

Lurking: An Underestimated Human–Computer Phenomenon

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E-learning, or online learning, is a fact of academic life today. Whether it's only those students actively participating in a virtual environment who achieve learning is, however, a matter of some debate. In general, according to educational technology professor Diana Laurillard,¹ e-learning outcomes could be greatly improved if higher-education teachers achieved three goals:

- developed better ways of searching for information;
- shared ideas and resources among learners; and
- improved, and practiced, communication techniques.

Searching and sharing are often well supported by typical learning management systems. On the other hand, communication is still

underestimated. Communication techniques are important because although learning is an active cognitive process on the part of learners, it's also a social process and develops through conversation.²⁻⁵ A special type of conversation is the online variety, which takes place via public message posting and represents one way in which an online group can benefit from the knowledge of its members. However, many group members lurk—that is, they don't take an active part in online conversation. Lurkers nevertheless perhaps make up the majority of a given discussion list's members, comparable to the nonactive participants of a normal discussion.

Much research has been conducted on Internet communities⁶ concerning the active, visible online learners. Less has been reported about the hidden participants—the lurkers. Some have argued that learning, even in this seemingly passive mode, occurs nonetheless.⁷

Consequently, we decided in 2001 to initiate a case study on both active and passive learners. Our case study was supported by the Graz University of Technology's e-learning project, Interactive Visualizations in Civil Engineering (iVISiCE).⁸ We designed our case study on the basis of what is known about interaction and learning, and on earlier research on lurking (see the "Previous Work" sidebar). For this case study, we conducted three experiments. We evaluated the passive participation in online discussion forums and proved that lurking can be considered a natural process of human communities.

Case study

In November 2001, we founded the iVISiCE project to investigate the possibilities of Internet use in higher education. As part of that project, we developed the case study and a so-called blended learning scenario. The scenario is called

Editor's Note

In this article, Ebner and Holzinger offer their perspective about online learning. In general, we know that online learning develops through interaction and that it's a collaborative process where students actively engage in writing and reading messages among themselves and with the instructor. However, it's also well known that in any online community, not all users are equally active, and there are indeed people who never take an active part—the so-called *lurkers*.

This article focuses on the lurkers; the authors ran extensive experiments to demonstrate whether there's a relationship between the writing and reading behavior of online students and whether active participation influences learning efficiency. An interesting related result that emerged from the study is that the effort of the instructor in terms of reading and writing posts is higher than that of the learners themselves!

—Tiziana Catarci

Previous Work

Earlier research has been done to investigate the relationship between interaction and learning. The following work amplifies our examinations to the phenomenon of lurking.

Interaction and learning

Research on traditional classroom settings has shown that increased interaction improves student achievement.¹ Constructivist psychologist Lev Vygotsky (<http://www.marxists.org/archive/vygotsky>) emphasized the role of interaction in learning, which can be summarized in three sentences:²

- The learners' achievement level depends on what they already know (previous knowledge).
- The mechanism that delivers learning is interaction.
- The goal of all learning is autonomy, aiming for independent problem solving.

The key interaction concept is based on Vygotsky's theory of the zone of proximal development (ZPD), which is the site where learning occurs. This zone is defined as the distance between the actual developmental level, as determined by independent problem solving, and the level of potential development, as determined through problem solving under adult guidance or in collaboration with more capable peers.¹

As a result of this concept, educators now view learning as a collaborative process that entails dividing large numbers of students into groups smaller than 10, providing specific tasks, and setting deadlines to help learners actively engage in collaborative work. The fundamental idea underlying such group work is that students meaningfully interact through a variety of learning activities such as student- or teacher-led discussion groups, debates, projects, and collaborative learning groups and, ultimately, achieve better learning outcomes.³

However, it's commonly known that interactive modalities such as newsgroups, chats, and so on have facilitated the con-

nectivity between students and teacher, between students, and between student and content. As a result, attention to online interaction has gained increasing interest for research in teaching and learning processes at a distance.⁴

Lurking

Lurking is widespread in nearly every online discussion group. Lurkers are generally learners who are bystanders to discussions about course content. Lurkers generally lack commitment to the rest of their class community and receive benefits without giving anything back.

A good example of lurker behavior is the study of Blair Nonnecke and Jenny Preece.⁵ They conducted an experiment involving 77 online health support groups and 21 online technical support groups. They determined that 46 percent of the health support group members and 82 percent of the technical support group members were lurkers. In this study the authors showed, that lurking is a normal process in public discussion lists. Whether this phenomenon is similar within a closed online course should be answered by this work.

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blended learning because it combines traditional classroom learning with online learning. The project stands on three pillars:

- interaction,
- visualization, and
- communication.

Our case study, and the focus of this article, dealt with the interaction component. Interaction⁹ is an important social element of effective

learning. Interactions can occur between learner and learner (known as collaborative learning) and between learner and instructor (known as computer-mediated communication, or CMC). Consequently, we tracked both types of interaction to examine the relationship between the interactivity and the students' learning process.

Experiment design

To determine if voluntary participation in virtual classes improves learning outcomes, we conducted a study that focused on virtual interaction specifically in the field of civil engineering. We

Table 1. Summary of student characteristics.

Question	Average
1. Concerning my computer knowledge, I am a ... (Beginner = 1; Expert = 5)	3.07
2. Concerning my Internet knowledge, I am a ... (Beginner = 1; Expert = 5)	3.08
3. How long have you been using the Internet? (... years)	5.14
4. How many hours do you spend using the Internet in a typical week? (... hours)	6.88
5. I have used the Internet for learning before this course. (yes/no)	87% (yes) 13% (no)
6. I am very enthusiastic about the possibilities of the Internet (yes = 1, no = 5)	2.4

focused on the lurkers—those students who never took an active role in online classes. The classes dealt with the subject of structural concrete, which happens to be the largest component in Graz University of Technology’s graduate-level civil engineering program.

We structured the case study on a blended lecture that consisted of both classroom and online work over a four-month period. The lecture’s subject was structural concrete—the design and construction of reinforced or prestressed concrete structures using the European Standard Norm, or EC2.

Data collection

The primary aim of our experiments was to quantify student responses in online forums and to understand how much online communication and online work assists each student’s learning process.

The lecture was conducted from November to February every year, and we studied student participation in its online portion for three years, or a total of 12 months altogether. We collected data for three research questions for the academic years 2001–2002, 2002–2003, and 2003–2004.

To pass their finals, students must pass four examinations—three written and one oral—at the end of each study year, with intervals of approximately three weeks between each exam. For the online communication, one discussion forum concerning the expertise to be learned by the students was offered for each mid-examination period. We tracked all postings that were relevant and correlated the postings with students’ grades.

Characteristics of the students

In 2003 and 2004, we examined the students’ characteristics, much as we did in 2001 and 2002. Table 1 shows the questions we asked the students, together with the average results.

The age range for students was from 21 to 30. The average age was approximately 22 years. About 15 percent of the course participants were female.

This data, along with the number, gender, and previous knowledge of the participants, is consistent with similar evaluations we conducted in previous years. The lack of significant diversification in the student population reflects the long-standing profile of civil engineering students.

Research question 1

Our first research question was: Does a higher level of online interactivity lead to a better learning result?

In 2001–2002 and 2002–2003, we counted all relevant—that is, concerning the content of the lecture—contributions. During the first year, 110 students participated; 102 students participated during the second year, and 128 students during the third year. About 30 percent took an active part in the online communication offered during the first and second year and more than 30 percent during the third year. Considering the voluntary nature of the participation, this was a high attendance. This means that in 2001–2002, 39—and in 2002–2003, 30—students posted at least one fundamental statement for the online community to the discussion forum. While researching the behavior of the online community, we developed the following hypothesis:

A higher level of online interactivity leads to a better learning result.

For this first hypothesis, we defined the *interactivity level* as the number of relevant forum postings. We measured the learning result by the grade the student received at the end of the four-month class.

Figure 1 shows the relationship between the discussion group postings and the students’ grades on a scale ranging from 1 to 5 (1 = very good, and 5 = fail). We applied the Spearman-Rho Test—a standard statistical test, which compares two data sets and measures their correlation—to our data (see Table 2). The statistical significance for 2001–2002 is shown by $p = 0.047$, and for 2002–2003, $p = 0.163$. The data

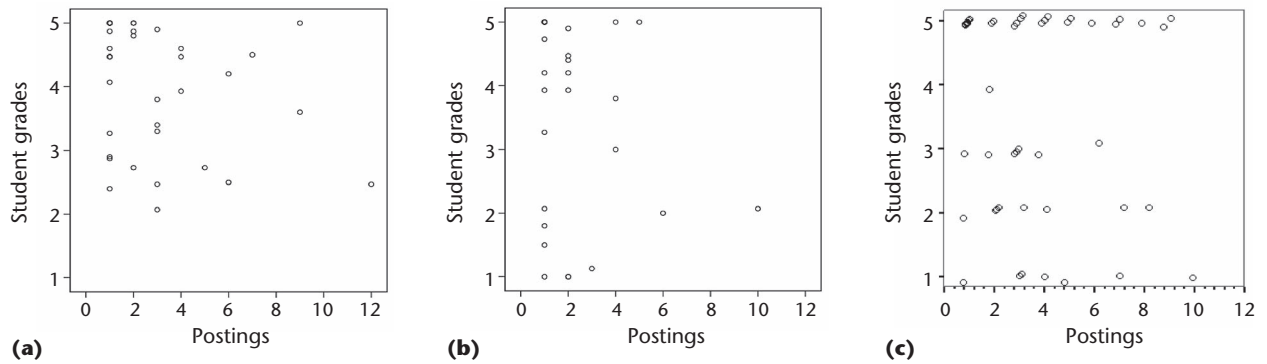


Figure 1. Posting activity in relationship to earned grades for (a) the academic year 2001–2002, (b) academic year 2002–2003, and (c) academic year 2003–2004.

correlation is significant if p is less than 0.05. We can see therefore that no relationship exists between interactivity and learning results.

Research question 2

Our second research question was: Does a learner who writes [posts] more contributions than a lurker automatically read more postings than a comparable lurking learner?

Concerning the result of research hypothesis 1, it was obvious that the online activity of each student was insufficient to account for the learning results. After rethinking this process, we decided to also track the so-called lurking population. This meant that, beyond tracking visible, posted messages, we would also track hidden interactions, such as reading someone else's posted contribution.

In 2003–2004, 128 students participated. Of these, 49 took an active part in the online communication. Consequently, to confirm the results of research question 1, we again determined the relationship between students' visible interactions and their grades (see Table 2). Row 3 in Table 2 shows the significance of the probability value, $p = 0.879$. Also, Figure 1 shows that no relationship exists between writing contributions and learning results. This means that the first research hypothesis has been confirmed.

In observing the discussion group activity by students, we found that 49 learners took an active part in the online discussion and that every one of the 128 students read at least one contribution. We can, therefore, state that 79 (almost two-thirds, or 62 percent, of the class) of the participants were lurking—only reading posts, not contributing anything.

The high lurking rate spurred us to state, and

Table 2. Weak correlation between students' postings and their grades.

Year	Students in Class	N (Students Posting)	Correlation Coefficient	p Significance
2001–2002	110	39	–0.321	0.047
2002–2003	102	30	–0.261	0.163
2003–2004	128	49	–0.022	0.879

Table 3. Relationship between the number of students reading posts and the number of students writing them.

Year	N Students Reading	Students Posting	Correlation Coefficient	p Significance
2003–2004	128	49	–0.040	0.654

research, the following, second hypothesis:

A learner who writes [posts] a contribution automatically reads more postings than a comparable lurking learner.

In other words, an active learner is also actively acquiring information. It should be clear that the members of the lurking population aren't as busy as their writing colleagues.

Table 3 shows the significance of probability value $p = 0.654$. This confirms that no relationship exists between the writing and reading behavior of an online student. Figure 2 (next page) demonstrates explicitly that there's no trend visible.

Research question 3

Ultimately, we needed to look not only at the learners and their learning processes but also at the lecturers' behavior. Our third research question was: How extensive is their effort in such an

Figure 2. The graph shows that there's no relationship between the number of students reading posts and the number of students writing them.

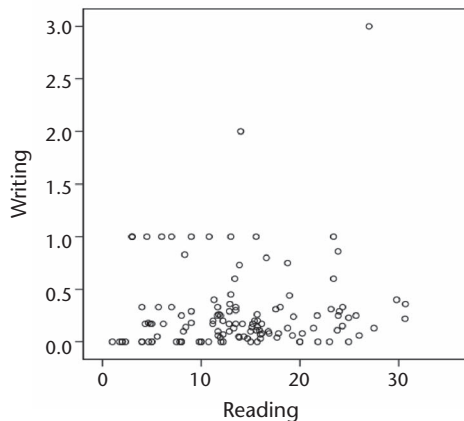


Table 4. Comparison of lecturer and student activity.

Type of Participant	Writing Log-Ins per Lecturer	Reading Log-Ins per Student
Lecturer	1.170	20.781
Student	0.298	13.576

e-learning scenario? This question prompted our third hypothesis:

The effort of the advisors for such an online course, represented by the writing and reading of postings, is higher than that of the learners.

Table 4 shows the data we collected. We counted each reading and writing activity of the lecturers and the students and compared them to the number of online discussion group log-ins.

Study group opinions

With the help of an online and a traditional evaluation, we discovered what the learners themselves feel about the use of discussion forums during their learning process. Of course, we can include here only a subset of the 25 total statements, followed by the number of students who agreed with the statement.

- "I lost track, because the numbers of postings increase very fast." (7 students)
- "Horrible Mess in the discussion forum—there have to be more topics/trees."(5 students)
- "Discussion forum can't replace a real office hour." (3 students)

- "I can save time, because I do not need to go to the university for each question." (4 students)

- "It is now possible to get an answer on the weekend to a short question during my learning process within a very short time. This supports me a lot." (8 students)

Obviously, some students like working with online discussion forums. But despite a student's individual preference for (or against) such a venue, all students lurked at some point while logged in to the forum. This leads to an interesting future research question: How can we improve the discussion forums to support the students' natural impulse for acquiring information?

Discussion

Does active interaction lead to greater in-depth learning? Is there a difference in learning efficiency between lurkers and active participants? In answering these questions, we've shown that visible participation does not constitute the majority of a virtual community. Furthermore, we've learned that the lurking student, who doesn't actively participate in the discussion lists, is at least as active as his or her writing colleague with regard to reading the postings. The situation is comparable with traditional teaching in the classroom; there, too, we find both active and passive students. Additionally, we recognized that although the participation in a supplementary online information exchange is voluntary; nearly all students who attended the lecture portion also took part in the online forum.

One salient characteristic of the online discussion community has emerged, namely that every participant of the online community, active or lurking, reads more postings than they write. As a result, we developed a simple equation:

$$\frac{R(t)}{p} - \frac{W(t)}{p} \geq 0$$

In the equation, $R(t)$ = the sum of postings read by a participant within a observation period; $W(t)$ = the sum of postings written by a participant within a given observation period; and p = the quantity of participation.

This equation shows that within a certain time period, each member of an online community will read more postings than they write. This is the beginning of the lurking process; activity tends to decrease while passive partici-

pation remains at its previous level or increases.

Research question 3 pointed out the new role of the online teacher. The traditional role of the lecturer is expanded from the face-to-face classroom model, in which students are typically more passive, to a model in which students take a more active role and lecturers behave more like tutors.

A tutoring model is still a rare role for traditional German-speaking lecturers. Successful e-learning needs lecturers who are willing to take a constructivistic approach—that is, adopting a more cooperational and interactive style with students rather than teaching in the old-style “drill and practice” methods.

The average student population was 113 participants per year (comparable studies do not assess such a high number of students)⁷ and the experiments took place in a lecture (as opposed to laboratory) setting. We believe that our experiences can also be applied to other technical studies with similar student populations.

Conclusion

A higher degree of visible interactions is not a precondition for higher learning efficiency. We have to expand the term interactivity to include the lurking activity.

With a simple equation, we demonstrated that the active participation in an online discussion list, based on passive lurking, is expressed by reading and reflecting on the contribution of all the other members.

Although some students are less visible than others, this is not necessarily an indication that the learning benefits are being compromised. According to psychologist John Dewey, a critical element of the teaching process is to create conditions for productive inquiry. A discussion forum—an online medium for successful lurking and learning—can provide those conditions. **MM**

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