Learners' evaluation of a navigation support tool in distance education

Original article

doi: 10.1111/j.1365-2729.2007.00223.x

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Abstract This article investigates the usability of a navigation support tool, which guides learners by generating advice on the next best step to take in a self-study e-learning course. The article draws on log data and responses from online questionnaires to provide insights into learners' evaluation of the tool, their adherence to the advice and their expectations of self-efficacy. The theoretical underpinnings of the work are described together with the experimental set-up. Results show that more than half of the learners in the experimental group adhered to the advice and held the opinion that the advice stimulated them to proceed with the course. Learners expressed a need to know what the advice was based on which can be seen as an essential element in future development of the tool.

Keywords adherence, navigation support tool, self-efficacy, self-organized indirect social navigation, usefulness.

Introduction

Research shows that educational yield and learner attrition are in need of improvement in higher online distance education (Cookson 1990; Moonen 1997; Yorke 1999; Lorenzetti 2002; Xenos *et al.* 2002; Rovai 2003; Simpson 2004). One of the factors contributing to the problem is the limited degree of guidance available to learners when navigating through the curriculum (Yorke 1999). When self-directed learners assume responsibility for choosing and sequencing learning modules, navigational difficulties can lead to learners 'not reaching their goals, or taking unduly long to do so' (Tattersall *et al*. 2005, p. 110). A study reported by Simpson (2004) found that one-fifth of those withdrawing from a study cited 'inadequate course choice guidance' as a reason for dissatisfaction.

Accepted: 12 December 2006

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One of the responses to these issues has been the development of navigation support tools. Janssen *et al.* (in press) describe the experimental evaluation of such a tool in a modular online course. Learners' interaction in the course is channeled through the tool, which gives an overview of the course modules showing a list of already completed modules and a list of the modules still to be completed. In addition, the tool provides advice on the next best module to study, based on the number of times a module had been *successfully completed* by other learners (Koper 2005). The advice can be configured to be shown or hidden, and is visible in Fig 1.

Results showed that learners who were exposed to the navigation tool and received advice about the next best step to follow in the course completed the course more often, and made significantly more progress through the course, than students who were not exposed to the navigation tool.

Janssen *et al.*'s experimental study focused solely on the tool's contribution to improved educational yield. This article describes a follow-on study, conducted after the experimental period, which broadens the tool's evaluation to include learners' views on its usefulness,

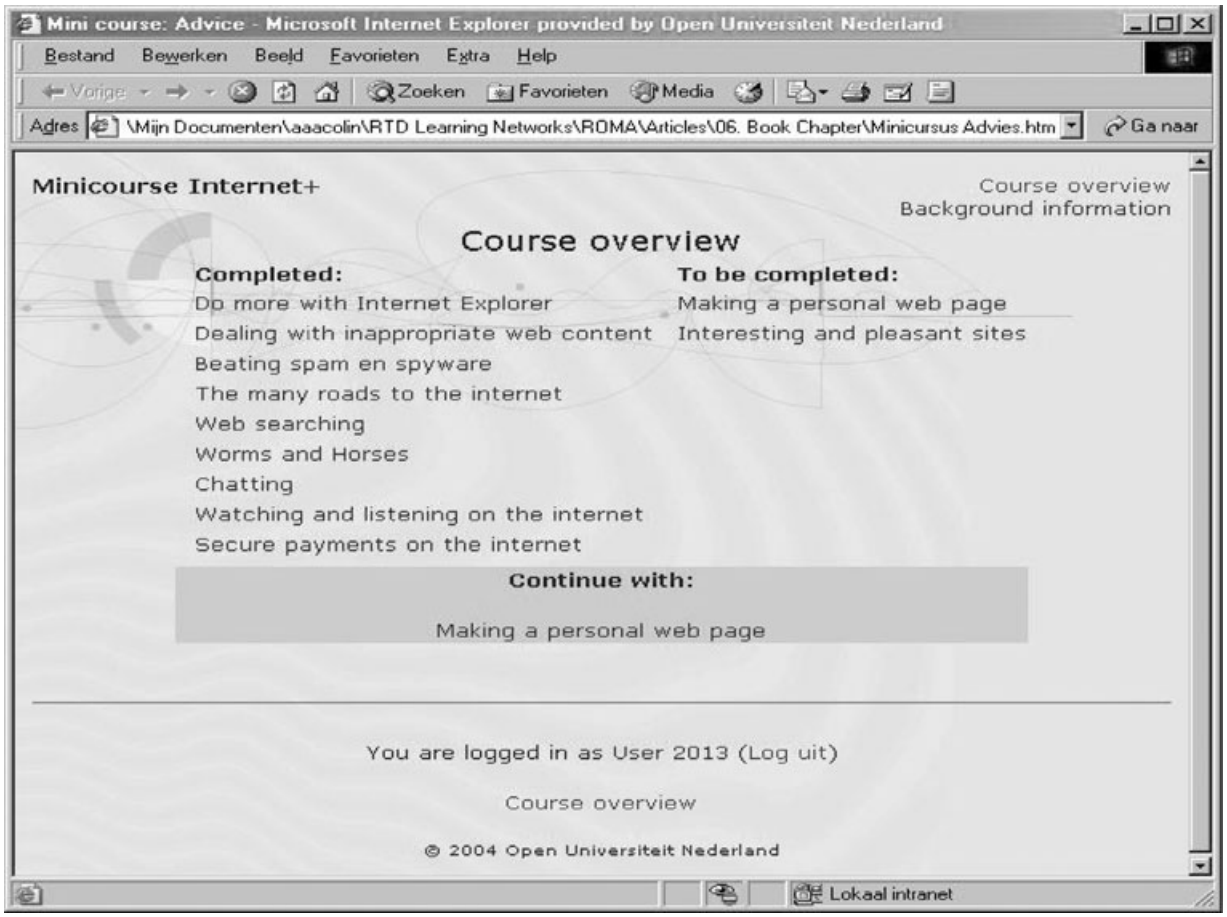

Fig 1 The navigation support tool which gives an overview of the course modules showing a list of already completed modules (left-hand side), a list of the modules still to be completed (right-hand side) and advice on the next best module to study.

and on the degree of their adherence to the generated advice. Furthermore, the study examines if Social Cognitive Theory (Bandura 1986), and in particular the notion of self-efficacy, could inform further refinement of the tool to increase its effects. Self-efficacy is defined as 'an individual's belief in one's capability to organize and execute the courses of action required to produce given attainments' (Bandura 1997, p. 3). In several studies, computerized guidance programs (e.g. Fukuyama *et al.* 1988; Waiman *et al.* 2003) have been shown to increase self-efficacy expectations towards task completion and task completion itself. Higher self-efficacy levels have been found to lead to increased levels of performance across a variety of tasks (e.g. Frayne & Geringer 1994; Bandura 1997; Stajkovic & Luthans 1998). Several studies (Vrught *et al.* 1997, 2002; Pietsch *et al.* 2003) and a meta-analysis (Multon & Brown 1991) reveal that academic students (though not specifically in online distance education) with high self-efficacy levels had better study results and showed more persistence in certain academic majors. Specifically in distance education, Tennant and Pogson (1995) found high self-efficacy levels to be predictive for successful study achievement. Furthermore, self-efficacy has been found to influence the perceived ease of use and user satisfaction with computerized guidance programs (Venkathesh & Davis 1996; Jarupathirun & Zahedi in press). This work suggests that incorporating self-efficacy enhancing strategies in the navigational support could be used to increase its effects on educational yield.

Given this background, this article reports on and investigates the following research questions:

- Did students adhere to the advice generated from the tool; if not, on which grounds did they decide on the next module to study?

- Did students appreciate and trust the advice?
- Did the advice stimulate students to proceed with the next module?
- Did the advice help the students in planning the course?
- Were self-efficacy expectations about course completion associated with satisfaction and adherence to the advice?
- Were self-efficacy expectations associated with course completion?
- Did the tool influence self-efficacy expectations about course completion?

Method

Study design and procedure

The experimental study revolved around a free course addressing introductory Internet skills. Learners were recruited from staff and students of The Open University of the Netherlands, together with friends and family. The recruitment announcement highlighted that the course was designed to test new technology, that it would take approximately 22 h to study, that the course would be available for 3 months starting in March 2005 and that its completion would be rewarded with a certificate.

Participants studying the course were randomly assigned to a control or experimental group. In the instructions given at the start of the study, learners were told they were free to study the modules in any order. The order of the list of modules still to be completed was reshuffled each time the page was viewed so that there would be no effect in learners' sequencing of modules because of their presentation in a fixed list. Participants were informed of this aspect of the tool, but were not told why this was the case. Learners in the experimental group were provided with advice on the next best step to proceed with and were advised to follow this recommendation. The control group was not exposed to this advice, but all other aspects of the course were identical in both groups.

At the start of the course, learners were asked to fill in a questionnaire on age, gender, educational level and computer skills. When the course closed (3 months after the start), all learners who had logged into their assigned site (which differed per condition) received an e-mail with a request to complete the online course evaluation questionnaire for learners, which is the subject of this article.

Data

Two types of data were gathered. First, logs of module completion were used – modules were completed through a multiple-choice quiz, with a threshold score of 60%. Each learner's completion of each module is logged by the system, together with the date of completion. The second source of information is learners' answers to various online questionnaires. These were used to gather *socio-demographic* information for both experimental and control groups (age, gender, educational level, level of computer skills), *general course-related* evaluation [time spent on the course, reason for not completing the whole course (if applicable) and learners' perceived increase in knowledge and skills as a result of the course] and *information on learners adherence to the advice and self-efficacy expectations*.

Inevitably, parts of the questionnaire differed between the experimental and control group. Table 1 presents the categories, questions and answer categories used in the questionnaires.

Self-efficacy expectations were measured identically in both groups using a scale developed specifically for this study, drawing on appropriate guidelines (Ajzen 1991). The self-efficacy scale score was calculated by taking together and averaging the scores on the three self-efficacy questions (Cronbach's standardized $\alpha = 0.67$). Perceived stimulation of the advice was also measured identically in both groups. It was measured by two questions which were transformed into the stimulation-scale by taking them together and averaging them ($r = 0.59$ for the experimental group, $r = 0.50$ for the control group).

Analyses

To study how learners evaluated the navigation tool, descriptive analyses were performed. Chi-squared tests were conducted to test for differences between the experimental and control group in the questions that were equal in both groups (see Table 1). Pearson correlations were computed between adherence and the self-efficacy scale and between stimulation-scale and the self-efficacy scale. *t*-tests were conducted to test whether the navigation tool resulted in higher self-efficacy levels and higher perceived knowledge and skills in the experimental compared with the control group. Differences were considered significant when

Table 1. Questionnaire items for the experimental and control group.

Category	Experimental group	Control group
Socio-demographic information	Age Gender Educational level (i) primary, basic vocational school, (ii) junior secondary school, (iii) senior secondary school, (iv) vocational school, (v) higher professional education, university, (vi) other Computer skills (1) very limited, (2) limited, (3) good, (4) excellent	Identical formulations and answer categories
Course-related evaluation	Time spent on the course in hours Perceived increase in knowledge and skills as a result of the course 5-point scale from (0) totally no increase to (+4) very large increase Do you feel that following a different path than you did would have been better for understanding the course content? 5-point scale from +2 = no, definitely not, to –2 = yes definitely	
Self-efficacy	Were you able to complete the course? 5-point scale from –2 = no, definitely not, to +2 = yes definitely Were you able to pass through the course efficiently? 5-point scale from –2 = no, definitely not, to +2 = yes definitely Were you able to pass through the course in an organized way? 5-point scale from –2 = no, definitely not, to +2 = yes definitely	Identical formulations and answer categories
Stimulation by the advice	To what extent did the advice stimulate you to proceed with the course? 5-point answering scale from –2 = definitely disturbed, to +2 = definitely stimulated To what extent was the advice helpful in planning your path through the course? 5-point scale from –2 = definitely did not help, to +2 = helped definitely	Would the availability of advice have stimulated you to proceed with the course? 5-point answering scale from –2 = definitely disturb, to +2 = definitely stimulate Would advice have been helpful in planning your path through the course? 5-point scale from –2 = definitely not help, to +2 = help definitely
Usefulness of the advice	Was the advice useful? Very useful (+2), useful (+1), unknown/no opinion (0), not very useful (–1), not at all useful (–2), I did not see any advice (user missing)	Would you have appreciated receiving advice? 5-point scale from –2 = definitely not, to +2 = definitely
Decision making	If you did not follow the advice, how did you choose the next module? The one which . . . (i) interested me most, (ii) was top of the list, (iii) I perceived as least fun, (iv) I perceived as most difficult, (v) I perceived as easiest, (vi) other Did you feel the need to know on what the advice was based? 5-point answering scale from –2 = definitely not, to +2 = definitely	How did you choose the next module? The one which . . . (i) interested me most, (ii) was top of the list, (iii) I perceived as least fun, (iv) I perceived as most difficult, (v) I perceived as easiest, (vi) other Not applicable
Adherence and trust	Did you follow the advice when you finished a module? (i) no, never, (ii) yes, very exceptionally, (iii) yes, sometimes, (iv) yes, mostly, (v) yes, always What degree of trust did you have in the advice? (0) no trust, (1) little trust, (2) reasonable trust, (3) complete trust	Not applicable

Table 2. Responses of learners in experimental group to questions regarding adherence to and trust in the advice.

Question	Answer categories	Experimental group (%)
Did you follow the advice when you finished a module?	Always	13.1
	Mostly	41.1
	Sometimes	32.6
	Very exceptionally	6.3
	Never	6.9
What degree of trust did you have in the advice?	Complete trust	25
	Reasonable trust	56.5
	Little trust	17.3
	No trust	1.2
Did you feel the need to know on what the advice was based?	Definitely	13.9
	Yes	43.4
	No	19.3
	Definitely not	3.6
	Do not know, no opinion	19.9

$P < 0.05$. All analyses were performed using SPSS 10.0.5.

Results

A group of 1011 people initially showed interest in taking the course. They were randomly assigned to either the experimental group or control group and were given login details accordingly. Twenty per cent ($n = 203$) did not log into their assigned course site, and this group is excluded from this article's analyses. This leaves 808 learners who entered the course sites; 398 in the control group and 410 in the experimental group. Response rates on the questionnaire on socio-demographics were about 60%, showing that overall there were more women (59%), people over 45 years old (57%) and people with an advanced educational level (higher professional education or university level; 63%). Finally, 48% said their computer skills were poor or very poor.

Table 2 presents responses from learners in the experimental group with respect to adherence to, and trust in, the advice. Note that the number of respondents differs per question as not all learners answered all questions. On average, half of the respondents answered the online learners' evaluation questionnaire. Slightly more than half of them followed the advice most of the time or always and almost 82% expressed trust in the advice. More than half of the experimental learners expressed the need to know the underlying basis for the advice.

Table 3 presents the responses to the questions on the experience of learners in the experimental group with the tool. Learners in the control group answered these questions hypothetically. Therefore, responses are only reported descriptively and were not tested on significant differences. Notable is that fewer learners in the experimental group reported the tool to be stimulating and helpful, compared with the control group. In both groups, comparable percentages of learners found the advice (very) useful. Learners in both groups most often chose as next module the one that interested them most. The percentage was, however, higher in the experimental group. A higher percentage of control group members than experimental group members chose the module that was top of the list.

Table 4 shows the results of an analysis of differences between the groups, revealing that the experimental learners had significantly higher scores than control learners in their perceived increase in knowledge and skills in the Internet domain as a result of the course. There were no differences in hours spent on the course nor in the judgement on the path followed through the course (sequence of modules).

Table 5 presents the correlations between the scales on self-efficacy, usefulness, adherence, stimulation and course completion for learners in the experimental group. As expected, self-efficacy expectations were positively correlated with the number of modules completed (course completion). To a lesser extent, they were also correlated with stimulation and adherence to the

Table 3. Responses to questions regarding the stimulation and usefulness of the advice and decision making.

Question	Answer categories	Experimental group (%)	Control group (answered hypothetically) (%)
To what extent did the advice stimulate you to proceed with the course?	Very stimulating	3	6
	Stimulating	25.5	54.2
	Not stimulating, not hindering	67.3	36.9
	Hindering	4.2	3
	Very hindering	–	–
To what extent was the advice helpful in planning your path through the course?	Very helpful	0.6	6
	Helpful	22.9	38.3
	Not helpful, not hindering	71.7	52.1
	Hindering	4.8	3
	Very hindering	–	0.6
To what extent was the advice profitable?	Very profitable	6.1	5.7
	Profitable	38.5	39.1
	Not profitable	37.4	32.2
	Totally not profitable	12.3	4.6
	No opinion, do not know	5.6	18.4
	Not seen an advice	0.1	Not applicable
How did you choose the next module? The one which . . .[1]	Interested me most	72	62.8
	Was top of the list	10.6	21.9
	I perceived as least fun	0.7	2.2
	I perceived as most difficult	1.2	1
	I perceived as easiest other	4.3	5.5
		11.2	6.6

[1]In experimental group: if advice not followed.

Table 4. Results of learner evaluation in experimental (n = 401) and control group (n = 399).

	Experimental group	Control group	χ^2-test/t-test	P
Hours spent on course			$\chi^2(3) = 1.99$	NS
Less than 10 h	24.7	23.6		
Between 10 and 20 h	38.3	33.9		
Between 20 and 30 h	24.1	30.9		
More than 30 h	13	11.5		
Mean increase in knowledge and skills in Internet domain as a result of the course	2.59	2.42	t(341) = –2.14	< 0.05
Mean score on question whether students were of the opinion that it would have been better for understanding the course content to follow another path through the course than actually followed	0.60	0.52	t(339) = 1.07	NS

NS, not significant.

Table 5. Means, standard deviations and pearson correlations.

	M (n)	SD	1	2	3	4	5	6
1 adherence	2.47 (175)	1.03	–	0.40**	0.43**	0.34**	0.06	0.20*
2 usefulness	–0.11 (178)	1.23		–	0.57**	0.52**	–0.07	0.09
3 trust	2.05 (168)	0.69			–	0.39**	–0.04	0.09
4 stimulation	0.23 (164)	0.49				–	0.04	0.20**
5 course completion[1]	5.61 (410)	0.92					–	0.35**
6 self-efficacy	1.09 (166)	0.71						–

*P < 0.05; **P < 0.01, two-sided.
[1]Number of course modules completed (range 0–11).

advice generated from the tool. This indicates that learners with high self-efficacy expectations completed more modules, adhered more often to the advice and were more convinced that the navigation tool helped them in planning the course. Noticeably, the number of modules completed is not correlated to any other subjective evaluation concept on which the opinion of learners was asked. Especially important is that the number of completed modules is not correlated to adherence to the advice, suggesting that course completion is not related to the adherence to the advice.

Adherence to the advice generated from the tool has strong associations with its perceived usefulness, the trust learners had in the advice, and the opinion learners held on the helpfulness of the advice in study planning and on the stimulating influence on proceeding with the course (the questions on helpfulness and stimulation were taken together as the stimulation-scale). This means the more trust, perceived usefulness and helpfulness, and perceived support in proceeding with a subsequent module, the more adherence to the advice generated from the tool. There were also strong correlations between the perceived usefulness of the tool and the trust learners had in the advice; the perceived usefulness and the opinion learners held on the perceived influence of the advice on planning. Finally, trust and stimulation were correlated.

We also explored the possible influence of the use of the navigation tool on self-efficacy expectations. A t-test (not presented in a table) showed no significant differences in self-efficacy levels ($t(335) = -1.09$, $P = 0.28$) between the experimental ($M = 1.09$, $SD = 0.71$) and control group ($M = 1.00$, $SD = 0.72$). This means that the study provided no indications that self-efficacy expectations towards course completion are influenced by using the navigational support tool (i.e. receiving advice on the best next step to follow).

Discussion

This study aimed to provide indications for the refinement of a navigation tool developed to support distance

learners by examining how learners evaluated the navigation tool, whether learners adhered to the advice, and whether the advice stimulated and helped them in planning the course. In addition, we explored the role of self-efficacy expectations in study progress and in adherence to the advice.

The study shows that slightly more than half of the learners in the experimental group followed the advice often or always. No related literature has been found on studies concerning adherence to advice in educational settings, but this amount is comparable with data from other domains, such as health care (La Greca & Schuman 1995; Myers & Midence 1998; World Health Organization 2003; DiMatteo 2004). The data reveal, however, that course completion has no correlation with adherence to the advice. This is hard to explain as the effectiveness study (Janssen *et al.* in press) showed positive effects of the tool on course completion. The measurement of adherence might not have been detailed and specific enough as the question was not posed for each module separately and only used one question measured by self-report and was asked retrospectively. We therefore need to interpret this finding with caution. Further research on the relation between adherence and course completion is recommended to validate our finding or to uncover the real relationship.

In line with results from studies of Bandura (1997), self-efficacy expectations and satisfaction with the tool were correlated. Contrary to our expectations, self-efficacy did not differ between the control and experimental group, which suggests that the navigation tool did not increase self-efficacy. In line with other studies (Multon & Brown 1991; Tennant & Pogson 1995; Vrught *et al.* 1997, 2002; Pietsch *et al.* 2003), self-efficacy was positively correlated with progress in the course. Learners in the experimental group reported a greater increase in Internet skills and knowledge than the control learners, which suggests a cognitive effect of the navigational support by the tool. Without influencing self-efficacy, the navigation tool might have had an effect on Internet skills and knowledge. Drawing hard conclusions on this effect is, however, difficult as we did not measure prior skills and knowledge of the responders. The effect on course progress was already shown by Janssen *et al.* (in press). In addition, it was found that self-efficacy and course completion are correlated. Causal inferences cannot be made as self-efficacy is only measured after course completion. The fact that self-efficacy did not differ between the two groups suggests that self-efficacy is not influenced by the navigation support tool.

With respect to tool refinement, results suggest informing learners of the goal of the advice and indicating the advantages of adhering to it. As usefulness is correlated to the trust learners have in the advice, clarifying the source of the advice might decrease learners' ambivalence towards its usefulness. As the study also indicated that stronger self-efficacy expectations result in better course progress, it is suggested to incorporate self-efficacy enhancing strategies in the navigational support. This could include information about successful comparable learners with whom the student can identify him or herself, thereby confirming the students' achievements and providing the learner with more information on how to approach a next module. It might also be useful to show the learners different paths to follow in a course in order to give them a sense of control (Tsai & Tsai 2003).

The study is subject to certain limitations. The first limitation is the response rate of on average 60% for the socio-demographic and evaluation questions. Learners who were positive about the course and the navigation advice may have been more likely to respond to the evaluation questionnaire than those who were less positive. Hence, the sample from which the data are reported may not be representative. Second, the questions were asked retrospectively after the course and only cross-sectional. Therefore, conclusions about causal relationships cannot be made. It remains, for example, unclear whether perceiving the tool as very useful precedes adherence or that adherence precedes usefulness. Third, adherence is measured subjectively, on the whole course, after course completion and with only one question. This might have negatively affected the reliability of the measurement as adherence may have varied between modules and might have been difficult to remember after the course. Further experimentation will help to address these shortcomings.

In summary, the study provides important insights into distance learners' subjective evaluation of working with a navigation tool. It shows that more than half of the learners in the experimental group adhered to the advice and held the opinion that the advice stimulated to proceed with the course. Learners expressed a strong need to know the mechanisms behind the advice, and

meeting this need is seen as an essential element in future versions of the tool.

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