Interactive Educational Multimedia, number 3 (October 2001), pp. 38−52
www.ub.es/multimedia/iem

An evaluation of Virtual Learning Environments and their learners: do individual differences affect perception of virtual learning environments

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Abstract

A wide−reaching, student−centred evaluation model was designed, aimed at appraising the quality of students learning experiences after the introduction of a virtual learning environment in two UK institutions. A central part of the model was to examine the individual differences of students and how these interact with their perceptions of this new way of working. The individual differences chosen for exploration included motivational orientation, cognitive style, time management practices, and IT ability. This paper explores the findings of the evaluation with respect to these individual differences and their interaction with perception of learning through VLEs. In this aim, it is divided into 3 parts. First, a summary of the evaluation model and a rationale for including the selected individual differences is offered. Second, details of the data collection process and results are discussed. Finally, the implications for future use and curriculum development are considered.

Introduction

One of the most powerful features of new learning technologies is their capacity to individualize instruction to meet the needs of the learner (Ramussen & Davidson, 1996). Self−paced instruction, the ability to present content in different ways, features such as hypertext, and a flexibility that allows learners to work when and where they want, make virtual environments potentially a very effective learning medium.

The use of virtual learning environments has burgeoned in recent years (Price, 1991; Anderson, et al. 1999; Richardson & Turner, 2000). Faced with increasing undergraduate intakes and workloads, higher education is looking more towards these technologies as a means of supplementing or replacing traditional face−to−face instruction. In addition software continues to improve in its ability to engage learners and provide realistic and stimulating learning environments (Price, 1991; Dymcock & Hobson, 1998).

As virtual learning environments (VLEs) are introduced in more institutions, it is fast becoming recognized that helpful models for evaluating their effectiveness are needed. Adopting appropriate evaluation methodologies at this stage, offers HE the chance to stand back, to cast a critical eye over developments,

and to appraise the changes for learners, tutors, managers and the wider community, as they are introduced. Recently, studies focusing on this very issue have increased (e.g. Oliver, 1998). However, most of these still focus on design and/or usability issues (e.g. Keegan, 1990; Anderson, 1988; Kapur & Stillman, 1997; Sneider, 1998), or compared traditional with technologically distributed courses (Souder, 1993). Both approaches however have tended to neglect the *individual learner*, and how learning through technological mediums is assisted or hampered by the numerous stable and dynamic characteristics they bring with them into any learning situation. A brief search of the social sciences citation index yields 898 hits for the term World Wide Web , however less than 10% of these describe or evaluate education individual learner , and these still tend to concentrate on technical issues.

Richardson and Turner (2000) attempt to redress this imbalance by developing a wide reaching student−centred model (see fig.1.0) for evaluating virtual learning environments (VLEs) that also incorporates broader teaching and resourcing elements. The model identifies a range of stable and dynamic individual differences and hypothesizes that these may interact with the learning and teaching processes involved. They identify several individual differences, including cognitive style, motivational orientation, gender, and time−management skills. If these student attributes are shown to qualitatively affect the learning experience, they will have significant implications for future curriculum development.

This paper seeks to empirically validate this hypothesis through evaluation, by asking, "How do these stable and dynamic individual differences interact with students experiences of using virtual learning environments?" To this end, the paper is divided into three parts. First, an introduction and description of the evaluation model is given together with a rationale for inclusion of these individual differences. Second, a description of the project is given and results are discussed. Finally, the implications for the future in terms of revising the model and the broader picture of curriculum development are considered.

The student−centred model for evaluating learning technologies

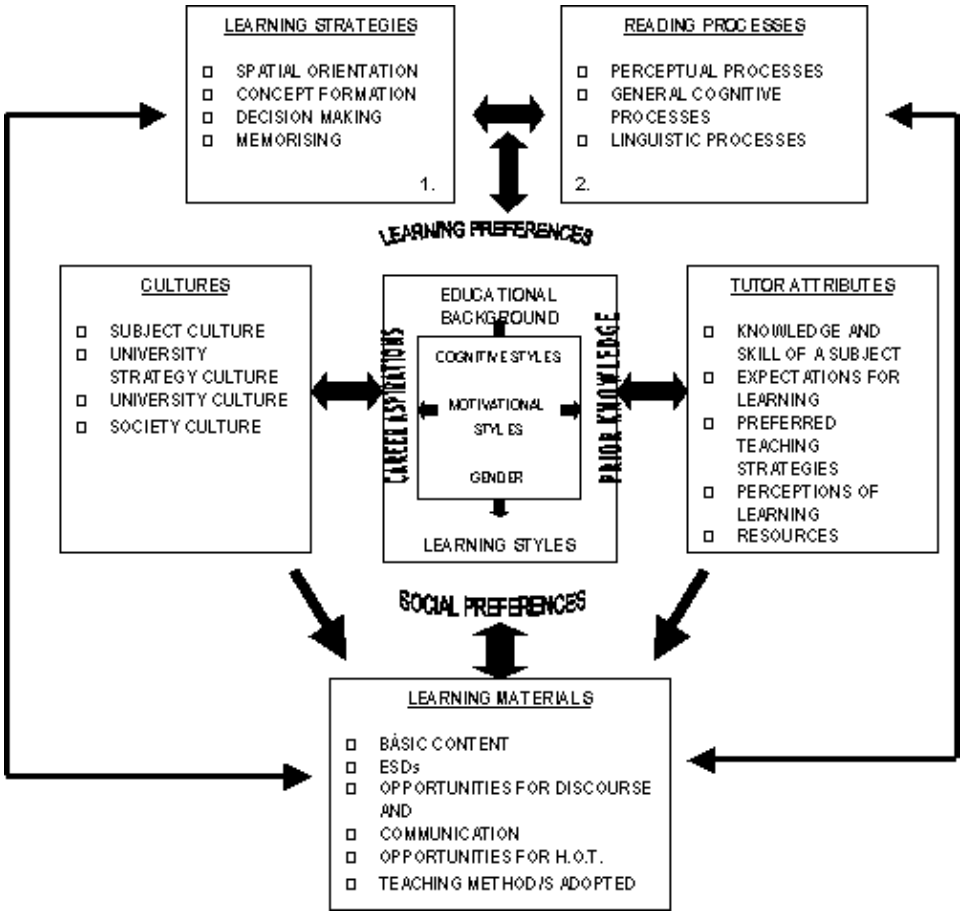

FIG. 1.0 A Model of Learning with V.L.Es

The starting point for developing a model for evaluating VLEs was that learning should be student−centred, and therefore any model of evaluating their learning, must also start with the student and work outwards. The quality and nature of a learning experience in any area are dependent upon an intricate interaction between the experiences, characteristics and attitudes that a student brings with them, and the attributes of the task environment (Pask, 1976). Thus any evaluation must include both elements. A model was constructed to help clarify some of the processes and variables that play a role during learning through VLEs. The authors endeavored to integrate a variety of theoretical perspectives to describe and explain the role of specific variables or processes and to scan their potential interactions holistically (see Richardson, 1999; Richardson & Turner, 2000 for fuller discussion).

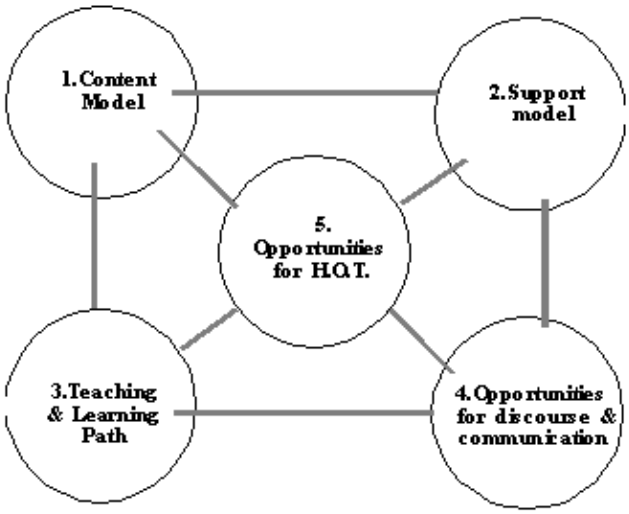

Fig. 1.1 Content Model

Figure 1.0 represents the interaction between the task environment and the student. Firstly, the learning materials define the task environment. Here the materials have been divided (fig.1.1) into the content; the embedded support devices (ESDs); opportunities for discourse and communication; and opportunities for Higher Order Thinking. Also highlighted here are some of the influences upon the production of the learning materials, such as subject and university cultural demands, tutor expectations and expertise. Secondly, the students qualities are specified in terms of stable and less stable characteristics. At the center of the model are those individual differences that are less likely to change over time, for example, cognitive styles and motivational orientation. Further out are those preferences must susceptible to change. The arrows between the process and variables in the model indicate potential interactions. The assumption is that elements of the content model will interact with these individual characteristics in different ways.

Elaborating Individual Differences

Gender

Barrett and Lally (1999) focused on computer−mediated communication in a specific context by a small number of post−grad students and their tutors. Content analysis was used to explore possible gender differences in the contributions. They found that the learning content of men and women were similar, however their social and interactive behavior was significantly different. It was found that men sent more messages than women; they wrote messages that were twice as long; and made more socio−emotional contributions than women. They concluded that the application of learning technologies "may reproduce gender differences within a learning community"(p.1). The focus of the evaluation data explored in the present paper is upon general differences in perception of VLEs.

Motivational Orientation/Achievement Motivation

Previous research has shown a clear relationship between the way students learn best within university environments and their motivational orientation (e.g. Zimmerman & Schunk, 1989). Although the concept of achievement motivation is plagued with may alternative descriptions, it is generally accepted that motivation is a construct that seeks to describe what incites and directs a response (e.g. Skinner, 1974). Achievement motivation is concerned with motivational factors that influence learning (Dweck & Elliott, 1983), and the intimate interplay between goals and competence (Heckhausen, 1977; 1981; Nicholls, 1984; 1989). Nicholls argued that individuals approach learning and achievement tasks based on their personal goals and these direct an individual s attitude towards the task. Two distinctively different goals that are often referred to are mastery and performance goals. An individual with a mastery goal is

characterized by the concern with increasing competence, or learning for its own sake. In contrast, an individual operating with a performance goal is characterized with a concern for showing either high ability or hiding low ability (Dweck & Elliott, 1983). These goals can also be seen as having different motivational orientations, task involvement and ego involvement .

For purposes of the present study the interest is in the general interaction between students orientations and their perceptions and practices using virtual learning environments. In sum the types of questions of interest here were, "What are students current positions in a mastery−performance goal continuum?" "Is the quality of learning experiences for students at one end of the continuum different to those at the other?". "Is independent learning aimed more towards ego−involved students?" or "Are the same motivational stimulants of a normal learning environment present in VLEs?".

Time−management Skills

Student s time is a limited resource and like other limited resources, it can be more or less effectively managed. VLEs have a different set of expectations, and demands on student time and require a different set of skills to that of more traditional learning environments. Primarily this difference is students use of time. Time−management practices have been the subject of an extensive popular literature (e.g. Bliss, 1976; Greene, 1969; Lakein, 1973), but this literature often presents only anecdotal evidence for the efficacy of time−management practices. In the research literature, it is generally agreed that intellectual achievement takes time (Barron, 1988; Csikszentmihayi, 1988) and perseverance (Gardner, 1988). If educational achievement, like intellectual achievement in general, takes time, then time−management practices should play a role. In empirical studies of self−regulated learning, researchers have often measured time−management variables in the context of single general variables such as self−monitoring, self−judgement, and alertness (Corno & Mandinach, 1983; McCombs, 1986; McCombs, et al., 1990; Zimmerman, 1990; Zimmerman & Schunk, 1989). In this evaluation the aim was to explore whether the new learning environment , places a different set of demands on students in terms on their time−management practices. And, if so, what strategies could we develop to assist them. Unlike some individual differences, Time−management appears to have good potential for strategies to help students improve.

General questions asked were *"Are we expecting to much?" "Do students need more input from us regarding how to organize their time?".*

Cognitive style

Cognitive style has been defined by Tennant (1988) as "an individuals characteristic and consistent approach to organizing and processing information". In the present context, a cognitive style is considered to be a fairly fixed characteristic of an individual, in contrast to strategies that are the ways that may be used to cope with tasks. Strategies may vary, and may be learned and developed. Styles, by contrast are static and are relatively in−built features of the individuals.

Several researchers (e.g. Brumby, 1982; Riding et al., 1997; Richardson, 1997) have argued that a number of cognitive style labels are actually different conceptions of the same dimension. Riding and Cheema (1991) concluded that they can be grouped into two principal cognitive style dimensions which they termed Wholist−Analytic and Verbal−Imagery. They may be summarized as follows;

1. The Wholist−Analytic style of whether an individual tends to process information in wholes or parts.
2. The Verbal−Imagery dimension of whether an individual is inclined to represent information during thinking verbally or in mental images.

Researchers have recently focused their attention on the interaction of learners and software in terms of their cognitive styles. Riding and Sadler−Smith (1992) concluded that there was a significant interaction between version of a computer−presented task and cognitive style in their effect on recall. More recently, Ross and Schulz (1999) investigated styles and human−computer interaction and concluded "computer−aided instruction may not be the most appropriate method of learning for all students" (p.5).

By including cognitive styles in this evaluation the opportunity of examining the learning environments offered to students and the influence on learning for students with different cognitive styles was explored by asking ***"Are VLEs equally suitable for students who have different stylistic tendencies?"***

In sum, the main individual differences included were gender; time−management skills; cognitive style; and motivational orientation, together with students perceptions of VLEs

Research Overview and Method

Participants and Procedures:

To gain as comprehensive picture of VLEs usage as possible, all nine modules presented via Lotus Learning were included. All students involved were asked to complete a single questionnaire, which incorporated motivational orientation, time−management skills, and general perception of using VLEs. This was distributed approximately halfway through the semester. There was high return rate of 88% (approx:230 students) to this. Students were also asked to complete the Cognitive Styles Analysis at a time convenient to them during the semester.

Evaluation Instruments

The Motivational Orientation Scale. (MOS) (Nicholls, et al., 1985) was used to assess students motivational orientations. The rating scale has 27 items divided into seven subscales, shown in Table 1.6. Nicholls et al. (1985) combined the first two subscales as an indicator of Task Orientation , and Nicholls (1989) combined the Work Avoidance and Alienation subscales as a measure of Work Avoidance.

The format of the MOS employs a 5−point Likert scale rating from strongly agree to strongly disagree. Scores on each subscale are calculated by adding points for each items−five points being assigned to the response of strongly agree, and one point for the response of strongly disagree. A high score on a subscale refers to a higher level of motivation. The complete test was administered via the student questionnaire.

The Cognitive Styles Analysis (CSA). (Riding, 1991) is a computer presented assessment developed from the Verbal−Imagery code test, with the addition of subtests to assess the Wholist−Analytic dimension. It comprises three subtests. The first assesses the Verbal−Imagery dimension by presenting statements one at a time to be judged true or false. Half of the statements contain information about conceptual categories whilst the rest describe the appearance of items. It is assumed that Imagers respond more quickly to the appearance statements, because the objects could readily be represented as mental pictures and the information for the comparison could readily be represented as mental pictures, whereas Verbalisers respond more quickly to conceptual items because the semantic conceptual category membership is verbally abstract in nature and cannot be represented in visual form.

The second two subtests assess the Wholist−Analytic dimension. The first of these requires individuals to compare geometrical figures and judge them to be either the same or different. Wholists tend to respond more quickly to this task. In contrast the third test, which requires individual to assess whether one geometrical shape is embedded in another, is performed more quickly by analytics.

Time−Management Practices: Britton and Glynn (1989) described a simple theoretical model of

time−management practices intended to maximize intellectual productivity. The instrument used here is based on a combination of that model and the results of some pilot interviews. This set of time−management questions placed within the student questionnaire, included 18 items, each answered on a 5−point scale consisting of the responses, always, frequently, sometimes, infrequently, and never. In scoring 5 points were assigned to the response at the end of the scale that we defined a priori as the "good" practice and 1 point was assigned to the response at the other end of the scale, with intermediate values given for the other responses. Higher values on the scale correspond to between time−management practices. See examples in Appendix A.

Perceptions of VLEs: student questionnaire: Prior to the start of the evaluation, in−depth pilot interviews were carried out and transcribed. Quotations that supported key themes were selected from these interviews to form the final section of the student questionnaire. Questionnaires were administered approximately halfway through the semester. Respondents were asked to rate whether they strongly agreed, agreed, were neutral, disagreed, or strongly disagreed with each of 15 statements. These can be seen in table 1.0.

I.T. proficiency: Here students were asked to rate themselves on a 3−point−likert scale (1=yes; 2=maybe; 3=no) to 51 questions concerned with I.T. competence. These statements were previously developed and used as a reliable measure of students level of IT skills. (examples can be seen in Appendix A).

Results

General perceptions of VLEs

Table 1.0 shows all questions and provides a summary of the data.

Statement No %	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Totals
"Working with a virtual learning environment means that I can work when and where I want"	26 11.0	104 43.9	44 18.6	35 14.8	24 10.1	233 98.3
"I find learning in this way useful because I can go over the material as many times as I want...if I go to lecture, I either get it or I don't!"	26 11.0	119 50.2	56 23.6	21 8.9	7 3.0	229 96.6
Even though I may not have as much class contact I still feel as though I am part of a learning community"	11 4.6	39 16.5	50 21.1	59 24.9	75 31.6	234 98.7
I can make more effective use of my time when I am learning using this kind of computer-aided learning...it's a bit like a flexi-time system	15 6.3	72 30.4	79 33.3	50 21.1	13 5.5	229 96.6
I like the way the responsibility for my learning is on me...I am more in control. I don't have to rely on tutors	37 15.6	72 30.4	54 22.8	60 25.3	7 3.0	230 97.0
I enjoy the flexibility of it because it allows me to go at my own pace	47 19.8	98 41.4	51 21.5	28 11.8	6 2.5	230 97.0
I feel isolated when I am using a VLE....I don't seem to talk to other students much anymore	42 17.7	64 27.0	59 24.9	53 22.4	13 5.5	231 97.5
I am not very confident with my own ideas and am afraid that I am getting lost in my learning	36 15.2	53 22.4	69 29.1	58 24.5	14 5.9	230 97.0
I would prefer to have more contact and guidance from tutors	70 29.5	84 35.4	51 21.5	20 8.4	6 2.5	231 97.5
I enjoy the flexibility of it because it allows me to go at my own pace	47 19.8	98 41.4	51 21.5	28 11.8	6 2.5	230 97.0
I feel isolated when I am using a VLE....I don't seem to talk to other students much anymore	42 17.7	64 27.0	59 24.9	53 22.4	13 5.5	231 97.5
I am not very confident with my own ideas and am afraid that I am getting lost in my learning	36 15.2	53 22.4	69 29.1	58 24.5	14 5.9	230 97.0
I would prefer to have more contact and guidance from tutors	70 29.5	84 35.4	51 21.5	20 8.4	6 2.5	231 97.5
I am not 'computer-minded' and don't enjoy sitting in front of a screen for long periods of time...its very boring to read from a screen	39 16.5	51 21.5	53 22.4	54 22.8	31 13.1	228 96.2
I can't afford a computer of my own and the amount of time that I have to spend in college in the computer labs has increased - it is time that I can't afford	36 15.2	40 16.9	66 27.8	61 25.7	27 11.4	230 97.0
I seem to spend lots of time just trying to find a computer that I can use...then feel pressured because others are waiting to use it	34 14.3	56 23.6	64 27.0	59 24.9	14 5.9	227 95.8
I don't think there are enough computers around the university I think that employers will like the fact that we are used to VLEs.	50 21.1	69 29.1	60 25.3	37 15.6	11 4.6	227 95.8
I think that employers will like the fact we are learning with VLEs.	55 23.2	112 47.3	47 19.8	12 5.1	3 1.3	229 96.6
I think this kind of computer-aided-learning will be used more and more in the future.	66 27.8	96 40.5	52 21.9	9 3.8	4 1.7	227 95.8

Table. 1.0: Summary of responses to student questionnaire

These results highlight a number of general issues for example, with regards flexibility of learning (# 1 & 6) students generally felt VLEs are flexible in terms of place and time and setting pace of work, however the responses to statement 12 suggest students clearly felt that their flexibility was restricted due to physical resources. In this case the largest group of respondents were in the neutral group (27%). Interestingly, the number of students who agreed and the number who disagreed were almost equal.

One of the strongest issues was students did not feel part of a learning community (#3). They felt more isolated from their peers, and unsupported in their learning. These results were strongly supported by in−depth interviews with students (see Richardson & Turner, 2000).

Finally, with regards students knowledge about their own learning, many of the statements may be reflecting students understanding about how they learn and work best . For example, statement 4, "I can make more effective use of my time when I m learning using VLEs"; and #5 "I like the way the responsibility for my own learning is on me" raise questions that may be best answered in terms of individual differences. In the first of these, combining the two agreed columns and then the two disagree columns, generates similar numbers of students who agreed and disagreed. This type of result in the perceptions questionnaire may be reflecting individual differences such as time−management, cognitive style, motivational orientation etc.

Individual differences and perceptions of VLEs

Gender and perception of VLEs

Using the responses in the questionnaire of perception of VLEs (shown in table 1.0), an overall mean was calculated for perception of VLE for each student. A higher mean represents a more *positive* perception. A t−test was performed to determine whether male and female students felt differently towards VLEs. The results (table 1.1) show that females responded significantly more negatively ($p<0.05$) toward VLEs than males. This outcome may be for several reasons. Firstly, female students may not be as computer literate as male students and therefore, less confident, or that some elements of working in this environment are not compatible with their learning needs. Richardson and Turner (2000) report a general finding of the evaluation was a significant reduction in the time students spend working in groups and cooperatively since the introduction of these environments. Female students may prefer more interactive methods of learning.

	Gender	No.	Mean	S.D.	F	Sig. (p=)
Perception	Female	110	39.049	6.26	0.94	0.49
	Male	116	40.71	5.97		

Table: 1.1
Gender and Perception of VLEs

I.T. proficiency and perception of VLEs

A mean score was calculated for I.T. awareness from the responses to the IT statements in the questionnaire. A higher mean represents [perception of] a lower I.T. proficiency. To explore a general interaction between students perceived IT skill and perception of using VLEs, a Pearson correlation coefficient was obtained. The results (0.177 p= 0.892) suggest no interaction between the variables. Earlier, it was suggested that female students had a more negative attitude toward VLEs that may be because female students did not have the same level of IT proficiency than male students. A t−test was performed to evaluate whether female students felt their IT skills were less advanced than their male counterparts. The results (table 1.2), show a significant difference ($p<0.001$), which may be a contributory factor to female students having a more negative attitude toward VLEs.

	Gender	No.	Mean	S.D.	F	Sig. (p=)
I.T. proficiency	Female	110	1.51	0.29	0.43	0.000
	Male	116	1.34	0.26		

Table: 1.2:
Gender and I.T. Proficiency

Time−management practices and perception of VLEs

All responses to the time−management questions in the questionnaire were collated and a mean response calculated. A higher mean represents more developed time−management practices. The value of the correlational coefficient for mean time−management skills and mean perception, (r=0.177, p= 0.009) strongly suggests that students who use more developed time−management practices have a more positive perception toward using VLEs (see fig.1.2).

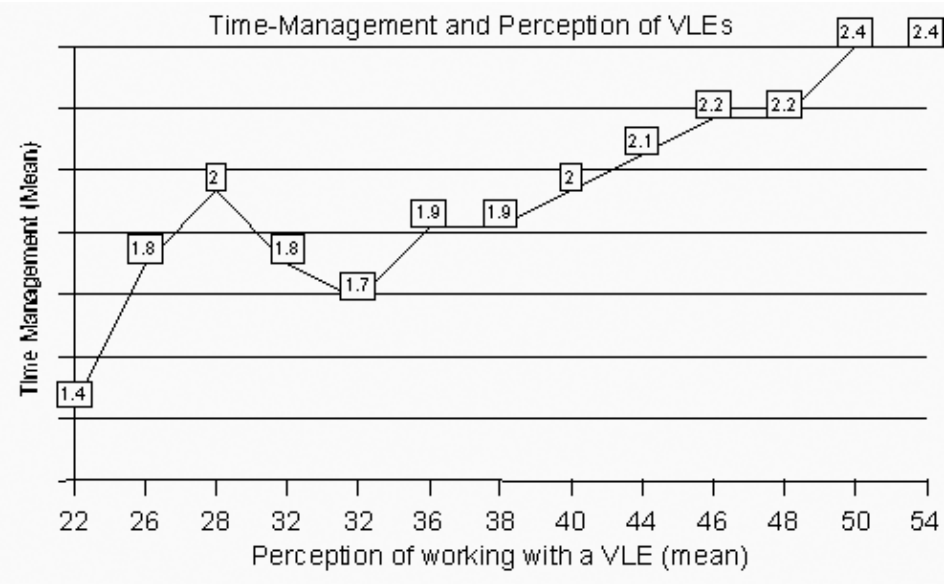

Fig. 1.2 Time−Management and Perception of VLEs

Motivational Orientation and perception of VLEs?

Students mean responses were calculated for items relevant to the different MOS scales. The mean value for each orientation scale was paired with mean perception of VLE and correlation coefficients obtained (table 1.3).

Pearson Corr. Sig. (2-tailed) N	Motivational Orientation Scales (MOS)				
	Task Orientation	Ego Orientation	Avoid Inferiority	Easy Superiority	Work Avoidance
Aims of Scale	To measure an orientation of involving oneself in	To measure an orientation to showing 'smartness'	To measure an orientation of sensitivity to others' negative	To measure an orientation of doing well without effort	To measure an orientation of avoiding hard work
	cognitive activities & keeping busy		evaluations of one's ability		
Perception of VLEs	0.20** 0.003 219	0.23* 0.001 222	0.05 0.45 222	0.08 0.20 221	-0.02 0.73 221

Table: 1.3
Motivational Orientation and Perception of VLEs

Firstly, the correlation coefficient and associated probability for task orientation and perception of VLEs support the suggestion that students who are inclined to engage and enjoy independent learning activities

which keep them busy, have a more positive perception of learning through VLEs. The results also support the interview data, where students who seemed have a stronger understanding, motivation toward independent learning, also expressed more positive perceptions of using VLEs.

Secondly, the results for ego orientation, suggest that these two groups also have different perceptions of working with VLEs. It is closely related to the concept of extrinsic motivation. Research often suggests that extrinsically motivated individuals prefer to be in the company of others (Dweck & Elliott, 1983), and, as the results later describe, students have been expected to use a virtual learning environment, at the expense of spending time with their peers. They have worked primarily alone. The results do not suggest an interaction between the avoid inferiority, easy superiority and work avoidance scales.

Cognitive styles and VLE perception?

The sample was grouped on the basis of their ratios on each cognitive style dimension. The divisions were: Wholists 0.23 to 0.89 (N=75), Intermediates 0.90 to 1.12 (N=45), Analytics 1.13 to 3.52 (N=20); Verbal−Imagery dimension, Verbalisers 0.48 to 1.02 (N=50), Bimodals 1.03 to 1.14 (N=59), Imagers 1.15 to 8.21 (N=31). One−way anovas were performed between each dimension and mean VLE perception. The results showed an overall significant interaction between wholist−analytic style and VLE perception ($F=4.40$, $p=0.01$). A post−hoc Tukey test revealed significant differences ($p<0.01$) between the perceptions of the wholist group and analytic group, but not between intermediates and analytics or wholist groups ($p>0.05$). The more analytic students were, their perception of VLEs became more positive. With regards the Verbaliser−Imager dimension, a one−way anova revealed no significant differences between the mean responses of the three V−I groups ($p>0.05$).

Conclusion:

If electronic distributed learning is to continue to develop successfully for HE then evaluating the quality of student experiences must play a central role. The power of the model designed and implemented here, has been its attempt to place the learner at the center of the evaluative process. Evaluating the quality of learning experiences began from the student experience and worked outwards. This paper has provided an overview of the model and presented relevant data to answer the question of whether students perceptions of using virtual learning environments differ according to a range of individual differences. The key findings may be summarized as follows:

Female students have a more negative perception of learning through VLEs. This finding may be due to a number of reasons. For example, Richardson and Turner (2000) report that that after the introduction of the VLEs, there was a significant reduction in collaborative cooperative working, and, generally students didn t feel part of a learning community. Numerous authors (e.g. Burton, 1990; Volman et al., 1995; Hayes & Richardson, 1995) suggest female students prefer instructional methods that adopt group and interactive methods. A second influence may be initial level of I.T. competence. Females reported themselves to have less developed IT skills than male students. Since the evaluation two pilot schemes have been designed and adopted across two institutions (see Richardson & Turner, 2001) that aim to increase the cooperative learning and the sense of learning community. However level of students initial IT skills needs further examination, possibly through a more objective means of assessment.

A second finding was students with developed time−management practices had more positive perceptions of using VLEs. Clearly, the move towards distributed learning places increased responsibility on individual students in terms of organizing their own learning. Not all students have had the opportunity to previously develop these skills and are therefore placed at a disadvantage. This needs further exploration, looking in more detail at the practices adopted by students, and also in terms of ways in which the university can help. For example, a series of preparatory workshops prior to using the virtual learning environments may significantly improve this.

Thirdly, students who are inclined to engage and enjoy independent learning activities that keep them busy, have a more positive perception of learning through VLEs. It is reasonable to suggest that these students benefit from the control of their own busyness . Ego orientation, which is closely related to the concept of extrinsic motivation, was also found to influence the student perception. Those individuals with more extrinsic motivation were found to perceive the experience as negative. By contrast ego orientated students felt more positive about VLEs. These results are well supported in the educational literature by suggesting that extrinsically motivated individuals prefer to be in the company of others (Dweck & Elliott, 1983), and, as previously highlighted Richardson and Turner (2000) report a reduction in group activities.

Finally, the cognitive style dimension of Wholist−Analytic showed that students in the two extreme groups (i.e. Wholist and Analytic) had significantly different perceptions. Wholists found the experience significantly more negative than analytics. These results are congruent with cognitive style theories (e.g. Witkin, 1977). The Verbaliser−imager dimension was not found to interact with the perceptions of the environments. This dimension is currently being explored further elsewhere in terms of whether the structure and content of the learning materials provided is more favorable for students along the V−I continuum.

The present study has thus highlighted a number of individual differences that affect the quality of students experiences using virtual leaning environments. Clearly some of these differences lend themselves to institutional strategies more readily than others. For example the suggestion of workshops to improve students time management skills and I.T. skills may be fairly simple to implement. However, other areas such as cognitive style need to explore further in terms of how materials and courses can been guided in their design and production to cater more effectively for a range of styles. Without this type of continuous and formative evaluation of institutional uses of learning technologies, groups of students may continue to be at an unfair disadvantage to their peers.

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Appendix A:

Examples of time management questions,(responses, always, sometimes or never):

Do you make a list of things you need to do each day?

Do you spend time planning each day?

Do you set and honour priorities?

Examples of IT competence statements (all responses, yes, no. or maybe):

Do you know how to use your word processor to .

Create tables?

Print a document?

Do you know

What a database is?

The common features of a database?