

Running Head: THE SURPLUS VALUE OF AN AUTHENTIC LEARNING
ENVIRONMENT

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The surplus value of an authentic learning environment
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Abstract

This article presents a study that provides insight in the effects of an authentic electronic learning environment on student performances and experiences. It is expected that learning in an authentic learning environment results in more active and deep learning and improves intrinsic motivation of students. The results of this study showed, contrary to what was expected, that student who worked in an authentic environment did not perform better than students who worked in a less authentic environment. Moreover, the experiences with the learning environment did not differ between both groups.

The surplus value of an authentic learning environment

An authentic learning environment is a context that reflects the way knowledge and skills will be used in real life. This includes a physical or virtual environment that resembles the real world with real-world complexity and limitations and provides options and possibilities that are also present in real life (Herrington & Oliver, 2000). An authentic learning environment is not the same as an authentic task, which is a task that resembles a task performed in a non-educational setting that requires students to apply a broad range of knowledge and skills (Roth, 1995). Authentic environments provide a realistic context to a (authentic) task (Herrington and Oliver, 2000). The function of both an authentic learning environment and an authentic task is to show students relevance and stimulate them to develop competencies that are relevant for their future (professional) lives. The focus of this article is not on the authenticity of the task, but on the authenticity of the learning environment, although both are of course interlaced.

Electronic applications are often used for implementing authentic learning environments, because technology provides a whole range of options for creating a more realistic simulation of the real world. The problem is that authentic (electronic) learning environments are developed all over the world, the development is time and money consuming, while the actual effects of these kinds of programs on student learning and experiences are relatively unknown. The purpose of this study was to examine the effects of an authentic electronic learning environment on student learning and student experiences with the learning environment.

This article will start with describing what authentic learning environments are and why it is expected that they have a positive effect on student learning and experience. The use of technology is discussed in the next section and the importance of taking student

experiences into account when designing effective authentic learning environments is described in the last section of this introduction.

The reason for developing authentic learning environments

During the last decade, the emphasis in education changed from focusing on the memorization of knowledge, to the development of an integrative whole of knowledge, skills and attitudes. In other words, students need to develop competencies (Stoof, Martens, Van Merriënboer & Bastiaens, 2002). Students need to be able to handle problems that they could be confronted with in their future working life. This is an argument that is supported by complaints that companies often express about students. Companies often argue that students know a lot of ‘facts’, but are not ‘competent’ (Bastiaens & Martens, 2000). In other words, they are not trained to solve real working problems. On the other hand, at schools and universities students often complain that they cannot see the relevance of a certain subject. They often experience learning and assessment tasks as trivial and as focusing almost entirely on factual knowledge (Birenbaum & Dochy, 1996). It seems like the kind of learning that occurs in school does not fit with what companies call ‘competent’ employees.

Authentic learning is thought to have an answer to these complaints. Learning authentically means that students should be stimulated to develop relevant competencies by being confronted with learning experiences that simulate their real life or future professional practice (Herrington & Oliver, 2000; Honebein, Duffy, & Fishman, 1993). Providing authentic learning experiences can involve the development of authentic tasks as well as authentic learning environments. While a lot of educational developers and researchers started arguing for the development of authentic tasks that reflect the way knowledge will be used in real-life (Herrington & Oliver, 2000; Nicaise, Gibney, & Crane, 2000), Brown, Collins and Duguid (1989) and the Vanderbilt Cognition and Technology Group (1992; 1996) stated that in order to provide students with meaningful learning experiences, the realistic learning

environment should be taken into account. This idea was based on the cognitive apprenticeship movement and the theory of situated cognition. Cognitive apprenticeship argues that students learn best when they are placed in a realistic (working) setting with knowledgeable others (Brown, Collins, & Duguid, 1989). Situated cognition argues that knowledge is a part of the environment and thinking lies in the relationship between the individual and his environment (Roth, 1995). According to both situated cognition as cognitive apprenticeship, investigating decontextualized learning processes is irrelevant. These theories stress that it is important to investigate what learning environments evoke in students, because it is not the task that is most important, the fact that the task is anchored in a meaningful and realistic context is crucial for effective learning. Petraglia (1998), Uhlenbeck (2002) and Wiggins (1993) argue for both designing authentic tasks and authentic learning environments. Petraglia even argues that it is almost impossible to provide students with an authentic task, without providing a realistic learning context. Honebein, Duffy and Fishman (1993) argue that an authentic task without an authentic context does not create a fair picture of the real world. As a result, students would develop a different kind of understanding than when they were confronted with both an authentic task and context. This study examines the effects of learning in an environment with a lot of authentic elements, while leaving the authentic task unchanged.

Authentic learning environments are expected to result in cognitive as well as motivational benefits for students. Newmann and Wehlage (1993) argue that when students are confronted with real life learning experiences and with environments that simulate real world problems, with their complexity and limitations, students are stimulated to more higher order thinking processes and active learning. These environments stimulate students to develop knowledge, but also skills and attitudes that are required to effectively apply the

knowledge to new problem situations (Birenbaum & Dochy, 1996; Herrington & Herrington, 1998).

Besides the cognitive benefits, it is also expected that authentic learning environments result in motivational benefits for students. Huang (2002) argues for two important principles that describe adults' motivation to learn. The first principle is that adults prefer a problem solving orientation in learning. In particular, adults express that they learn best when the problem is presented in a real life context. The second principle is that adults are highly motivated to learn when they can gain new knowledge in such a way that this new knowledge helps them to solve important problems in their professional lives. Authentic learning environments have this connection to reality that seems to be so important for the motivation to learn (Herrington & Oliver, 2000; Newmann & Wehlage, 1993). Altogether, the motivational effect of authentic environments is that these contexts make it easier for students to identify themselves with the learning material and make learning more interesting and meaningful.

Authentic tasks and multimedia

Information Communication Technology (ICT), and especially multimedia, is often used to support the design of authentic learning environments (Herrington & Herrington, 1998; Means & Olsen, 1994). Multimedia means that a program makes use of verbal, auditory and illustrative information sources that are closely related to each other (Naijar, 2001). Research on multimedia has already shown that learning with multimedia can be effective (Naijar, 2001; Sherry, 1996). When designing authentic contexts, instructional designers can draw on multimedia to simulate a real world environment and create electronic environments for experimentation, so that student can carry out authentic tasks like real workers would. Moreover, multimedia creates possibilities for implementing new ideas about important learning activities like discovery learning and active exploration that are important in learning

authentically. For example, multimedia makes it possible for students to explore new fields, meet people and use a variety of tools to gather information and solve problems. Via technology an integrated and interactive context can be created to help students comprehend new ideas more easily. A problem with creating a realistic learning environment (virtually or real) is that the development of these environments is time and money consuming, while the actual effects on student learning and experience are still mostly based on expectations (Nicaise, Gibney, & Crane, 2000). Most studies that studied implementations of authentic environments were done in a high school context and were mostly descriptive of processes teachers used to develop the classroom environment, learning activities or resources (Newmann & Wehlage, 1993; Perkins & Blythe, 1994; Stepien & Gallagher, 1993). Research that attempts to understand the influence of environments with a lot of realistic or authentic elements on students learning and motivation in different levels of education needs to be accomplished. Simulating authenticity in an electronic learning environment makes it easier to examine the effects of these authenticity interventions on student learning and motivation. The kind of motivation that is of interest here is the intrinsic motivation of students, which measures if students are doing an activity for the inherent satisfaction of the activity itself. Research has shown that intrinsically motivated students show more behaviour that can be described as explorative, self-regulated, aimed at deep level processing, and aimed at exploration and reflection (e.g., Ryan & Deci, 2000). Authentic learning environments are expected to stimulate these kinds of learning behavior and therefore intrinsic motivation is measured in this study.

Student experiences of authenticity

Relying on student experiences of the learning environment is important, because it cannot be assumed automatically that an environment that is designed by educational developers as an authentic environment is also experienced as authentic by students. Honebein, Duffy and

Fishman (1993) argue that authenticity is a subjective concept and for cognitive or motivational benefits to arise, students at least have to perceive the environment as authentic. Huang (2002) and Petraglia (1998) mention the process of ‘pre-authentication’ in this context. This means that designers develop authentic learning environments according to what they think is authentic, without taking students opinions about authenticity into account. It can be questioned what the relevance is of an authentic learning environment that is perceived as authentic in the eyes of teachers, but not in the eyes of students. Therefore, this study examines if students do indeed perceive an environment that is designed to be authentic as more authentic than an environment that eliminates a lot of the authenticity creating elements.

The research questions of this study are twofold. The first question is if learning in an authentic learning environment influences student performance. The hypothesis is that learning in the authentic environment leads to better learning performances than learning in a non-authentic environment. The second question is if learning in an authentic environment influences student experiences with the learning environment. More specifically, the interest is in the intrinsic motivation of students and the experience of reality as a result of the learning environment they worked in. The hypothesis is that the authentic learning environment will result in more intrinsic motivation and an experience of more connection to reality, simply because the authentic environment is a more realistic simulation of reality.

Method

Participants

Participants were 34 higher education students, 20 students studying psychology at the University of Maastricht and 14 students studying technology at the Institute of Higher Education in Heerlen. All students were approximately 20 years old and the male-female ratio was 1:1. Participants were randomly assigned to one of the two conditions.

Materials

The learning environment Buiten Dienst. Buiten Dienst (BD) is an electronic program that is designed at the Open University of the Netherlands. This program is designed to be an authentic learning environment and makes use of a lot of multimedia to improve the realistic value of the simulation. The student is placed in the role of a junior advisor of a consultancy agency that is given the assignment to write a report about why there is so much absence through illness in a bus company and what can be done about it. No limitations with respect to the length of this report are provided. This assignment is an authentic task. The original BD program consisted of 16 steps, but because students in this experiment could only work with the program for two and a half hours, three steps were selected and used. These steps were: interview with the different virtual employees, work floor research on the bus, and the reflection report. The authenticity of the learning environment BD can be described according to guidelines for authentic environments (Herrington & Oliver, 2000). The *authentic context* is created by simulating a consultancy agency in a virtual way with a lot of multimedia (visual, aural, and written information). The environments contains for example real (virtual) employees of the bus company who answer questions aurally, a personal workspace for the student with a computer on which emails and reports can be received and a secretary. The authentic context is also characterized by the availability of relevant as well as irrelevant information, because this is a crucial aspect of real life (Herrington & Oliver, 2000). By providing a lot of choice options, relevant as well as irrelevant information, and the use of multimedia, the authentic context became relatively complex. Complexity of the context is also inherent to a realistic simulation of the real world (Honebien, Duffy, & Fishman, 1993; Uhlenbeck, 2002). The *authentic activities* are the activities that the student can undertake in order to find answers to the problem. Students can talk to different employees, they can observe a bus driver while he is doing his job and they can read articles from the archive.

Moreover, students are free to decide how to handle the problem. The *authentic assessment* of the program is that students have to write a reflection report about their findings on their computer in their personal workspace. Students can go back and forth between to report and the other elements of the program. Because students can ask the same questions to different people and can examine objective information in reports or articles *multiple roles and perspectives* are provided in the learning environment. *Reflection* is stimulated by a note-taking book that is integrated in the learning environment and allows students to take notes of all the information they here or see. Students can constantly look back on their notes. Furthermore, students sometimes receive emails on their personal computer that stimulate them to think something more through. Finally, students can ask questions to a senior advisor whose answers often stimulate reflection. *Articulation of knowledge* is stimulated by the note-taking book, but mostly by the fact that students have to write a reflection report about their findings. A senior advisor fulfills a *coaching and scaffolding* function concerning the content of the assignment and the secretary of the consultancy agency can be consulted about process information of the learning environment.

The non-authentic condition was also an electronic program, but left out most of the authenticity elements of BD, while keeping the content and the assignment the same as in the authentic condition. The non-authentic learning environment was implemented as a website, designed in FrontPage. This version was a non-realistic simulation of a consultancy firm and contained no multimedia, all the information was only provided in a written form, less context information, and no senior or secretary. As a result the non-authentic condition contained less irrelevant information and was less complex than the authentic condition. Furthermore, the assessment was no integrated part of the learning environment. Students had to write their reflection report in a separate word processing program (Microsoft Word). Reflection and articulation are less stimulated because the non-authentic did not contain a note-taking book

or a coach who stimulated reflection or the articulation of knowledge. The non-authentic condition was based on the three steps of BD that were used in this study, but the names of these steps were, contrary to the authentic learning environment, not explicitly mentioned to students, because the names of these steps could create a more authentic context. The starting page of both the authentic and the non-authentic condition are shown in Figure 1 and 2.

****Insert Figure 1****

****Insert Figure 2****

Performance test. The reflection report that students had to write as the third step of the program was used as a performance test. Writing this reflection report was the original assessment of BD. No limitations with respect to this report were provided. In the authentic condition, this report was an integrated part of the program. In the non-authentic condition, the report had to be written in Microsoft Word. The reflection reports were judged on three measurements. First, the amount of content statements was scored. Second, the total amount of words was counted and finally, the ‘quality’ of the reports was estimated based on the amount of correct content statements that they contained, controlled for the total amount of words that students used to write the report. The content statements were based on the relevant content information available in BD for solving the problem. Examples of content statements were “bus drivers experience a high workload” and “the manager is completely unsympathetic”. The reports were scored by two independent raters with an interrater reliability of .95.

Multiple-choice test. The multiple-choice test was developed as a quantitative measurement of the learning performance, with every item containing four answer options. The questions of the multiple-choice test were based on the relevant content of the two steps of both versions of BD. After item-analysis a scale of seven items was rated sufficiently reliable, $\alpha = .57$.

Experience survey. The experience questionnaire that was used in this study was originally designed at the Open University to examine the experience of students who work in an authentic electronic learning environment. The questionnaire consists of 25 Likert-type items, created around six scales that examine different aspects of authentic learning. Table 1 presents the reliability coefficients of the six scales.

****Insert Table 1 about here****

For the non-authentic condition, the questionnaire was adapted to this learning environment, such that the questions were comparable to the original questions that were asked in the condition that used the authentic learning environment.

Results

Performance measures

The descriptive statistics of the amount of content statements, the total number of words and the multiple-choice test of both conditions are shown in Table 2.

****Insert Table 2 about here****

The results showed that students in the non-authentic condition used more content statements, $F(1, 32) = 14.45, p < .01$ and more words to write their reports, $F(1, 32) = 26.77, p < .01$. The analysis of the amount of content statements, with the total number of words as a covariate, was not significant. In fact both groups scored almost identical. This means that what participants wrote in the reports did not seem to differ qualitatively between the conditions, while the length of the reports and the number of correct content statements did differ. The results of the multiple-choice test showed that students in both conditions did not differ significantly from one another.

Experiences

The results on the experience survey showed that there were no significant differences between the authentic and the non-authentic condition on any of the subscales of the

experience questionnaire (see Table 3). It was hypothesized that an authentic environment would have a positive effect on the experiences of students, especially on the experience of connection to reality and student motivation. However, it turned out that this hypothesis was not confirmed either. Students did not experience the authentic program as more authentic than the non-authentic version.

****Insert Table 3****

Conclusion and discussion

This study examined the effects of an authentic learning environment on student performances and experiences. The two conditions used in this study were: (1) the authentic condition (the original authentic learning environment), and (2) the non-authentic condition (learning environment without the authentic elements). The results of the performance tests showed that learning in an authentic learning environment did not improve, or even worsen, student performance on the reflection report. Moreover, the results on the experience survey showed that students experienced both conditions as identical. These findings create serious doubts about the surplus value of an authentic learning environment.

The absolute measurements of total number of words and amount of content statements were used because they reveal information about the efficiency of learning in both conditions. These results showed that students in the non-authentic condition produced quantitatively more in the same time on task. There are two possible explanations for these findings. Firstly, students in the non-authentic condition were less distracted because this condition contained less irrelevant information and less multimedia effects. As a result, students could devote more time to finding out relevant information for the report. Students in the authentic condition were confronted with much more choice options and a lot to see and hear because of all the multimedia that was used. It is likely that students in the authentic

condition experienced more distraction as a result of a lot of the implemented authenticity elements. On the other hand, it is possible that when students were given more time on task, the differences between both conditions would disappear. However, even if this is the case, it can still be questioned if learning in an authentic environment is the most efficient way of learning. Secondly, students in the non-authentic condition had to write their reports in a standard word processing program, while students in the authentic condition had to write their report as an integrated part of BD. It is possible that the standard word processing program stimulated the production of more words and longer texts. On the other hand, it could also be argued that the integrated assessment in the authentic condition fitted better with the authentic task, and as a result would stimulate better performance. Future research should examine the effects of authentic (electronic) learning environments on student performance in other and longer programs in order to examine if a non-authentic condition indeed results in more efficient learning. Also research about the influence of a real authentic learning environment compared to a simulated, electronic authentic learning environment can add additional information to the effects and efficiency of authenticity elements of the learning environment on student learning and experiences.

Students in both conditions did not differ in their amount of content statements when this was controlled for the amount of words, which can be treated as an indication of quality. The most likely explanation for this finding is that the task was identical for both conditions. This task was authentic, because it was a task that students could be confronted with in real professional practice. This is a strong argument for the idea that an authentic task and an authentic context are two different things that can have different impacts on student learning. Brown, Collins and Duguid (1989) strongly argue for the importance of taking the context in which students learn into account when designing learning environments and Huang (2002) even states that adult learners learn best when a real life problem is presented in a real life

context. Petraglia (1998) and Uhlenbeck (2002) also stress the importance of the distinction between an authentic task and an authentic environment. They argue that in order to stimulate students to develop relevant competencies that they need in their future professional lives, an authentic task as well as an authentic context is required. However, the quality measure of this study did not show any additional impact of an authentic learning environment with a lot of multimedia. Besides the result that students in the authentic condition did not perform better than students in the non-authentic condition, there was also no difference in the experiences of both learning environments. Contrary to what was hypothesized, the authentic learning environment with a lot of multimedia did not motivate students more than the non-authentic environment. Cronin (1993) states that educators have the misguided belief that the learning environments they provide must be big and glamorous in order to be authentic and to motivate students. Instead, providing low-key experiences that directly connect to the lives of students would suit them better. Nicaise, Gibney and Crane (2000) investigated the effects of an authentic task on student experiences. This task was implemented in a classroom with no specific attention to the authentic context. Reactions of students were mostly positive. They stated that the task showed them real professional practice and motivated them to put in more effort. These findings in combination with the results of this study argue for the conclusion that the authenticity of the task has more impact on students than the authenticity of the environment. However, empirical evidence for the actual effects of an authentic task on student performances is scarce (Nicaise, Gibney, & Crane, 2000; Perkins & Blythe, 1994). Future research should examine the effects of an authentic task and an authentic learning environment on student learning and experience separately. Moreover, the results show that it is crucial to take student experiences into account, because if students do not perceive the environment as more authentic, as was the case in this study, the environment does not influence their performance or experience.

In conclusion, based on the findings of this study, the surplus value of an authentic learning environment is far from confirmed. Students in the non-authentic condition performed at least equally well as students in the authentic condition, and based on the absolute performance scores, they even performed better. Furthermore, the authentic learning environment did not result in more motivation. Based on these results, the question if it is worth spending a lot of money and devoting a lot of time and energy on the development of authentic learning environments, has become even more pressing since the results seriously question the efficiency of many of the multimedial add-ons that are all too often found in 'modern' learning environments.

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Table 1

The Reliability of the Subscales of the Experience Survey

Variables	Reliability (alpha)	Number of items within the subscale
Perceived authenticity of the learning environment	.65	3
Extend of confusion regarding the learning environment	.85	4
Experienced support in the learning environment	.74	3
Extend of explorative behavior of the learner	.91	6
Extend to which the learning environment was innovative	.75	4
Experienced motivation	.78	5

Note. Alpha level for reliability was set $\alpha = .55$

Table 2

Descriptive Statistics of the Three Performance Measures of the Authentic and the Non-Authentic condition

	Authentic		Non-Authentic	
	<i>n</i> =17		<i>n</i> =17	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Score on the MC-test	2.18	1.33	2.94	1.88
Number of content statement	14.12	3.44	20.88	6.48
Number of words	422.65	156.83	951.71	391.37

Table 3

Descriptive Statistics of the Scores on the Scales of the Experience Survey for the Authentic and the Non-Authentic Condition

	Authentic		Non-authentic	
	<i>n</i> = 17		<i>n</i> = 17	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Authentic experience	14.29	2.11	13.59	2.23
Motivation	16.11	3.60	16.47	3.10
Innovation	14.88	3.21	13.11	2.23
Confusion	10.76	3.21	9.67	3.17
Support	10.47	2.48	10.47	2.40
Exploration	22.94	4.11	21.47	4.12

Figure Captions

Figure 1. The authentic learning environment

Figure 2. The non-authentic learning environment



Figure 1.

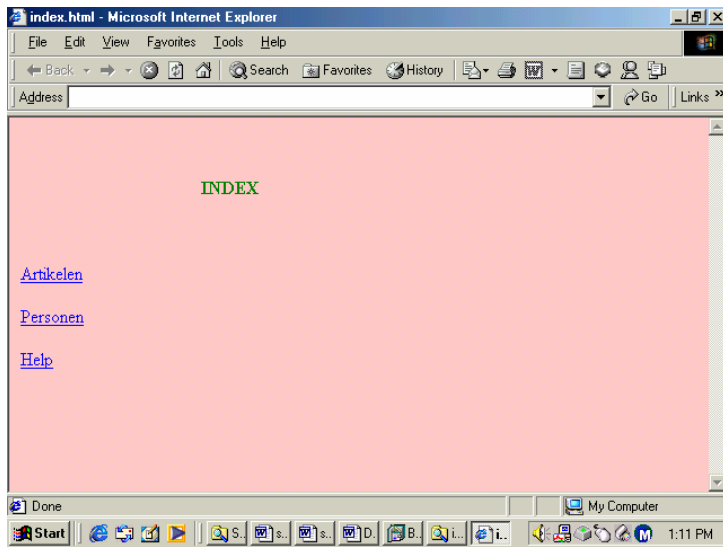


Figure 2.