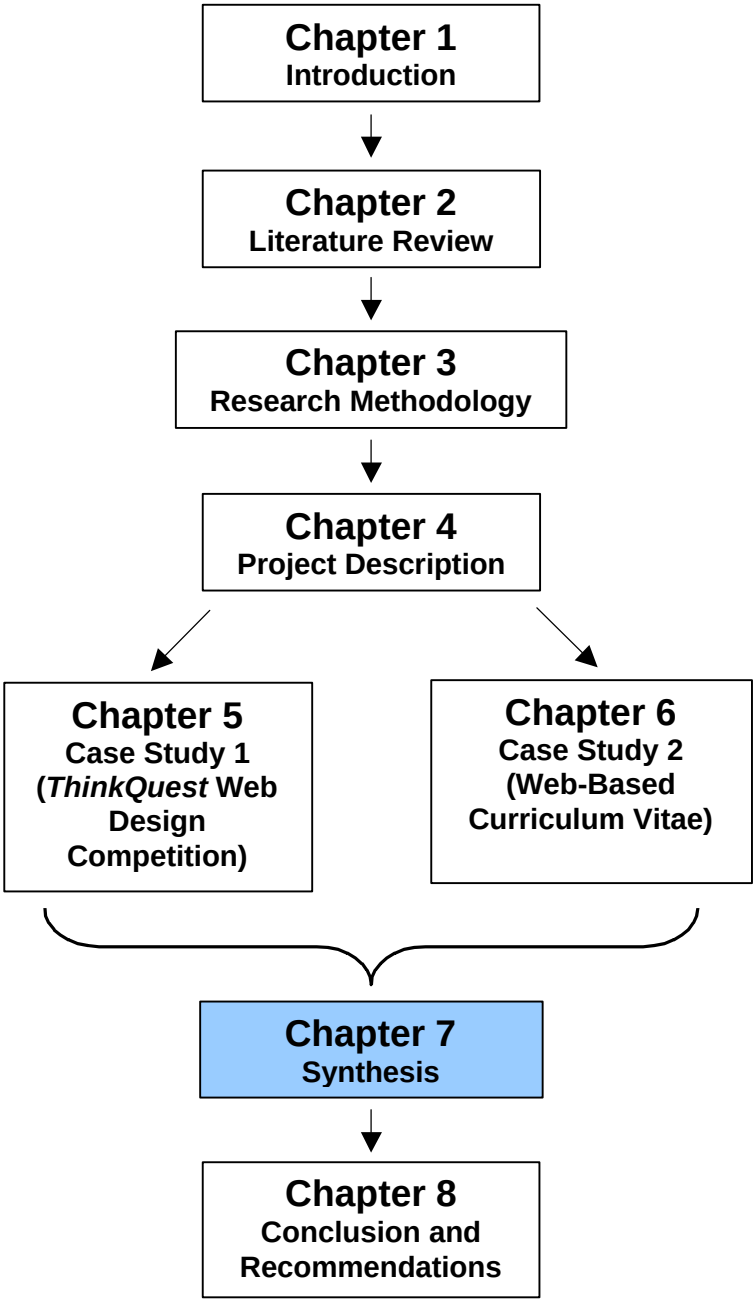
Chapter 7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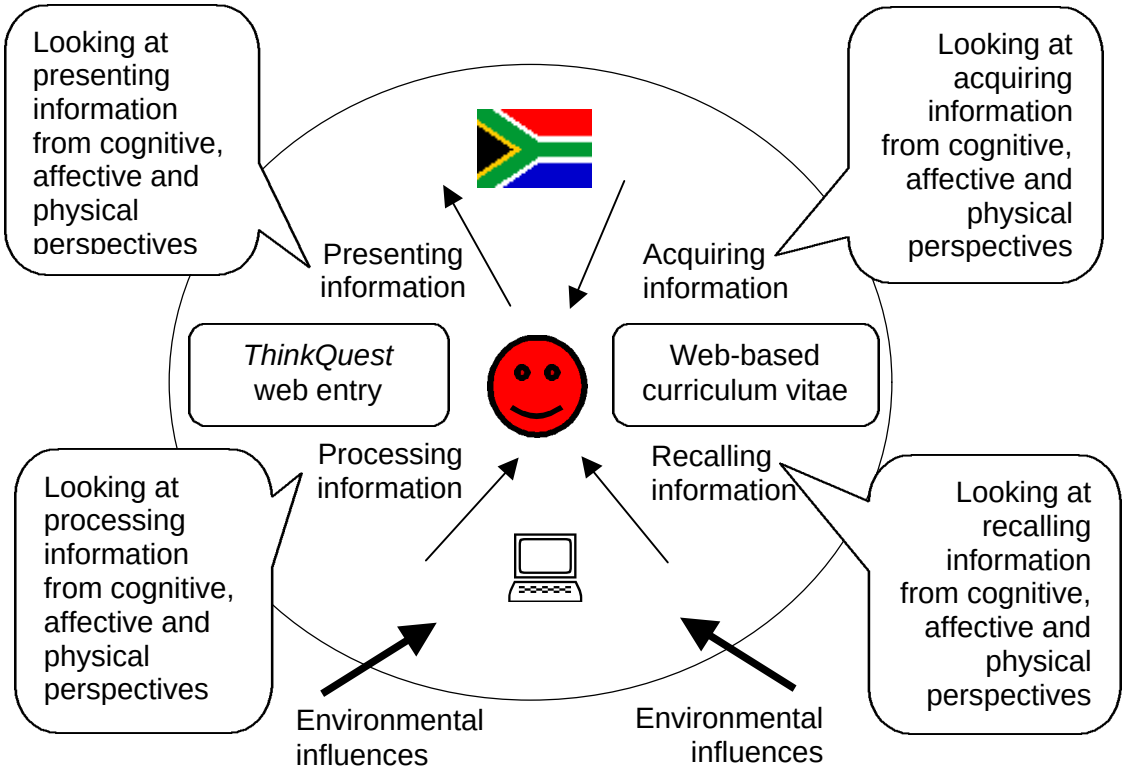
Chapter 7 Synthesis

1 Introduction

The aim of this research was to investigate how South African FET learners interact with information in a digital environment from cognitive, affective and physical perspectives as they acquire, recall, process and present information. This chapter synthesises the findings of the two case studies against the background of the usual work done at PHS in the computer laboratory, illustrated in .

Figure 7 - 1 Interaction with information by South African FET learners in a digital environment as they made two web sites



In order to provide a basis for the investigation, the literature was reviewed and reported on in Chapter 2. On the basis of the literature review a profile was developed in Chapter 2 of how South African FET learners in a digital environment interact with information. Chapter 3 described the research methodology used to investigate the problem of how the learners acquire, recall, process and present information in a digital environment. Chapter 4 described the usual work done by South African FET learners in the digital environment of the computer laboratory at PHS in Computer Studies SG. Chapters 5 and 6 described two case studies where PHS learners interacted with information while creating web sites. This chapter

synthesises the two case studies and compares the findings with the literature review.

2 Scope of the two case studies

Two case studies, the *ThinkQuest* web entry and the creation of a web-based CV, were conducted and reported on in Chapters 5 and 6. They differed in management, see Table 4 - 12, and in each of the following points providing context and credibility to ensure reliability of the findings:

- Content of the web sites
- Provision of examples
- Clarity of instructions
- Motivation, intrinsic and extrinsic
- Influence of peers
- Group dynamics
- Availability of software
- Method of submission
- Physical proximity
- Place of work
- Allocation of time
- Lead time

As tabulated in Table 3 - 5, three groups of learners, altogether 86, took part in the two case studies. The learners differed from each other as follows:

- one to two years difference in ages;
- ranging from academically strong to academically weak;
- different levels of prior experience;
- one week's training in the application to one term's training in the application and features used with the application;
- working with peers at a distance and in a contact situation; and
- experience in the application and no experience with the application.

There was a period of two to three months between the two case studies, conducted against a background of usual class work.

3 Synthesis of the two case studies

The way in which the learners in the two case studies interacted with information in a digital environment is now synthesised from cognitive, affective and physical perspectives and compared with the literature review

The following section examines how the learners interacted with information from cognitive, affective and physical perspectives. The perspectives and behaviours or activities, tabulated in Table 7 - 1, used for the examination of the interaction with information were developed in Chapter 2, Section 6, *Synthesis and profile*. The way the learners interacted with information with respect to acquiring, recalling, processing and planning, and presenting information while working on the two case studies is tabulated and synthesised in Tables 7 - 2, 7 - 3 and 7 - 4.

Table 7 - 1 Examination of perspectives and activities

Perspective	Behaviour or activity
Cognitive perspective	• Learning and mentally processing information • Long term memory recalled • Planning / creating of digital projects • Use of higher-level thinking skills • Cognitive processing of screen-based material • Ability to communicate their understanding of the subject matter in multiple formats
Affective perspective	• Intrinsic motivation • Extrinsic motivation • Types of motivation for different ability learners • Social environment • Critical appraisal of own digital creations • Group ownership of created material • Time spent on work • Meeting deadlines • Computer anxiety • Acceptance of error • Willingness to explore the digital unknown
Physical perspective	• Working / learning actively doing things • Working / learning in a group with talking • Working with partner, sharing ideas and copying work • Choice of software

Table 7 - 2 Synthesis of cognitive processing of information in the two case studies

Processing	Cognitive processing	Way in which the learners created their *ThinkQuest* web entries	Way in which the learners created their web-based CVs	Synthesis of two case studies
Acquiring information	Learning and mentally processing information	• Learners gained web-authoring skills as they created the entries. • Learners used a variety of resources to obtain information, those new to web-authoring mainly from the World Wide Web and those experienced in web-authoring from printed resources.	• Learners acquired web-authoring skills influenced by their peers.	• The learners acquired the skills necessary for creating the web while they were creating it, influenced by their peers. • The learners used a number of resources for information, novice users preferring the World Wide Web and experienced learners preferring printed resources.
Recalling information	Long term memory recalled	• Not observed.	• Learners recalled web-authoring skills through interacting with their peers.	• The learners recalled web-authoring skills through interacting with their peers.
Processing / planning information	Planning / creating of digital projects	• A small level of planning is evident.	• The learners did not preplan their CV but created it as they went along.	• Preplanning of the work was not evident. The learners created the webs as they worked.
	Use of higher-level thinking skills	• Higher-level thinking skills were used in structuring the webs on two levels, a format found in most webs. Frames, indicating higher-level thinking skills, were used by a number of learners although Grade 10D learners were not successful. Quizzes found in half of the entries indicated higher-level thinking skills.	• About half of the learners developed a CV arranged with pages and hyperlinks at two levels using higher-level thinking skills. As they developed interactive features they used meaningful higher-level thinking skills. The learners modelled or structured their CV using higher-level thinking skills.	• Higher-level thinking skills were evident in conceptualising and creating the webs with levels of information, frames, image maps and interactivity.

Processing	Cognitive processing	Way in which the learners created their *ThinkQuest* web entries	Way in which the learners created their web-based CVs	Synthesis of two case studies
Presenting information	Cognitive processing of screen-based material	• Very few spelling errors noted.	• Most learners had spelling errors on their web pages that they had not seen when they created the site, indicating superficial reading of screen-based material.	• Work done as a team presented fewer spelling errors than work done by an individual. Individuals seemed not to have seen their superficial spelling errors.
	Ability to communicate their understanding of the subject matter in multiple formats	• Learners did not communicate their content in multiple formats, mainly staying with static images, thumbnails and text-based content.	• Grade 11D, or the academically strong class, were better able than Grade 11A, or the academically weak class, to create interactive features and communicate the subject matter in multiple formats. • Static and animated clipart images added to the web pages seldom complemented the content. • Interactive features complemented the content. • The learners had difficulty mentally processing and creating the text-based information required.	• Academically strong and experienced learners were able to communicate the content in multiple formats. • Self-created interactive features complemented the text, but not ready-made features. • The learners had difficulty writing the text to add to the webs.

Table 7 - 3 Synthesis of affective processing of information in the two case studies

Processing	Affective processing	Way in which the learners created their *ThinkQuest* web entries	Way in which the learners created their web-based CVs	Synthesis of two case studies
Motivation	Intrinsic motivation	• Learners were proud of their web entries, both groups were proud that they had managed to create a web, on the World Wide Web, for everyone to see.	• Learners were intrinsically motivated to create their own web-based CV.	• The learners were intrinsically motivated to create a web site, particularly when it was relevant to their lives.
	Extrinsic motivation	• Marks and grades were the major motivating factor.	• Learners were extrinsically motivated to obtain high marks.	• The learners were extrinsically motivated to obtain good marks.
	Types of motivation for different ability learners	• The novice Grade 10D learners were proud of the content of the web. • Experienced Grade 11D learners were proud of the interactive features of the web, although there were few.	• Grade 11A, or the academically weak class, were more intrinsically motivated by the graphics, interactivity of web site features and by creating a web-based CV about themselves, than extrinsically motivated by good marks. • Grade 11D, or the academically strong class, were more extrinsically motivated to obtain high marks than the Grade 11A, or the academically weak class.	• Novice and academically challenged learners were motivated by managing to create a web with its content and graphical interface, whereas experienced or academically bright learners were more motivated to obtain good marks.

Processing	Affective processing	Way in which the learners created their *ThinkQuest* web entries	Way in which the learners created their web-based CVs	Synthesis of two case studies
Influence of peers	Social environment	• The majority of the learners enjoyed working with their team members. • Conflict experienced creating the web was not brought to the classroom. • The learners were supportive of their team members. • Friendship was the main criteria for team selection, and not marks. • Novice learners learned from each other. • Learners were knowledgeable about their own computer skills, in comparison to those of others.	• Learners supported and helped those seated physically near them in a non-competitive way by showing them various web-based computer skills.	• The learners supported and helped each other for no ulterior purpose.
	Critical appraisal of own digital creations	• Learners did not exhibit the need to impress others, rather to show what could be done.	• Learners were critical of their own digital creations, for extrinsic and intrinsic motivational reasons, and not to impress their peers.	• The learners explored features to share the excitement of the feature.
	Group ownership of created material	• The learners worked and learned with group ownership as they were making a group or team entry.	• Some learners supported each other in kind, for example, with ready-made graphics. No selfish, unhelpful behaviour was shown.	• Learners shared ideas and skills they had learned.

Processing	Affective processing	Way in which the learners created their *ThinkQuest* web entries	Way in which the learners created their web-based CVs	Synthesis of two case studies
Managing time	Time spent on work	• A short time was spent on the entry, having wasted time and procrastinated.	• Learners lost themselves in their work, forgetting about time.	• The learners focused on the work losing sight of time.
	Meeting deadlines	• Most of the learners were a few days short of the deadline, i.e. most did not keep to the deadlines.	• Most of the learners submitted their work in time, despite their initial unease about the amount of time devoted to the web-based CV.	• The learners had problems keeping deadlines, particularly those with long lead times.
Mental state	Computer anxiety	• The Grade 10D novice users were more stressed by the malfunctioning computers and printers than the experienced Grade 11D learners. • Novice learners preferred to work where there was access to help. • Uploading a web to a server was a stressful technical problem.	• Learners did not suffer from computer anxiety.	• When working in a supportive environment the learners did not suffer from anxiety.
	Acceptance of error	• Nothing noted.	• Both groups of learners accepted error and tried to resolve their own problems up to a certain level.	• The learners accepted errors and resolved their own problems up to a point.
	Willingness to explore the digital unknown	• Experienced Grade 11D learners learned the web-authoring skills more by exploring the packages themselves than from other features.	• Both classes were adventurous and willing to explore new features, up to a point, based on their assumed ability.	• Experienced learners pushed the boundaries of the programs, learning new features. Novice learners explored up to a point.

Table 7 - 4 Synthesis of physical processing of information in the two case studies

Processing	Physical processing	Way in which the learners created their *ThinkQuest* web entries	Way in which the learners created their web-based CVs	Synthesis of two case studies
Processing / planning information	Work / learn actively doing things	• Nothing noted.	• Learners seldom sat still for any length of time; they were usually active doing things, such as using input devices. • Learners were able to use input devices such as a mouse and scanner competently, but not the keyboard. The learners keyed in their information slowly. • All learners worked at a workstation during the period set aside for the web-based CV, although three worked and fiddled on non web-based CV related matters.	• The learners are always physically active using the mouse or keyboard. • Learners keyed in information slowly with errors.
	Work / learn in a group with talking	• Nothing noted.	• Learners interacted with each other and the computer, working, talking and looking at each other's screens.	• The learners interacted with each other much of the time.
	Work with partner, share ideas and copies work	• This was an integral part of the project.	• Learners copied and shared the skills of creating interactive features with those seated next to them. In the class where the learners were physically nearer each other, more features were shared.	• The learners worked and interacted with those on either side of them although it was not required. • The learners shared features with those on either side.

Processing	Physical processing	Way in which the learners created their *ThinkQuest* web entries	Way in which the learners created their web-based CVs	Synthesis of two case studies
	Choice of software	• Access to the preferred personal programs was of paramount importance to experienced users.	• Time was not an issue when presented with the choice of 'inferior' software and class time, or 'superior' software and their own time. Own choice of software was of great importance.	• Experienced learners are most particular with respect to software selection.

In Tables 7 - 2, 7 - 3 and 7 - 4 the ways in which the learners interacted with information in the two case studies were synthesised by tabulating how they acquired, recalled, process and planned, and presented information. The following section compares the findings at PHS with the data from the literature review.

4 Comparison of the findings at PHS with the literature review

Many of the behaviours and activities present at PHS when the learners created their web sites were not mentioned in the literature review in Chapter 2, Section 6, *Synthesis and profile,* others were in agreement with the literature review and others differed from the literature review. Tables 7 - 5, 7 - 6 and 7 - 7 compares how the learners at PHS interacted with information with that of the literature review in Tables 2 - 26, 2 - 27 and 2 - 28 as they acquired, recalled, processed and planned, and presented information motivated, being influenced by peers, managed time and mental state.

Table 7 - 5 Comparison of the cognitive processing at PHS with the literature review

Processing	How the learners at PHS interacted with information	Literature review
Acquiring information	The learners acquired the skills necessary for creating the web while they were creating it, while influenced by their peers.	Not mentioned
	The learners used a number of resources for information with novice users preferring the World Wide Web.	Not mentioned
Recalling information	The learners recalled web-authoring skills through interacting with their peers.	Not mentioned
Processing / planning information	Preplanning of the work was not evident. The learners created the webs as they worked.	Differs from
	Higher-level thinking skills were evident in conceptualising and creating the webs with levels of information, frames, image maps and interactivity.	Agrees with
Presenting information	Work done as a team presented fewer spelling errors than work done by an individual. Individuals seemed not to have seen their superficial spelling errors.	Not mentioned
	Academically strong and experienced learners were able to communicate the content in multiple formats.	Agrees with, but with additional information
	Self-created interactive features complemented the text, and not ready-made features.	Not mentioned
	The learners had difficulty writing the text to add to the webs.	Not mentioned

Table 7 - 6 Comparison of the affective processing at PHS with the literature review

Processing	How the learners at PHS interacted with information	Literature review
Motivation	The learners were intrinsically motivated to create a web site, particularly when it was relevant to their lives.	Agrees with, but with additional information
	The learners were extrinsically motivated, to obtain good marks.	Agrees with, but with additional information
	Novice and academically challenged learners were motivated by managing to create a web with its content and graphical interface, whereas experienced or academically bright learners were more motivated to obtain good marks.	Agrees with, but with additional information
Influence of peers	The learners supported and helped each other for no ulterior purpose.	Agrees with
	The learners explored features to share the excitement of the feature.	Not mentioned
	Learners shared ideas and skills they had learned.	Agrees with
Managing time	The learners focused on the work, losing sight of time.	Not mentioned
	The learners had problems keeping deadlines, particularly those with long lead times.	Not mentioned
Mental state	Working in a supportive environment the learners did not suffer from anxiety.	Not mentioned
	The learners accepted errors and resolved their own problems, up to a point.	Agrees with, but with additional information
	Experienced learners pushed the boundaries of the programs, learning new features, while novice learners explored up to a point.	Agrees with, but with additional information

Table 7 - 7 Comparison of the physical processing at PHS with the literature review

Processing	How the learners at PHS interacted with information	Literature review
Processing / planning information	• The learners are always physically active using the mouse or keyboard. • Learners keyed in information slowly with errors.	• Not mentioned • Not mentioned
	• The learners interacted with each other much of the time.	• Agrees with
	• The learners worked and interacted with those on either side of them although it was not required. • The learners shared features with those on either side.	• Agrees with • Agrees with
	• Experienced learners are most particular with respect to software selection.	• Not mentioned

Tables 7- 5, 7 - 6 and 7 - 7 compared the factors at PHS with those of the literature review. Many additional factors on how learners interacted with information in a digital information environment are tabulated not having been found during the literature review; other factors are developed in the tables and a few differ from the literature review.

5 Factors contributing to interaction

The two cases studies were synthesised on the basis of factors contributing to the interaction between the learners and information from cognitive, affective and physical perspectives.

The following synthesis takes the preceding synthesis beyond the work of a web-based task to that of 'usual' work in an educational digital environment. Tables 7 - 8, 7 - 9 and 7 - 10 illustrates how South African FET learners interact with information in a digital information environment while doing work in general. The tables illustrate how cognitive, affective and physical factors such as content, examples, instructions, motivation, peers, management of time, mental state, classroom ecology, contact environment and software influences the way learners interact with information from cognitive, affective and physical perspectives.

Table 7 - 8 Cognitive factors that contribute to interaction from cognitive, affective and physical perspectives

Factor	Cognitive perspectives	Affective perspectives	Physical perspectives
Content	• Learners have difficulty conceptualising content. • Transmediating content from one format to another is dependent on computer skills in the particular formats. • Ready made images and features add little to the content it is meant to complement. • Self-made features have relevance to the work it is meant to complement.	• Personally meaningful content leads to greater motivation. • Transmediating content from one format to another is enjoyed by learners.	• Content is gleaned from print rather than digital sources.
Examples	• Examples prove important to learners who have not been exposed to computer technology. • Examples provide something to aim for and improve upon, leading to higher-level thinking.	• Examples provide security in that one can see what has to be made, particularly with novice or beginner users.	• Examples are easily accessible.
Instructions	• Vague open-ended instructions lead to challenging work from experienced users but confuse and put less experienced users off. • Clear detailed instructions with lists of options lend themselves to more effort from novice or weaker learners, as well as experienced users. • Instructions are not always read and comprehended properly. • Academically bright learners do just enough work to achieve the set instructions.	• Clear detailed instructions with lists of options lead to more objectives being reached; and less stress.	• Instructions given in multiple formats such as voice, digital and print enhance comprehension.

Table 7 - 9 Affective factors that contribute to interaction from cognitive, affective and physical perspectives

Factor	Cognitive perspectives	Affective perspectives	Physical perspectives
Motivation	• Academically bright learners motivated by grades. • Academically weak learners motivated by creating work in a digital environment.	• Learners enjoy working in digital environment. • Learners share exciting features.	• The 'buzz' of the proximity of others in a computer laboratory stimulates and motivates learners.
Peers	• Learners acquire and recall skills with their peers. • Higher-level thinking skills were developed with peers in a contact environment meeting challenges set by the instructions.	• Learners acquire and recall skills interacting with their peers.	• Learners acquire and recall skills interacting with their peers in a contact environment.
Time management	• Structured time in the digital environment leads to focusing the mind on the work at hand.	• Learners are prepared to spend more time on work which is emotionally fulfilling than mundane work.	• Academically bright learners do just enough work to achieve the goal set by the teacher and do not waste time doing anything extra. • Learners underestimate the time required for work.
Mental state	• A positive mental state in the class leads to better work and higher-level thinking skills.	• Companionship of peers lends emotional support. • Work in the computer laboratory is enjoyable.	• Peers seated next to each other affect mental state.

Table 7 - 10 Physical factors that contribute to interaction from cognitive, affective and physical perspectives

Factor	Cognitive perspectives	Affective perspectives	Physical perspectives
Classroom ecology	• Physical layout of classroom with rows lends to learners collaborating with those on either side, leading to work requiring higher-level thinking skills as learners are motivated to share ideas.	Physical closeness in computer laboratory • leads to peer support particularly to academically challenged learners; and • motivates learners to create features to share with peers.	• Physical layout of classroom with rows lends to learners collaborating with those in the same row. • Learners sit next to a person of their own choice, hence friends produce similar work.
Contact environment	Physical contact leads to learners • sharing work and ideas; • discussing work, thus verbalising ideas; and • lends itself to immediate feedback on problems.	Physical contact • lends emotional support to learners who are anxious; and • leads to learners exploring applications.	• Physical contact leads to learners talking to each other.
Software	• Experienced users are irritated by so-called inferior software and prefer to endure time in a computer laboratory, and then do their work in another environment which has the preferred software. • Learners explore software applications with their peers in a contact environment. • Learners explore applications up to a level of their assumed competence.	• Learners explore applications in the emotionally secure contact environment with their peers nearby. • Learners do not use all the software available but select what suits their emotional needs.	• Learners physically explore applications in the emotionally secure contact environment with their peers nearby.

Table 7 - 8, 7 - 9 and 7 - 10 described how certain cognitive, affective and physical factors can impact on learners' work in a digital environment from cognitive, affective and physical perspectives. The impact of relatively unimportant factors such as content, examples, instructions, motivation, peers, time, mental state, classroom ecology, contact environment and software on the way learners interact with information in a digital environment is great, affecting cognitive, affective and physical perspectives of learners' education.

6 Summary

This chapter concludes the major part of the research by synthesising the data obtained from two case studies and comparing it with the literature review. The chapter opens by describing the scope of the study and describes the width and depth of the situations from which the data was collected. The two case studies were then compared based on the perspectives and activities developed in the literature review. The data was then re-examined by looking at factors which contributed to the way the learners cognitively, affectively and physically interact with information.