The surplus value of an authentic learning environment

Judith T.M. Gulikers *, Theo J. Bastiaens, Rob L. Martens

Educational Technology Expertise Center, Open University of the Netherlands, P.O. Box 2960, Valkenburgerweg 177, 6401 DL Heerlen, The Netherlands

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Abstract

This article presents a study that provides insight in the effects of an authentic electronic learning environment on student performance and experiences. It is expected that learning in an authentic learning environment results in higher performance 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 reported experiences with the learning environments did not differ between both groups.

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1. The surplus value of an authentic learning environment

An authentic learning environment provides 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
An authentic learning environment is not the same as an authentic task, which is a learning task that resembles a task performed in a non-educational setting and that requires students to apply a broad range of knowledge and skills (Roth, 1995). Authentic environments provide a realistic context to an authentic task (Herrington & 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 or daily 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 interlaced.

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

This article will start with describing what authentic learning environments are and why they are expected to have a positive effect on student learning. 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.

1.1. 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 Merriënoer, & Bastiaens, 2002). Students need to be able to handle problems that they will be confronted with in their future working life. This is an argument that is supported by complaints that companies often express about students they hire as new employees. 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 as if the kind of learning that occurs in school does not fit with what companies call ‘competent’ employees.

Authentic learning is thought to provide 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. 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 (e.g., Herrington & Oliver, 2000; Nicaise, Gibney, & Crane, 2000). In addition to this viewpoint, (Brown, Collins, & Duguid, 1989) and the Cognition and Technology Group at Vanderbilt (1992, 1994) 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 et al., 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 and 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 for effective learning, but the task being anchored in a meaningful and realistic context. 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 et al. (1993) argue that an authentic task without an authentic context does not create a fair picture of the real world. As a result, students working on an authentic task in a non-authentic context would develop another kind of understanding than students confronted with an authentic task in an authentic 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 students who are confronted with real life learning experiences and with environments that simulate real world problems, with their complexity and limitations, are stimulated to apply higher order thinking processes and active learning strategies. Thus, authentic learning environments stimulate students to develop not only knowledge but also skills and attitudes, which are all required for effective performance in new problem situations (Birenbaum & Dochy, 1996; Herrington & Herrington, 1998).

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 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.
1.2. Authentic tasks and multimedia

Information and Communication Technology (ICT) and, especially, multimedia are often used to support the design of authentic learning environments (Herrington & Herrington, 1998; Means & Olsen, 1994). Multimedia means that an electronic environment 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, the use of multimedia creates possibilities for implementing new ideas about important learning activities like discovery learning and active exploration, which are important in authentic learning. For example, multimedia applications make it possible for students to explore new fields, to meet people, and to 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 either virtual or real authentic learning environments is, however, that the development of these environments is very time and money consuming, while the actual effects on student learning and their experiences are mostly based on expectations instead of empirical findings (Nicaise et al., 2000). The few research projects that studied implementations of authentic environments were conducted in a high school context and described the processes teachers used to develop classroom environments, learning activities and/or learning 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 at different educational levels yet needs to be accomplished. Simulating authenticity in an electronic learning environment makes it easier to examine the effects of authenticity on student learning and their intrinsic motivation, which indicates if they are doing an activity for the inherent satisfaction of the activity itself. Intrinsically motivated students show more behavior that can be described as explorative, self-regulated, reflective, and aimed at deep level processing (e.g., Ryan & Deci, 2000). Intrinsic motivation is measured in this study because authentic learning environments are expected to stimulate exactly these kinds of learning behavior.

1.3. Student experiences of authenticity

Relying on student experiences of the learning environment is important, because it cannot be automatically assumed that an environment that is designed by educational developers as an authentic environment is also experienced as authentic by students. Honebein et al. (1993) argue that authenticity is a subjective concept and for cognitive and 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 higher test performance 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 work in. The hypothesis is that the authentic learning environment will result in higher intrinsic motivation and an experience of increased connection to reality, simply because the authentic environment is a more realistic simulation of reality.

2. Methods

2.1. Participants

Participants were 34 higher education students in The Netherlands; 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.

2.2. Materials

The learning environment ‘Buiten Dienst’. Buiten Dienst (Dutch for ‘Out of Service’) is an electronic learning environment designed at the Open University of the Netherlands. It is an authentic learning environment that makes use of a lot of multimedia features to improve the realistic nature of the simulation. The student is placed in the role of a junior advisor of a consultancy agency who is given the authentic task to write a report about the causes for the high sick-rate in a bus company and what can be done about it. No limitations with respect to the length of this report are provided. Originally, Buiten Dienst consisted of 16 phases, of which three phases were selected and used for this study. These phases were: (1) holding interviews with the different virtual employees, (2) conducting work floor research in the bus, and (3) writing the final report.

The authenticity of Buiten Dienst can be described according to the guidelines for authentic environments formulated by Herrington and Oliver (2000). An authentic context is created by simulating a consultancy agency in a virtual way with a lot of multimedia features combining visual, aural, and written information.
The environment contains, for example, virtual employees of the bus company who answer questions aurally, a personal workspace for the student with a computer on which e-mails and reports can be sent and received, and a secretary who can assist with administrative issues. 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 high level of learner control, presenting relevant as well as irrelevant information, and using multimedia, the authentic context became relatively complex. Complexity of the context is also inherent to a realistic simulation of the real world (Honebein et al., 1993; Uhlenbeck, 2002).

The authentic activities are the activities that students can undertake in order to find solutions to the problem. Students can talk to different employees, observe a bus driver while he is doing his job, and read articles from the archive. Moreover, students are free to decide how to handle the problem. The authentic assessment used in the environment is that students have to write a final report about their findings on the computer in their personal workspace. Students can go back and forth between writing the report and the other activities in the environment. Because students can ask the same questions to different people and can examine ‘objective’ information in different 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 hear or see. Students can constantly refer back to their notes. Furthermore, they sometimes receive e-mails on their personal computer that stimulate them to think something through. Articulation of knowledge is stimulated by the note-taking book, but mostly by the fact that students have to write a final report about their findings. A senior advisor fulfills a coaching and scaffolding function concerning the content of the task, and the secretary of the consultancy agency can be consulted about administrative issues with regard to performing the task.

The non-authentic condition was also an electronic learning environment, but it left out most of the authentic elements of Buiten Dienst, while keeping the content and the task 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 provided in a written form only, there was less context information, and there was no senior advisor 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 not an integrated part of the learning environment. Students had to write their final report in a separate word processing program (Microsoft Word). Reflection and articulation were less stimulated because the non-authentic condition did not contain a note-taking book or a coach who stimulated reflection or the articulation of knowledge. In contrast to the authentic environment, the names of the three phases in the whole task were not explicitly mentioned to students in the non-authentic environment, because this was expected to create a more authentic context. The starting page of both the authentic and the non-authentic condition are shown in Figs. 1 and 2.
2.2.1. Performance test

The final report that students had to write was used as a performance test. Writing this report was the original assessment of Buiten Dienst. No limitations with respect to this report were provided. In the authentic condition, writing the report was an integrated part of the learning environment because it had to be done in the student’s personal workspace. In the non-authentic condition, the report had to be written in Microsoft Word. The final reports were judged on the amount of meaningful content statements. The acceptable content statements were based on the relevant content information available in Buiten Dienst 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 inter-rater reliability of 0.95. In order to be able to control the amount of content statements for the length of the report, the total amount of words was counted for each report.

2.2.2. Multiple-choice test

The multiple-choice test was developed as a quantitative measurement of the acquired factual knowledge, with every item containing four answer options. The questions of the multiple-choice test were based on the relevant content of the former two
phases of both versions of Buiten Dienst. After item-analysis a scale of seven items was rated sufficiently reliable, $\alpha = 0.57$.

2.2.3. Experience questionnaire

The questionnaire was originally developed at the Open University of the Netherlands 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 of the subscales of the experience questionnaire.

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Reliability</th>
<th>Number of items within the subscale</th>
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</thead>
<tbody>
<tr>
<td>Perceived authenticity of the learning environment</td>
<td>0.65</td>
<td>3</td>
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<tr>
<td>Experienced motivation</td>
<td>0.78</td>
<td>5</td>
</tr>
<tr>
<td>Extend to which the learning environment is perceived as innovative</td>
<td>0.75</td>
<td>4</td>
</tr>
<tr>
<td>Extend of confusion regarding the learning environment</td>
<td>0.85</td>
<td>4</td>
</tr>
<tr>
<td>Experienced support in the learning environment</td>
<td>0.74</td>
<td>3</td>
</tr>
<tr>
<td>Extend of explorative behavior of the learner</td>
<td>0.91</td>
<td>6</td>
</tr>
</tbody>
</table>

*Note. $\alpha$ level for reliability was set at 0.55.*

Fig. 2. The non-authentic learning environment.
sents the reliability coefficients of the six scales. For the non-authentic condition, the questionnaire was slightly adapted to this learning environment by formulating the questions in such a way that they made sense for this environment.

3. Results

3.1. Performance measures

The means and standard deviations for the amount of content statements, the total number of words, and the scores on the multiple-choice test of both conditions are shown in Table 2.

ANOVA showed that students in the non-authentic condition used more content statements in their reports ($M = 20.88$, $SD = 6.48$) than students in the authentic condition ($M = 14.12$, $SD = 3.44$), $F(1, 32) = 14.45$, $MSE = 26.92$, $p < 0.01$. The students in the non-authentic condition also used more words for their report ($M = 952$, $SD = 391$) than the students in the authentic condition ($M = 423$, $SD = 157$); however, this number of words is strongly correlated with the amount of content statements, $r = 0.87$, $p < 0.01$. An ANCOVA on the amount of content statements, with the total number of words as covariate, did not yield a significant difference between the non-authentic condition (estimated mean = 17.49) and the authentic condition (estimated mean = 17.50), ($F(1, 31) = 0.00$, $MSE = 12.76$, ns). This means that what participants wrote in the reports did not seem to differ qualitatively between the conditions, while

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Means and standard deviations of the measures for the authentic and the non-authentic condition</th>
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<tbody>
<tr>
<td></td>
<td>Authentic ($n = 17$)</td>
</tr>
<tr>
<td></td>
<td>$M$</td>
</tr>
<tr>
<td>Number of content statements</td>
<td>14.12</td>
</tr>
<tr>
<td>Number of words</td>
<td>422.65</td>
</tr>
<tr>
<td>Score on the MC-test</td>
<td>2.18</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Table 3</th>
<th>Means and standard deviations on the scales of the experience questionnaire for the authentic and the non-authentic condition</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Authentic ($n = 17$)</td>
</tr>
<tr>
<td></td>
<td>$M$</td>
</tr>
<tr>
<td>Authentic experience</td>
<td>14.29</td>
</tr>
<tr>
<td>Motivation</td>
<td>16.11</td>
</tr>
<tr>
<td>Innovation</td>
<td>14.88</td>
</tr>
<tr>
<td>Confusion</td>
<td>10.76</td>
</tr>
<tr>
<td>Support</td>
<td>10.47</td>
</tr>
<tr>
<td>Exploration</td>
<td>22.94</td>
</tr>
</tbody>
</table>
the length of the reports and the number of correct content statements did differ. The 
results on the multiple-choice test showed that the acquired factual knowledge of stu-
dents in the authentic condition ($M = 2.18$, $SD = 1.33$) did not differ significantly from 
students in the non-authentic condition ($M = 2.94$, $SD = 1.88$).

3.2. Experiences

There were no significant differences between the authentic and the non-authentic 
condition on any of the six subscales of the experience questionnaire (see Table 3).

4. Conclusion and discussion

This study examined the effects of an authentic learning environment on student 
performance, acquired knowledge, and experiences. The two conditions used in this 
study were: (1) the authentic condition (i.e., the original authentic learning environ-
moment Buiten Dienst), and (2) the non-authentic condition (i.e., Buiten Dienst without 
the authentic elements). The results of the performance test showed that the authen-
tic learning environment did not improve, but might have even deteriorated, student 
performance on the final report. Moreover, the results on the experience question-
naire showed that students experienced both conditions as identical. These findings 
create serious doubts about the surplus value of an authentic learning environment.

Students in the non-authentic condition produced, in the same time on task, more 
content statements than students in the authentic condition. There are two possible 
explanations for this finding. Firstly, students in the non-authentic condition could 
have been less distracted because this condition contained less irrelevant information 
and less multimedia features. As a result, students could devote more time to finding 
out relevant information for the report, and thus produced more content statements 
and longer reports. Students in the authentic condition were confronted with much 
more choice options and a lot to see and hear because of all the multimedia features 
that were used. Because they were distracted during learning, they produced less con-
tent statements and shorter reports. Possibly, this difference between both conditions 
would disappear if students were given more time to perform the task. However, 
even if this would be the case, it can still be questioned if learning in an authentic 
environment is the most efficient way of learning.

As a second explanation, it could be that students in the non-authentic condition 
wrote longer reports than students in the authentic condition because they had to 
write their reports in a standard word processing program, which might have stim-
ulated the production of more words and longer texts. The higher amount of content 
statements could then be the result of the higher number of words, and the difference 
between conditions in the number of content statements indeed disappears if it is 
controlled for the length of the texts. Future research should investigate the validity 
of both explanations. First, other and longer programs should be used, and students 
should be given more time to learn, in order to examine if a non-authentic condition 
indeed results in more efficient learning. And second, identical conditions for testing
performance should be applied. Research about the influence of a real authentic learning environment compared to a simulated, electronic authentic learning environment can also yield additional information regarding the effects and efficiency of authentic elements of the learning environment on student learning.

Summarizing, no evidence was found at all for the expected superiority of the authentic learning environment. The most likely explanation for this finding is that the learning 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, which can have different impacts on student learning. Brown et al. (1989) strongly argue for the importance of taking the context in which students learn into account when designing learning environments. 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 they need in their future professional lives, an authentic task as well as an authentic context is required. However, this study did not show any additional impact of an authentic learning environment with a lot of multimedia features.

With regard to student experiences, there was also no difference between the learning environments. Contrary to our hypothesis, the authentic learning environment with a lot of multimedia features did not motivate students more than the non-authentic environment. Cronin (1993) states that educators have the misguided belief that learning environments must be big and glamorous in order to be authentic and to motivate students. Instead, low-key experiences that directly connect to the lives of students would suit them better. Nicaise et al. (2000) investigated the effects of an authentic task on student experiences. Whereas the task was implemented in a classroom and without 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. In combination with the results of our study, these findings argue for the conclusion that the authenticity of the task has more impact on students than the authenticity of the environment. Future research should make a clear distinction between the effects on student learning of an authentic task (e.g., Nicaise et al., 2000; Perkins & Blythe, 1994), an authentic learning environment, or the combination of both. Moreover, the results of this study show that it is crucial to take student experiences into account. If students do not perceive the environment as more authentic, as was the case in this study, it is very unlikely that it will positively influence their performance.

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. Furthermore, the authentic learning environment did not result in higher 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. At least, our results seriously question the
effectiveness and efficiency of many of the multimedia features and add-ons that are all too often found in ‘modern’ electronic learning environments.

References


