Individual Approaches to Studying and the Affordances of Interacting with Networked Learning Environments

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Abstract

This paper presents the general results of an investigation into networked learning via autonomously accessible, integrated environments which focused on individual approaches to studying, learning outcomes, and subjective descriptions of experience. Learners orientated towards understanding and possessing organised study methods performed most effectively, successfully acting upon the affordances of the environments. The implications are discussed.

Introduction

In recent years the basic concept of affordances that is central to the theory of the perceptual psychologist James Gibson has been adopted by an increasing number of theorists and researchers seeking to understand and explain the potential of educational technology to support and facilitate effective student learning. Gibson defined the term 'affordance' to describe the relationship between an individual and the perceived value of objects in their environment, thus a chair is seen to 'afford' support for sitting down (1979). In the context of educational technology we think of an affordance as being the opportunity for action and extended learner capabilities perceived in the properties of a specific technology or media (Ryder & Wilson, 1996).

A Networked Learning Environment (NLE) is an autonomously accessible hypertext-based resource that combines comprehensive course material with computer-mediated channels for student-student or student-tutor communication and, frequently, multimedia content. Contemporary theory in the broad constructivist tradition claims manifold affordances for students interacting with NLEs and their constituent elements. These affordances are seen to include self-paced and reflective learning (Hiltz, 1994; Grabinger & Dunlap, 1995), the appropriation of conceptually rich knowledge via exploration of conceptually rich hypertexts (Jacobson & Spiro, 1995, Jonassen et al., 1997), authentic representation of information within multiple media formats (CTGV, 1993; Jonassen et al., 1996), and the critical multi-perspective negotiation of understanding that can be fostered by effective asynchronous computer-mediated discussion (Mason, 1994; Yakimovicz & Murphy, 1995). In general terms, the rationale for having students interact with NLEs is the facilitation of an active, learner-centered educational experience that immerses the learner in the personal construction of meaning as opposed to the passive acquisition of knowledge for short-term application.

However, the potential for NLEs to enable active, effective learning can only be fully realised if the learner recognises and acts upon the affordances of the technology. Yet what guarantee do we have that each learner will interact effectively with NLEs under autonomous conditions, fully utilising and benefiting from self-paced study of mediated course material, multimedia representations of information, and the opportunity to participate in asynchronous discussion? Furthermore, what do we understand about the subjective experience of networked learning from the perspective of the learners themselves, or of the factors intrinsic to both the learner and the NLE that influence interaction and subsequent learning outcomes?

Unfortunately current research provides little insight into such issues. Studies of learning involving hypermedia have tended to be highly experimental in nature, based upon controlled interaction with stand-alone environments not autonomous interaction with integrated networked environments. Regarding the nature of the networked learning experience, an over -reliance on anecdotal descriptions of practice by educators at the expense of methodological investigation into student practice, perception and knowledge gained has been recognised (Windschitl, 1998; Ward & Newlands, 1998). The research reported within this paper was conducted to address these shortcomings on a modest scale, and provide an insight into the relationship between individual learners, subjective experience, and the affordances of NLEs.

Method

The research comprised a naturalistic experiment and case study, both of which involved undergraduate information management students (n=30) interacting with NLEs as the sole method of campus-based course delivery. Students were required to autonomously learn the mediated material, participate in on-line discussion, and complete small-scale assignments.

Semi-structured interviews with each student were the primary method of data collection and explored individual accounts of interaction, perceptions of how the NLEs and their constituent elements were intended to and did support learning, and feelings regarding personal suitability to networked learning as a mode of course delivery. To provide further insight into the latter issue and identify any possible relationship with existing learner traits, a short-form version of the Approaches to Studying Inventory (ASI) enabled students to indicate how they undertook learning on their conventional undergraduate courses (Tait et al., 1997). The ASI is grounded within the phenomenographic tradition of educational research (Entwistle & Ramsden, 1983; Marton et al., 1997), and measures whether an individual takes a deep, strategic or surface approach to learning based upon an accumulation of scores on several sub-scales representing the traits generally associated with each specific approach.

To directly assess the potential influence of individual approaches to networked learning upon subsequent learning outcomes, the experimental study facilitated naturalistic conditions through pre-selecting a group of students (n=20) to interact with a networked environment designed to complement a core module yet to be undertaken. This allowed a degree of control over prior knowledge, and ensured the mediated material to be learned was academically relevant to each individual. Students periodically completed short written tests designed to elicit a demonstration of any conceptual knowledge gained, the responses to which were analysed using the SOLO taxonomy (Biggs & Collis, 1984). The SOLO taxonomy enables the classification of learning outcomes at increasingly complex levels of conceptual understanding from a position of meaninglessness to one of abstract thought. Learning outcomes as measured by the SOLO taxonomy have been found to correlate closely with the individual approaches to studying that are measured by the ASI (Van Rossum & Schenk, 1984; Boulton-Lewis, 1998).

Approaches to Studying and Networked Learning

The relationship between individual traits, patterns of interaction and outcomes of learning with educational hypermedia is not fully understood. Whilst some studies report a correlation between these factors (e.g. Rasmussen & Davidson-Shivers, 1998; Chuang, 1999), others report no significant findings regarding learning style and outcome (Fitzgerald & Semaru, 1998). Dillon and Gabbard's (1998) recent meta-analysis further demonstrates our current lack of understanding, but does provide evidence to suggest that individuals who might be considered 'high-ability' or 'independent' learners perform most effectively with hypermedia. If this is accepted, then it would seem reasonable to assume that those individuals who indicated an orientation towards conceptual understanding or an organised approach to learning as measured via the ASI would prove to be efficient in a networked learning context.

Table 1: ASI Mean Scores with Lowest and Highest Individual Scores

Student n=30	Mean Score	Low Score	High Score
Deep Approach	**14.4**	**10**	**18**
Seeking meaning	14.3	8	18
Relating ideas	13.9	8	20
Use of evidence	15.0	10	18
Strategic Approach	**14.1**	**9**	**18**
Organised studying	13.6	8	19
Time management	13.0	6	19
Alertness to assessment demands	15.6	10	19
Surface Approach	**11.0**	**6**	**15**
Lack of purpose	8.3	4	13
Unrelated memorising	11.4	7	16
Syllabus-boundness	13.4	6	20

Range for scores on sub-scales = 4 to 20. Scores on each approach therefore range from 12 to 60, but have been expressed above as an accumulated average of the related sub-scale scores.

The mean scores on deep, strategic and surface approaches to studying and related sub-scales can be seen in Table 1, which also includes an indication of the variation in individual scores. Because the ASI was designed to assess approaches to learning on conventional courses it is inherently problematic as a direct measure within networked or hypermedia-based learning. However, the findings of this study did indicate a relationship between responses to the ASI at main scale and sub-scale level, and the way in which individual students described their approach to networked learning. The contrasting approaches to networked learning described ran on a continuum from passivity to pro-active interaction with the environment. The former extreme was characterised by disorganised autonomous study methods and an orientation towards rote learning, and the latter by highly organised autonomous study methods and an orientation towards understanding the mediated material. These contrasting positions are encapsulated within the following interview extracts, which are also indicative of the relationship between individual approaches to conventional and networked learning:

"I do work well alone. It's a way that I like to work and I'm reasonably good at setting deadlines for myself...I tended to do it twice a week, usually at the beginning of a week and then at the end of the week for a shorter time before the test...I tried to pick out the most important things and see what's going to come up because it's a good way to work through it, it puts the points in your head...and if I didn't remember just go back and try and fill in the gaps...If you wanted to, you could just use a search engine to find similar or more [material]."

"I sort of learnt stuff and memorised it for the test, and then just forgot it again. Just trying to cram it, yeah. I do that for exams...See, that's me. I'm just basic. I don't do any further reading or anything... I just kept reading it again. I'd do it a couple of times before coming in."

The first quotation is from a learner who scored highly on deep and strategic approach scales within the ASI, the second from a surface learner with low 'time management' and 'organised study methods' sub-scale scores. Each is describing how they approached learning the mediated material between the periodic knowledge tests administered during the experimental study. Although these comments are illustrative of extremes in approaches to networked learning, it was generally found that those students who described themselves as independent, self-motivating learners with an orientation towards conceptual understanding interacted most effectively with the NLEs. These individuals studied the mediated material in an organised, reflective manner, and fully utilised constituent elements of the NLEs through purposefully attempting to learn from the supporting multimedia components and regularly accessing asynchronous discussion facilities to read and contribute to on-line debate. In contrast,

students who described themselves as disorganised, lacking motivation and with a tendency to 'cram' undertook networked learning in a 'just in time' manner, interacting with the NLEs to access the mediated material immediately prior to task deadlines which reduced the scope for reflection, interaction with multimedia components and participation in asynchronous debate.

What these findings confirm, in accordance with existing research, is that learning style or approach is to some measurable extent a factor in determining the efficiency with which an individual interacts with hypermedia-based environments. Within this study individual approaches to learning as measured by the ASI, and approaches to networked learning as described within the subjective accounts of students, provide a feasible explanation as to why only certain learners interact with networked environments in a manner conducive to the reflective, self-paced learning that asynchronous environments can facilitate (Hiltz, 1994).

Networked Learning Outcomes

Although the influence of learning style upon the effectiveness with which an individual interacts with educational hypermedia environments is accepted, the degree of influence regarding learning outcomes has hitherto been unclear (Chen & Rada, 1996; Dillon & Gabbard, 1998). As regards the findings of this study, the range of answers at increasing levels of conceptual understanding from learners who indicated a deep, strategic and surface approach to studying as measured by the ASI is shown in Table 2. No answers were classified at the extended abstract level of the SOLO taxonomy, signifying full conceptual understanding and an ability to hypothesise, possibly due to the parameters of the experiment.

Table 2: Knowledge Test Answers (SOLO) x Learning Approach and Course Preference

Student n=20	Level 1	Level 2	Trans	Level 3	Trans	Level 4
Deep Approach						
Support understanding (n=3)	1.7%	2.8%	0.0%	5.6%	2.8%	2.2%
Transmit information (n=7)	5.0%	10.0%	1.7%	15.6%	1.7%	1.1%
Strategic Approach						
Support understanding (n=3)	0.6%	1.7%	0.6%	7.2%	1.7%	3.3%
Transmit information (n=5)	3.3%	5.6%	0.0%	14.4%	1.7%	0.0%
Surface Approach						
Transmit information (n=2)	1.1%	2.8%	0.6%	5.6%	0.0%	0.0%
Total % Answers	11.7%	22.8%	2.8%	48.3%	7.8%	6.7%
Total N Answers	21	41	5	87	14	12

Level 1 = Prestructural response and in the above includes non-meaningful responses; level 2 = unistructural; level 3 = multistructural; level 4 = relational; trans = transitional. Response n=180.

Within the context of 'dominant' individual approaches to studying, the results from the knowledge tests seem at first inconclusive. The majority of responses were at the multistructural level, which is the mid-point of conceptual understanding in the SOLO taxonomy, and the number of surface learners too insignificant upon which to base any conclusions regarding the inability of these learners to answer beyond a multistructural level. The nature of these findings is possibly attributable to the potential problem of analysing approaches at main scale level as an individual may, for example, indicate that they approach learning with a focus on understanding (deep) combined with organised methods (strategic).

However, when individual approaches are differentiated by preferences for different types of course and teaching as measured by the ASI the results become more interesting. Of the 14.5% of test answers above the multistructural level at either a transitional or relational level, 10% were given by deep or strategic learners with a preference for courses which support understanding as opposed to transmitting information. This finding is perhaps more

significant when considering that the individuals who provided the aforementioned 10% of answers account for only six of the eighteen learners indicating deep or strategic approaches.

The distinction between learners who prefer courses that support understanding as opposed to transmitting information would therefore seem to be a potentially important one. Presumably this is because the factors which contribute to a preference for courses that support understanding as measured via the ASI, including the opportunity for independent thinking and exposure to material that can provide explanations beyond those possible within a lecture, are also those factors central to the demands of learning via asynchronous, integrated NLEs. Evidence for this relationship was also found within learners' subjective accounts of experience. Those students taking what was earlier described as a 'passive' approach to networked learning characterised by disorganised, 'just in time' learning generally expressed a dislike for networked learning because the onus to learn was entirely upon them. Increased control over when to study was considered negative precisely because it did enable the repeated delay of studying, and the lack of lecture-based delivery was lamented because the synchronous nature of lectures prompted attendance and therefore exposure to course content. Students who expressed these views did not feel they learned effectively, which was generally reflected in their knowledge test responses. Learners who approached networked learning 'pro-actively' generally felt suited to this mode of course delivery and believed it to be educationally effective. Test responses consistently indicated higher levels of understanding.

Perception and Realisation of Networked Learning Affordances

To recall, an 'affordance' is the opportunity for action perceived in the properties of an educational technology or media (Martin & Ryder, 1996). If approaches to studying and preferences for different modes of course delivery influence the nature and quality of networked learning, then a logical assumption is that these factors might also influence the capacity for an individual to perceive and act upon the affordances inherent within NLEs. This issue is of critical importance, as the degree to which an individual undertakes reflective learning of mediated material, interacts with multimedia, and participates in online discussion will determine how active the networked learning experience becomes, and could subsequently either inhibit or facilitate the realisation of the potential learning outcomes.

In the subjective accounts of experience provided, a relationship between the effectiveness of individual interaction with NLEs and the perception of networked learning affordances was apparent. The following describes how one student interacted with visual multimedia:

> "Basically, there's got to have been a point to it to have been put in, that's what I think, so I keep looking at it until I get the point of why it's there, really. I did look at them all...I did actually study them to see exactly what it was trying to prove to me."

This learner perceived there to be some educational purpose to the presence of the multimedia intended to enhance the textual content of mediated material, and subsequently studied each multimedia component until they reached an understanding of the content. This approach is in contrast to that of another student who believed the multimedia was intended primarily to make the mediated material more visually interesting, and who described only looking or interacting briefly with the multimedia components as they read through the text. Such variations in perception also informed the extent to which individuals interacted with asynchronous discussion facilities, followed links to further reading material on the WWW, or attempted to learn the mediated material in an organised, reflective manner. The primary defining factor enabling successful exploitation of the affordances inherent in autonomous interaction with integrated NLEs was an acute awareness of potential educational benefits.

However, the accurate perception of affordances does not guarantee that potential educational benefits will be realised. Individual approaches to networked learning were found to limit the potential for action, especially in the case of learners who took a 'just-in-time' approach:

> "It's good having all the information there for you prepared in advance. You can look at it whenever you want [and] work at your own speed...I don't know if it worked for me. I left it all to the last minute...I could have done better if I had looked at it more...I'd be too tempted to do other things once I'd got the computer switched on."

This student demonstrated full awareness of the affordances of autonomous learning, but their own approach to learning prevented them from realising the potential benefits of self-paced study. This is illustrative of many similar comments from students who took a 'just-in-time' approach to networked learning - accessing the mediated material immediately prior to a test or work completion deadline, and generally 'cramming' within the limited time available. The fundamental problem with this approach is that it negates the opportunity for reflection, interaction with multimedia components, or participation in asynchronous discussion should the need to articulate a difficulty in understanding some aspect of the mediated material arise. For those 'passive' networked learners who did fully comprehend some or all of the affordances inherent within NLEs, the 'just-in-time' approach was often an overriding factor.

What becomes apparent in considering the relationship between individual learners and their ability to perceive and act upon the affordances of interacting with networked learning environments, and possibly any educational technology, is that it is perhaps misleading to think of affordances as being opportunities for extended learner capability there for all. In contrasting the different ways in which individuals approach networked learning it seems more appropriate to think of affordances as being inherent properties which facilitate enhanced learning potential for some, yet inhibit this for others. Beyond specific approaches to networked learning this could also apply, for example, to a student who understands the value of asynchronous discussion as a medium for reflective debate but is discouraged from contributing due to the idea of their comments being visible on-screen for scrutiny by others.

One possible reason underlying the inconsistency in the perception and realisation of networked learning affordances, and which may also apply to those students who feel their approach to studying is unsuitable to this mode of learning, is the issue of 'learning to learn'. It has been found that as meta-cognitive awareness improves so too does the ability to work effectively in a networked learning context (Hill & Hannafin, 1997). The learners in this study who took an active approach to networked learning generally indicated that they approached conventional learning in a reflective, organised manner. The likelihood is that these students already possessed the necessary meta-cognitive awareness to learn effectively. Those who approached networked learning in a passive manner tended to indicate a similar approach to conventional studying, but generally also expressed a dislike for networked learning due to what it did not afford that a traditional course did – they did not seem to fully appreciate what networked learning offered them that traditional courses do not. Perhaps as students 'learn to learn' in a networked learning context it will become more appropriate to discuss what this mode of study can universally afford all individuals, and the form of active, constructivist learning discussed in the contemporary literature will be more widely observed.

Conclusion

Within the limited parameters of this small-scale study, findings strongly suggest a relationship between individual approaches to learning and effective autonomous interaction with integrated networked environments. Directions for continuing research include further investigation into the nature of individual approaches to networked learning, and into the influence constituent NLE features have upon the mode of interaction with mediated material.

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