THE COMPLEXITY IN ADOPTING
NEW TECHNOLOGICAL PROGRAMS IN EDUCATION

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Abstract: The Complexity in Adopting New Technological Programs in Education. The internet has become an increasingly important feature of the learning environment. For Indonesian university students, access to the Internet has been provided in many campuses, including the Economics Faculty of the State University of Malang. As the installation of Internet infrastructures in this Faculty is relatively new, it is interesting to investigate how and why students use such a new technology. This exploratory study refers to the notion of Activity Theory developed by Engeström. The primary intention is discussion of tensions as contradictions in an activity system. The findings indicate that the participants' attempts to use the Internet in the Faculty were constrained by factors beyond participants' control. Using Activity Theory, this study has identified some contradictions that exist within the system.

Abstrak: **Kompleksitas dalam Menggunakan Teknologi Baru dalam Pendidikan**. Internet telah menjadi bagian penting dalam lingkungan pembelajaran. Bagi mahasiswa di Indonesia, akses terhadap internet telah disediakan di berbagai kampus, termasuk di Fakultas Ekonomi Universitas Negeri Malang. Berhubung instalasi infrastruktur internet di fakultas ini masih relatif baru, maka akan sangat menarik untuk meneliti mengapa dan bagaimana mahasiswa menggunakan internet di fakultas. Penelitian ini termasuk penelitian eksploratif yang menggunakan Teori Aktivitas (Activity Theory) rancangan Engestrom (1987) sebagai landasan teori. Fokus dari pembahasan berkisar pada "kontradiksi" yang terjadi dalam sistem aktivitas. Hasil penelitian menunjukkan bahwa usaha responden untuk menggunakan teknologi (Internet) terhalangi oleh faktor-faktor di luar kontrol responden. Dengan menggunakan Teori Aktivitas, penelitian ini telah mengidentifikasi beberapa kontradiksi yang muncul dalam sistem penggunaan internet.

Keywords: internet usage, activity theory, communication

Information and Communication Technology (ICT) has long been indicated as a crucial element of both professional accountancy and accounting education, resulting in the introduction of mandatory ICT elements into undergraduate syllabi (Marriott, Marriott, & Selwyn, 2004). However, as Albrect and Sack (2000) have noted, many accounting educators have still not understood how ICT, such as the Internet, can be potentially used as a real educational technology when it is integrated into meaningful educational practices.

In the USA, the 2002 Pew Internet and American Life Project (Jones, 2002) reported that college students were intense users of the Internet. About 86% of college students in the U.S. had gone online, compared with 59% of the general population. They made significant use of the Internet in their academic lives, as an educational tool "to communicate with professors and classmates, to do research, and to access library materials", which "has greatly changed the way they interact with others and with information as they go about their studies" (Jones, 2002:2).

In Indonesia, more recent statistics from the Internet World Statistics reported that as of May 2008, the number of Internet users in the country had reached about 25 million, which is still low in proportion (10.5%), considering a total population of 237 million (InternetWorldStats, 2008). In Australia, on the other hand, the Internet penetration has reached 74.3% of the total population (InternetWorldStats, 2008). Like many other countries with developing ICT infrastructure, such as Peru and India, the majority of Indonesian Internet users gain access through Internet cafes that offer Internet access to the public on a pay-per-use basis (Wahid, Fu-

ruholt, & Kristiansen, 2006). The acceleration of ICT infrastructure in recent years has triggered many universities in Indonesia to build their own Internet infrastructure designed to provide free Internet access to students as a way to improve learning spaces associated with their courses.

The Economics Faculty of the State University of Malang is among those which have put an emphasis on the development of the Internet on campus. This Faculty began to provide an open and free Internet access program to students in September 2007. It is expected that students will be willing and able to benefit from the Internet facilities in the Faculty. However, whether or not undergraduate accounting students use the Internet facilities provided by the Faculty has not been studied. Drawing on the premise originating from Activity Theory (Arievitch, 2007) that the mere act of providing access to the Internet on campus may not automatically result in substantial student Internet use and ensure students are utilizing the Internet to enhance their learning. Therefore, the purpose of this study is to examine how and why undergraduate accounting students use the Internet in the Faculty. This study will focus on the following question: "What practices explain undergraduate accounting students' use of the Internet facilities provided by the Faculty?"

METHOD

The survey method was used for the study. Questionnaire was the only data collection instrument. A detailed questionnaire, based on the objectives of the study, supplemented with the explanatory statement, was administered to undergraduate accounting students at the State University of Malang who were willing to participate in the study. The questions consist of mostly closed questions and ranking questions. An optional "comments" section was provided at the end of the questionnaire to obtain qualitative data. This approach allowed each respondent to make additional comments and clarify their responses. 150 students were willing to participate. They were then asked to complete the questionnaire. No name or other identifying information was collected and this had been made clear in the accompanying explanatory statement.

The data obtained in this study were presented in the form of frequency distribution. In discussing the implication of this study and to better understand the result of this study, the findings were conceptualized using the theoretical framework of Activity Theory (Engeström, 1987, 1999).

Table 1 presents a summary of the research analysis, aligning the steps of analysis with the tool/framework needed.

FINDINGS AND DISCUSSION

Of the 150 questionnaires sent out, a total of 119 usable questionnaires were returned, while 31 questionnaire were not returned. The response rate of this survey was quite high, 79.3%, making the analysis more reliable for the selected distribution group. The data show that the number of female participants was higher than male participants, with females comprising 75.6% and males 24.4% of responses. In terms of age, most of the participants were aged 18-20 years (74.8%), followed by 21-22 years (21.8%), with only 3.4% aged 23-24 years, with the average age 20.12 years. Also, in terms of undergraduate level, 71.4% of participants were in the second year of their study, while the rest of the participants were in third year (17.6%), fourth year (9.2%) and first year (1.7%).

The results also show that all students who responded to the questionnaire (119) indicated they were aware of computers and the Internet. More than 70% participants said they had a computer at home and had frequent access to the Internet. However, only a few (14.3%) reported that they had Internet access at home.

Participants were also asked to indicate for how long they had been using the Internet and the various Internet resources they owned. All participants claimed to have experience on the Internet, with the majority with 1-5 years (72.3%) of experience. The results also show that e-mail was the most well-known application the participants owned (98.3%), followed by social networking sites (67.8%), weblog (22%), mailing list (13.6%), and websites (3.4%).

How the Students Use the Internet in the Faculty

Several questions were used to understand how students used the Internet in the Faculty. These included frequency of use, duration per session, tools, participation, assistance, and purpose to use the Internet.

A number of students reported that they never used the Internet in the Faculty. But the percentage of the students who utilized the Internet (94.1%) was much higher than the percentage of those (5.9%) who never used the Internet. To some extent, this finding supports the contention of Arievitch (2007) and Schofield (2006) that Internet access on campus may not automatically result in students' Internet use.

Table 1. Research Analysis

Research Analysis	Research tool/framework
1. Describing the current use of the Internet in the Faculty	SPSS, descriptive output
2. Identifying the contradictions	Activity Theory
3. Constructing solutions/recommendation	General analysis using the Activity Theory framework

Of the students who made use of the Internet, results indicated that in average they used the Internet in the Faculty a few times a month and they mostly spent 15 minutes to 60 minutes each session to access the Internet. Also, they reported the use of public computers as the main tool to get connection to the Internet. These public computers, on the other hand, have not fulfilled their current expectation in terms of number and quality. As expressed in the questions about barriers to effective Internet use, and in additional comments, most students shared the same opinion that public computers connected to the Internet in the Faculty need to be increased in number and upgraded. Additionally, those who owned laptop computers also tend to use public-access computers. As identified by 21.4% of the participants, they access the Internet in the Faculty both from their own laptop and from public-access computers. Thus, the ratio of public computers per students was higher. Therefore, from these data, the technical factors in designing new technology in an educational context might have affected students' Internet use as argued in many research studies (Luambano & Nawae, 2004; Madhusudhan, 2007; Younis, 2002).

From this study, there is an indication that students' backgrounds of Internet usage affect the way they access the Internet in the Faculty. Most students appeared to be confident to use the Internet in the Faculty without the assistance of technician/staff. As other data revealed, 53.6% of the participants accessed the Internet together with their friends and 37.6% had assistance from friends. This could suggest a strong peer learning in this Faculty.

The purposes for Internet use outlined by the students in this study are closely related to the purpose of the study. The uses of the Internet can be roughly divided into two categories, firstly for academic purposes and secondly for entertainment purposes. The results of this data align with other studies (e.g. Fortson, Scotti, Chen, Malone, & Ben, 2007; Jones, 2002) which reported the use of the Internet mainly for academic purposes. Almost 50% of students' time in this Faculty was used for seeking information, 10.4% was used to communicate with others by email, while 4.0% was used to participate in discussion groups. This data may suggest

that because the Internet is still perceived as a high cost infrastructure in the Indonesian context, students rarely use it for entertainment purposes. However, just as indicated in the literature about Internet usage among university students (e.g. Luambano & Nawae, 2004), it can be identified that part of their time (38.2%) while using the Internet in the Faculty was used for downloading, updating blogs and checking social networking sites.

The overall perceptions of the students towards the Internet in the Faculty concurs with previous findings (e.g. Jones, 2002) that university students do support the installation of the Internet on campus. The students' comments also showed they believed that access to the Internet in the Faculty is crucial. In summary, students believed the Internet in the Faculty was desirable, but changes were needed, particularly in technical design and assistance, as showed by the fact that the majority of the students (68.2%) prefer to use the Internet outside the Faculty's network.

Coming to Understand the Use of the Internet in the Faculty: Mapping the Elements of Activity System

The prresentation of the data has provided a sense of patterns of Internet usage in the Faculty. However, looking at all these patterns is not adequate in structuring empirical evidence when dealing with the diversity of the data. We need to focus on which aspects of the phenomena under investigation are more important and how these aspects are related to each other (Kaptelinin & Nardi, 2006). In this light, Activity Theory suggests the concept of contradictions as an important aspect to analyse. As contradictions may exist within and among elements or components of an activity system (Engeström, 1987), we need to recognize the elements of the activity system under investigation to provide a holistic view of the system.

In this study, we can view an organization-the Economics Faculty of the State University of Malang-as an activity system which is framed within Activity Theory. This activity system comprises undergraduate accounting students as the key actors under
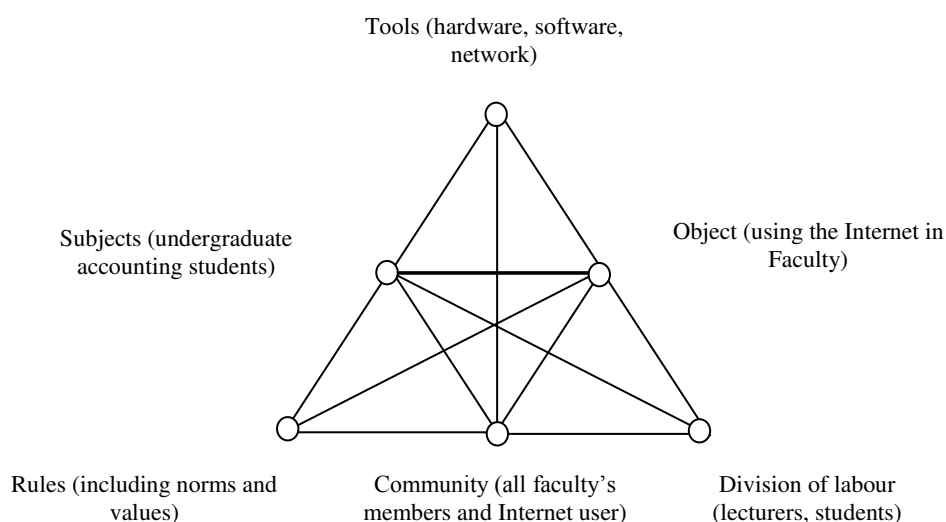
investigation or the *subjects*. The *object* in this study is the focus of activity: using the Internet in the Faculty. In order to reach the object, students are utilizing major tools such as hardware (public computer in the Faculty, their own laptop), software and wifi 'hotspot' connections. These tools have an important function as mediators of subjects' action upon the object (Russell, 2002). The tools that students in this activity system utilized and the ways students used them varied, as we can see in their responses about 'pattern of Internet usage'. Rules regulate actions and interactions within the system (Kuutti, 1996). Although rules largely assume the need to be explicitly stated with the new tool (Russell, 2002), in this activity system, however, the rules are implicit. They include norms and values to use the Internet facilities appropriately. The subjects are becoming part of a *community* who share the same object within an activity system. In this study, the community involves all members of the Faculty: students, staff, and lecturers. The community might also include outsiders who use the Internet in the economics Faculty. Moreover, this activity system also has a *division of labour* that shapes the way the subjects act on the objects. Lecturers and other Faculty staff (who support students' use of the Internet in the Faculty) and students (who access the Internet in the Faculty) are the labour of this activity system.

The relations of subject and object as mediated by the components that constitute the Faculty of Economics of the State University of Malang as an activity system can be seen in Figure 1.

Contradictions

After identifying each element within an activity system, it is time to realize the breakdowns between what the activity system looks like and what it should look like. For this purpose, the concept of contradictions is used. Based on the data, most participants have used the Internet in the Faculty, though, a number of them reported they never make use of it. At first glance, this seemed to be the fault of the students. Perhaps, those who never used the Internet in the Faculty found it uninteresting or unhelpful. Meanwhile, those who utilized the Internet in the Faculty reported that a significant time of their Internet usage were used for entertainment purposes. Perhaps, they were unwilling/unaware to take advantage of the Internet as a potential support for education. Using Activity Theory, however, we can map the contradictions within and among elements in an activity system with a more useful analysis of the problem to guide future efforts. What follows is a discussion of contradictions within the activity system of the use of the Internet in the Economics Faculty of the State University of Malang.

From the data in this study, it is evident that the first primary contradiction characterizing the use of the Internet in the Faculty is the available technology-hardware, software, and the network (the tool). This contradiction occurs because of the lack of alignment between the Faculty's expectation to provide appropriate technological infrastructure for effective learning, and the current realities of technology available at the Faculty. At this moment, the bandwidth capability

Tools (hardware, software, network)

Subjects (undergraduate accounting students)

Object (using the Internet in Faculty)

Rules (including norms and values)

Community (all faculty's members and Internet user)

Division of labour (lecturers, students)

Figure 1. The Relations Among Elements in Activity System

in the Faculty is only 256 kbps, causing a very slow access speed and has been ranked by the participants of this study as the top barrier to effective Internet use. Moreover, the number of public computers connected to the Internet in this Faculty is only 3, serving thousand students in the Faculty. This contradiction may lead to further problems such as students' reluctance to utilize the Internet in the Faculty. They prefer to access the Internet from other places out of the Faculty's network, particularly in a commercial Internet café. Unlike Internet access on campus, Internet cafés usually provide a better connection, without undue restrictions on what they use it for and for how long they will use it. By comparison, at the Faculty, although there are no explicit rules to restrict students' Internet usage, typically, students have access to public computers for limited periods of time. They may have to negotiate to take turns with their peers. As a result, students' use of the Internet in the Faculty is partly for entertainment purposes which takes less time to use the Internet in the Faculty. Checking messages/comments in social networking sites, for example, is more possible to do in a short time rather than searching for and compiling materials for studies. In spite of these technical inadequancies, almost all of the students supported the free Internet access program in the Faculty.

The second contradiction exists between elements of the activity system. Although most students appeared to be confident users of the Internet, some of them identified their lack of skill as affecting their Internet usage in the Faculty. The difficulty the students were experiencing in using the Internet in the Faculty can be seen as a contradiction between students' skill (*subject*) and the support system (*division of labor*). Although the implementation of an Internet access program in this Faculty is supported through various means such as offering free access, installing hotspot connection and providing public computers regardless of their inadequacies, some students found the guidelines/training support of how to use the Internet in the Faculty was insufficient. Yet, the contradiction the students faced in this regard may lead them to ask for help from their peers. To some extent, this might explain why most of the participants reported their preference to co-access the Internet with their friends.

Another contradiction arise between *Tools* and *Rules* since the Internet-as a new tool-is introduced into a community without any rules of practice to make effective use of this tool. From the survey, it was noticeable that one student suggested the need for a user password to connect to the Faculty's network. This was due to the fact that both students in

this Faculty and outsiders can get Faculty Internet access. As the current bandwidth was limited to 256kbps, the more that outsiders and Faculty members are likely to be on the system at the same time, the slower the speed of the Internet connection will be. Athough this issue was raised by one student, it is of particular importance that the Faculty sets a rule to limit the Faculty's Internet use to the members of the Faculty only. In relation to the issue of setting rules, two participants' comments indicated the need of filter to block inappropriate resource such as pornography. There is no denying that the Internet comes with unstructured resources which can be a dangerous place for students. Sometimes commercial pornography advertising impinges on learning resources. Filters that block access to certain resources can be used to minimize any potential harm that might come to students (Schofield, 2006). However, undergraduate accounting students aged 18+ in this Faculty should have the power to ignore the disturbing resources that came to them. It might be better to provide training on how to evaluate resources over the Internet rather than try to impose rules that would raise some potentially difficult issues (Schofield, 2006).

The next contradiction is due to different motives to use the Internet. Eventhough not officially stated, the motive to use the Internet in the Faculty is basically to enhance learning. However, as students approach the Internet in the Faculty with different understanding and different motives, as I found out when they responded to one question about 'purpose for Internet use' indicated, a contradiction emerged. It can be seen from the data, part of students' time while accessing the Internet in the Faculty was used for updating social networking sites, blogging, downloading software/music and playing games. For many older users of the Internet, such as lecturers or the Faculty's policy maker who have been encultured to concentrate on one thing at a time (Somekh, 2007), multi-tasking is generally considered as less 'academic' and unacceptable. Yet, students claimed that their current Internet usage did support their study. In this case, there is no shared view between students and the Faculty/lecturers as to what constitutes learning with the Internet. An open vision toward the many activities that constitute learning may provide a useful addition to other available academic activities. For example, the process of seeking information concerning project assignment may require a certain degree of exploration over the Internet. There will be some programs that need to be downloaded; weblog or social networking sites which need to be updated, as an integral part of their learning. The consumption

and production of these digital activities may not appear within the context of traditional learning resources such as textbooks or printed journals. Therefore, it may not be difficult to argue that every activity the participants are engaged in over the Internet in the Faculty may relate to meaningful outcomes.

There was also a contradiction in the activity system but not perceived as such by the participants. Internet access in the Faculty has not been followed by any access to a quality source of information such as online journals and databases. Therefore, the available information was often less relevant to become research materials, while valuable resources were inaccessible. This might appear to be a contradictory situation, but as the participants viewed other factors to be of greater importance, this lack of quality information available to the students was not considered a contradiction. Alternatively, maybe this lack of access to peer reviewed journals is promoting a google knowledge culture amongst the students.

CONCLUSION

This study found that attempts to use the Internet in the Faculty were constrained by factors beyond participants' control. Firstly, technical problems such as low speed Internet and limited public access computers gave rise to a culture of resistance among students to access the Internet from the Faculty's network. Students preferred to use the Internet outside of the Faculty's network and they were resisting using it in the Faculty. Secondly, insufficient guidance and inexplicit rules on how to use the Internet in the Faculty also contributed to the student's Internet use. Despite the many weaknesses in elements of the system-tools, rules and support system-a pattern that clearly emerged from this research was that students supported the free Internet access program in the Faculty.

At this point, the technology factors were clearly more important than other factors such as pedagogy and quality of available information, as perceived by the participants. Several contradictions were also identified in this activity system. If not resolved, these contradictions may lead to complete breakdown. Some suggestions based on Activity Theory perspectives could address these contradictions. First of all, there should be an attempt at re-aligning each element of activity system such as subjects, tools, rules, division of labor, community andat motivating to direct the activity. However, despite the crucial importance of this alignment, the top priority at the moment must be the access to the technology itself. It is an important factor that delayed students' use of the technology, in turn, might delay the students' acceptance of the practical value of the Internet to enhance learning. Considering the fact that there are very few undergraduate students who own laptops, providing students with alternative access points through a list of places in the Faculty area with adequate public computers to access the Internet may be necessary.

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