

**RESEARCHING STUDENTS PERCEPTIONS OF DIGITAL CONTENT USING
A PERCEPTUAL MEASURE**

John Clayton
Waikato Institute of Technology
Hamilton
ctjfc@wintec.ac.nz

ABSTRACT

As information and communication technologies become more user friendly the use of connected computers as a tool in learning and teaching increases. Economies of delivery, the ability to create media rich content and ease of access are but a few of the perceived benefits of using digitally created content. However, while it is technically feasible to create and make available digital material a number of issues must be explored before teachers can confidently use these materials. This paper informs educationalists of the process and procedures used in the development of an instrument to investigate students' perceptions of digital material. It then reports on an exploratory study using the instrument.

INTRODUCTION

The creation of the Internet, the development of the World Wide Web (WWW) and the introduction of learning management systems have influenced all aspects of education (Clayton, 2005a). Increasingly the perceived benefits of information stored in a digital format are being exploited. The sophistication and ease of supporting web browsers, the creation of internet search engines, the advancing computer skills of students, mean educational institutions at all levels are using the WWW and Internet to supplement classroom instruction, to give learners the ability to connect to information (instructional and other resources) and to deliver learning activities (Bonk, 2001; Clayton, 2005b). In short the Internet and the WWW has altered approaches to education, has changed, and is continuing to change, the way teachers present content to learners. Educationalists are challenged to develop appropriate digital material to deal with new information and communication technology rich ways of teaching and learning (Chin & Ng Kon, 2003). Over the last three decades learning environment researchers have recognised student reactions to, and perceptions of, the learning environment they participate within will have a significant impact on their performance. The following paper outlines the process and procedures used in the development of an instrument to investigate students' perceptions of digital material presented in an online course.

LEARNING ENVIRONMENT RESEARCH

The essence of a learning environment is the interaction that occurs between individuals, groups and the setting within which they operate. The investigation in and of learning environments has its roots nourished by the Lewinian formula, $B=f(P, E)$. This formula identifies that behaviour (B) is considered to be a function of (f) the person (P) and the environment (E). It recognizes that 'both the environment and its interaction with personal characteristics of the individual are potent determinants of human behaviour' (Fraser, 1998, p. 529). Since the classroom is a place where teachers and students congregate for long periods of time to participate in the activity of learning, the classroom environment created, also referred to as climate, atmosphere, tone, ethos or ambience, during this activity, is regarded as an important component in the learning process (Fraser & Wubbels, 1995). Both teachers and learners hold views on the learning environment they operate within and these views will affect the way they participate in learning activities undertaken (Moos, 1979). But how and in what ways

can the digital material created and presented affect student performance, and how can these effects be measured?

Since the early awkward measures that were developed in the late 1950s (Fisher & Fraser, 1990) there has been considerable growth in the development of learning environment inventories and instruments (Fraser, 2001). The focus on obtaining data from those participating in the environment rather than relying on the views of external observers or academic outcomes has provided rich insights into how the environment is created and maintained (Fraser, 1998, 2001). Early learning environment surveys and inventories exploring the broad picture of learning environment activities and relationships have been expanded. Instruments have been developed to investigate the environments of specialist disciplines, such as the science laboratory, or innovations teachers introduce, such as computer simulations (Maor, 2000; Taylor & Maor, 2000). Through ongoing research, instruments developed have been proved to be flexible, reliable and cost effective. The above description of learning environment research demonstrates the feasibility of developing perceptual measures capable of successfully analysing a student's perceptions of digital material presented in online activities.

INSTRUMENT DEVELOPMENT

Any instrument developed to explore digital course materials and the online learning environment should be firstly, based solidly on past research in learning environment research, secondly, incorporate and where necessary expand upon previous studies undertaken in this area and finally, be aware of and incorporate constructivist views of learning on the need to create environments that promote conceptual change.

Student interface interaction

When the learner 'logs on' to the computer, (i.e. establishes a connection), immediately an interactive relationship is created. The learner through input devices (key board mouse, microphone, and scanner) interacts with the computer. The computer through a range of output devices (printer, visual display unit, sound card, video card) interacts with the learner. The relationship created, while apparently 'two way', is input dependant. For example, to print a page the learner must instruct the computer to print. When the computer receives the instruction, it processes the command and carries out the task. Without input the computer does not function. Online activities are also input dependant. The learner must select an appropriate 'tool' to participate fully in the course. It would appear important to investigate how this interface is structured, laid out and organised. There are three broad factors to be considered when designing or investigating the interface for online courses (Clayton, 2003). Firstly, there are technological issues. For example, what is the level of technology required to make the system operate smoothly? This would include software applications, browser capabilities and plug-ins. Secondly, what is the required level of student technological capability to successfully learn within the environment? This would include the types of software applications students are required to use and the types of activities students will be engaged in. Thirdly, how is the environment organised and ordered? This would include the ease of navigation, the visual layout of tools on the screen and the explanations provided.

Previous research has, to some extent, investigated the broad factors outlined above. Newby and Fisher (1997), in the instrument *Attitude toward Computers and Computer Courses*, developed items using the scales, 'Lack of Anxiety' and 'Enjoyment'. These scales explored the extent to which the student felt comfortable using a computer and the extent to which students enjoyed using a computer. It was found these two scales were reliable, and although needing further testing, could be used with some confidence. For this instrument it is proposed a scale 'Computer Competence' will be developed. The scale and examples of items associated with the scale are illustrated below.

Scale:	Computer Competence
Description:	Extent to which the student feels comfortable and enjoys using computers in the online environment.
Items:	
	I have no problems using a range of computer technologies.
	I am confident in using the web-browser tool bar (back, forward, home, and search).

Student-tutor relationships

In many connected computer or web-based courses there is an invisible level of tutor-student communication, this is in the form of pre-set computer marked activities. The communication channel can be regarded as invisible in there appears to be no direct relationship between student activity, marks, and feedback received, and tutors. The computer - student relationship appears to be the dominant and sole relationship. However, this does not take into account the tutors' creation of the activities and their pre-recorded responses to student actions. The tutor instructs the computer to respond in particular ways to student input. Since the tutor is responsible for the task design, type of input and nature of response, the relationship established is a student - tutor relationship, mediated by the computer. Since the types of questions posed will influence student achievement tutors must be able to ask suitable questions and sequence those questions in an order that will generate understanding. The pre-recorded feedback preset by the tutor to activate on student input, will influence student motivation, interaction and progress.

Maor and Fraser, (1993) in the *Computer Classroom Environment Inventory* developed items using the scale 'Open-Endedness'. This scale investigated the extent to which computer activities emphasized an open-ended approach to inquiry. Teh and Fraser (1994), in the *Geography Classroom Environment Inventory*, developed items using the scale 'Innovation'. This scale investigated the extent to which the teacher planned new and varying activities and techniques, and encouraged students to think creatively. Walker (2001), in the *Distance Education Learning Environment Survey*, developed items using the scale 'Active Learning'. This scale investigated the extent to which students had the opportunity to take an active role in their learning. For this instrument it is proposed a scale 'Active Learning' will be developed. The scale and examples of items associated with the scale are illustrated below.

Scale	Active Learning
Description	The extent to which the computer activities support students in they're learning and provide ongoing and relevant feedback.

Items
 The feedback I receive from activities / quizzes is meaningful.
 I am motivated by the responses I get from the activities / quizzes included in this course.

Student-media interaction

There are a number of aspects that need to be taken into account when reviewing content provided to students in a connected computer environment. Firstly, there are physical considerations. When using print based materials, the student generally reads the material at 'arms length' moving from page to page by hand. The physical position of the arms in relation to the eyes mean the print material is held below head level and the reader looks down on the information presented. Computer presented information is viewed on a visual display unit (VDU) that is in a fixed position, generally positioned at eye-level. The presence of input devices in front of the VDU, keyboard and mouse, ensures the material is presented at a distance further than arms length. To view the information the reader uses the keyboard or mouse to move from section to section. Secondly there are differences in presentation. Information in print can be regarded as static, the text, graphics and photos used to explain concepts or illustrate processes remaining constantly unchanging. While it is possible to enhance material by supplementing the text with audio or videotapes, these are separate and distinct items utilizing specialist devices. Information presented via the computer is dynamic, the text, graphics and photos can be animated to illustrate complex relationships. Audio and video components can be embedded in the material and be reviewed on the same device.

Maor and Fraser (1993), in the *Computer Classroom Environment Inventory*, developed items using the scale 'Organization'. This scale investigated the extent to which classroom activities were planned and organised. Chang and Fisher (2001), in the *Web-Based Learning Environment Inventory*, developed items using the scale 'Information Structure and Design Activities'. A section of this scale explored whether the materials presented followed accepted instructional design standards. Instructional design standards include the visual display of material reviewed. For this instrument it is proposed a scale 'Information Design and Appeal' will be developed. The scale and examples of items associated with the scale are illustrated below.

Scale	Information Design and Appeal
Description	Extent to which class materials are clear, stimulating and visually pleasing to the student.

Items
 The choice of the text font was good.
 The material presented is visually appealing.

Student reflection activities

In web based and connected computer learning environments, the computer mediates all the relationships created within that environment. Electronic mediation eliminates traditional physical cues that are present in face-to-face relationships. The tutor cannot smile, glare or raise an eyebrow if things are going right or wrong. Students cannot nudge or wink at each other or look bored, excited or vacant when the tutor is explaining concepts. These physical cues within the face-to-face classroom environment prompt students and teachers to stop, modify or continue with the behaviour being exhibited. In the web based and computer-connected environments these physical cues are not present. Students have to be conscious of their own learning. After the course has been completed students must also reflect on the environment they have been participating within and ask themselves if they were satisfied with learning in the environment created. For example, did they enjoy learning in this environment, did the environment motivate them, and did the course meet their learning needs?

Previous research has, to some extent, investigated the broad factors outlined above. Taylor and Maor (2000), in the *Constructivist On-Line Learning Environment Survey*, developed items using the scale 'Reflective Thinking'. This scale investigated the extent to which critical reflective thinking is occurring in association with online peer discussion. Duschl and Waxman (1991), in the *Individualized Classroom Environment Questionnaire*, developed items using the scale 'Investigation'. This scale explores the emphasis on the skills and processes of inquiry and their use in problem solving and investigation. Maor and Fraser (1993), in the *Computer Classroom Environment Inventory*, developed items using the scales 'Investigation' and 'Satisfaction'. These scales investigated the extent to which the student was encouraged to engage in inquiry learning and the extent to which the student was interested in using the computer and in conducting investigations. Walker (2002), in the *Distance Education Learning Environment Survey*, developed items using the scale of 'Enjoyment'. This scale investigated the extent to which students enjoyed learning in a distance environment. It must be noted Walker regards this scale as a 'measure' and as such cannot be regarded as a social climate dimension. Chang and Fisher (2001), in the *Web-Based Learning Environment Inventory*, developed items using the scale 'Qualia'. This scale explored six categories, enjoyment, confidence, accomplishments, success, frustration and tedium. For this instrument it is proposed a scale 'Reflective Thinking' will be developed. The scale and examples of items associated with the scale illustrated below.

Scale	Reflective Thinking
Description	Extent to which reflective activities are encouraged and how students enjoyed learning and participating in this environment.
Items	
	I feel a sense of satisfaction and achievement about this learning environment.
	I am satisfied with my experience of using the internet and learning online.

The instrument

Based on the discussions above a perceptual measure has been created based on four (4) scales, computer competence, active learning, reflection and information design and appeal. While the scales have been used in previous learning environment research and could be considered to be reliable. The instrument as a whole has not been validated and the results obtained should be used with some caution. However, it is hoped the data collected will provide a general overview of students' perceptions of the material developed and the environment created.

FINDINGS OF EXPLORATORY STUDY

Sample

The sample comprised 67 vocational students studying trades courses at institutes of technology. There was a minority of females (4/67) and a significant majority were male (63/67). It was also notable that a large number (34/67) were under 20 years of age. The sample also appeared to show a high degree of technological literacy with a significant majority (46/67) indicating they used a computer at least three times a week. Given the exploratory nature of the study and the limited number of participants no attempts were made to structure the data based on gender, age or socio-economic status, although with further data this may be a worthwhile area to explore.

Computer competence

To participate fully in e-environments it could be argued learners have to be technologically literate, confident and competent in using a computer (Clayton, 2003). When analyzing the data it was found a significant majority of participants were confident and competent in using computers (56/67), searching for information using the World Wide Web (50/67), using a web-browser (54/67), reconnecting to the internet when disconnected (50/67) and were capable of storing information on their computer (45/67). On the surface it would appear participants are confident and technologically capable of participating in the e-environment created. However, a significant minority (31/67) felt they would be unable to find a solution if 'error messages', caused by software or hardware failures, occurred during their learning. This indicates that the provision of a technical helpdesk could be regarded as a crucial service to enable continuing success for this group.

Active learning

For students to remain motivated in digital environments they should be encouraged to engage with the content presented (Clayton, 2002). When analyzing the data it was found a significant majority of students felt the feedback received from material helped them to identify areas of concern (59/67) or where they were having difficulties (58/67). They were also motivated by engaging with the content provided (61/67) and felt it enhanced their learning (63/67). They also felt the feedback received during activities were meaningful to them (61/67). These findings indicate materials created for students with a high degree of interactivity and feedback is appreciated by learners.

Information design and appeal

It is argued students will perform more productively in their preferred learning environment (Yarrow, Millwater & Fraser, 1997). Therefore, it was hypothesized that if students felt “comfortable” with course material presented they would achieve at a higher standard. When analyzing the data it was found students felt the formatting of the text (61/67), the use of colours in tables and pages (60/67), and the use of images (63/67) enhanced their learning. Students also indicated graphics played a useful in illustrating main points and aiding understanding (63/67) and they found the material visually appealing (60/67). These findings indicate materials created for learners should utilize well designed, appealing graphics extensively.

Reflection

Zariski and Styles (2000) have speculated e-learning students need to be highly self regulated and be responsible for organizing and reflecting on their learning. They must become self-directed learners. When analyzing the data it was found student’s perceptions of online learning where positive. All participants were satisfied with their experience (58/67). They found using the internet for learning was stimulating (56/67), they had few problems accessing material presented (56/67), and they felt they where in control of their learning (63/67). It was significant a majority of students (56/67) believed online learning could enhance the classroom environment and they felt they would learn more if this occurred (54/67). This may indicate that online activity sessions for these learners should be an integral part of teaching.

Limitations

The research sample is very limited and it should not be regarded as representative of all current or potential students in vocational courses. Most of the students who participated in this exploratory research had easy access to computers and during this study had access to a range of interactive material. The instrument was heavily weighted towards investigating student perceptions of their computer competence, how they engaged with content, the appeal of material presented, and how they perceived online learning. It did not fully probe student online interactions with each other or their online interactions with their tutors.

CONCLUSIONS

This paper has described a potential new instrument which assesses student perceptions of the digital material presented to students in online learning environments. The study of the 30 item instrument with 68 students indicates the instrument can be further developed with confidence. The review presented here is the first part of a more extensive study. An extensive analysis involving the further refinement of the instrument and further analysis of data collected will be reported in further publications. It is hoped the availability of this instrument will allow researchers and developers to evaluate the use of digital material in online learning environments. The author believes the development of a perceptual measures exploring digital material in online learning would be a valued tool.

REFERENCES

- Bonk, C. (2001). *Online teaching in an online world*. Bloomington, IN: CourseShare.com. Online <http://publicationshare.com/>.
- Chang, V., & Fisher, D. (2001, December 2-6). *The validation and application of a new learning environment instrument to evaluate online learning in higher education*. Paper presented at the Australian Association for Research in Education, Fremantle.
- Chin, K. L., & Ng Kon, P. (2003). Key factors for a fully online e-learning mode: A Delphi study. In G. Crisp, D. Thiele, I. Scholten, S. Barker & J. Baron (Eds.), *Interact, integrate, impact: Proceedings of the 20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education* (pp. 589-593). Adelaide, 7-10 December 2003.
- Clayton, J. (2002, April 10-12). *Using web-based assessment to engage learners*. Paper presented at the DEANZ: Evolving e-Learning Conference, Wellington.
- Clayton, J. (2003). Assessing and researching the online learning environment. In M. S. Khine & D. Fisher (Eds.), *Technology-rich learning environments: A future perspective* (pp. 127-137). Singapore: World Scientific.
- Clayton, J. (2005a). Education and the internet. In C. Ghaoui (Ed.), *Encyclopaedia of human computer interaction* (pp. 175-178). Hershey: Idea Group.
- Clayton, J. (2005b). On-line Learning. In C. Ghaoui (Ed.), *Encyclopaedia of human computer interaction* (pp. 435-439). Hershey: Idea Group Reference.
- Duschl, R., & Waxman, C. (1991). Influencing the learning environments of student teaching. In B. Fraser & H. Walberg (Eds.), *Educational environments: Evaluation, antecedents and consequences* (pp. 255-271). Oxford: Pergamon Press.
- Fisher, D., & Fraser, B. (1990). School climate (SET research information for teachers No. 2). Melbourne: Australian Council for Educational Research.
- Fraser, B. (1998). Classroom environment instruments: Development, validity and applications. *Learning Environments Research: An International Journal*, 1(1), 68-93.
- Fraser, B. (2001). Twenty thousand hours: Editors introduction. *Learning Environments Research: An International Journal*, 4(1), 1-5.
- Fraser, B., & Wubbels, T. (1995). Classroom learning environments. In B. Fraser & H. J. Walberg (Eds.), *Improving science education* (pp. 117-143). Chicago: The University of Chicago Press.

- Maor, D. (2000). *Constructivist Virtual Learning Environment Survey*. Retrieved March 15, 2003, from http://www.curtin.edu.au/learn/unit/05474/forms/CVLES_form.html
- Maor, D., & Fraser, B. (1993). Use of classroom environment perceptions in evaluating inquiry-based computer learning. In D. Fisher (Ed.), *The study of learning environments* (Vol. 7, pp. 42-57). Perth: Curtin University of Technology.
- Moos, R. H. (1979). *Evaluating educational environments*. San Francisco: Jossey-Bass.
- Newby, M., & Fisher, D. (1997). An instrument for assessing the learning environment of a computer laboratory. *Journal of Educational Computing Research*, 16, 179-190.
- Taylor, P., & Maor, D. (2000). Assessing the efficacy of online teaching with the Constructivist On-Line Learning Environment Survey. In A. Herrmann & M. M. Kulski (Eds.), *Flexible Futures in Tertiary Teaching. Proceedings of the 9th Annual Teaching Learning Forum, 2-4 February 2000*. Perth: Curtin University of Technology.
- Teh, G., & Fraser, B. (1994). An evaluation of computer assisted learning in geography in Singapore. *Australian Journal of Educational Technology*, 10(1), 55-68.
- Walker, S. (2002, January 22-25). *Evaluation, Description and Effects of Distance Education Learning Environments in Higher Education*. Paper presented at the Ninth Annual Distance Education Conference, Austin, Texas.
- Zariski, A., & Styles, I. (2000). Enhancing student strategies for online learning. In A. Herrmann & M. M. Kulski (Eds.), *Flexible Futures in Tertiary Teaching. Proceedings of the 9th Annual Teaching Learning Forum, 2-4 February 2000*. Perth: Curtin University of Technology.