

Experiences of on-campus students with asynchronous online collaborative learning

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Abstract

A study was conducted with 148 on-campus university students in 7 courses on relationships between student attitudes towards different varieties of learning, their satisfaction with and perceived learning from asynchronous online collaborative learning tasks in a blended course environment, which was aimed at facilitating deep level group discussion. A mix of methods was used to collect data about experiences of students with asynchronous online collaborative learning.

The results show that 54% of the students agreed with the statement that the asynchronous online collaborative course environment (AOCCE) could facilitate student learning (17.6% of the students did not agree; 28.4% neither agreed nor disagreed); 44% of the students agreed with the statement that they were satisfied with their learning (2.7% disagreed, 53.4% neither agreed nor disagreed).

A factor analysis revealed seven factors. Cronbach's Alpha scores range from .70 to .93.

Correlations of these factors with the attitude about e-learning, satisfaction with and perceived effects of the AOCCE vary between -.34 to .68.

The attitude towards e-learning, the satisfaction with the AOCCE and the perceived effects of the AOCCE are strongly correlated (varying from .73 to .82).

A first regression analysis with perceived effects of learning tasks in the AOCCE as dependent variable showed four factors that were significant: attitude towards e-learning (beta=.585), ease of use (beta=.301), self confidence (beta=.154) and attitude regarding F2F learning activities (beta=.147). The total $R^2=.701$ ($p=.000$).

A second regression analysis with student satisfaction with the AOCCE as dependent variable showed that again attitude towards e-learning (beta=.666), ease of use (beta=.279), and self confidence (beta=-.137) were significant. Also, student opinions about web-assisted learning

activities (beta=-.164) and previous experience with e-learning and AOCCE (.097) were significant. The total $R^2 = .749$, $P = .000$. The study has major implications for on-campus learner support in asynchronous online collaborative course environments.

Key words: e-learning, online learning, collaborative learning, asynchronous communication, knowledge construction, constructivism

1. Introduction

Learning theories about constructivism and knowledge construction influence the debate about designing education, supporting learning, and implementing instruction. The essence of constructivism as an overarching and heterogeneous perspective on learning is that students actively construct their own knowledge and meaning based on their experiences in social reality (Doolittle, 1999), or more general, that human knowledge is constructed and that students build new knowledge based on prior learning. As Kanselaar (2002) stated ‘...this view of learning sharply contrasts with one in which learning is the passive transmission of information from one individual to another, a view in which reception, not construction, is key.’ He also mentioned that constructivist learning is based on the active participation of students in problem solving and critical thinking regarding a learning activity that they find relevant and engaging. They are ‘constructing’ their own knowledge by testing ideas and approaches based on prior knowledge and experience, applying these in a new situation, and integrating new knowledge gained with pre-existing constructs. Constructivist learning should also embrace social negotiation (Vygotsky, 1962), mediation and active learning. Constructivism in general and social constructivism in particular emphasizes interaction. Based on this theory, learning environments should facilitate interaction and negotiation in learning processes. From this perspective, instruction should facilitate student-to-student as well as student-to-teacher interactions and provide students with opportunities to negotiate ideas, conduct inquiry and reflect their thoughts.

A major strength of collaborative learning (CL) is that it can enhance multi-perspective discussions about given information, analyses of problems, and elaborations and refinements to

reconstruct and co-construct knowledge (Veerman, 2000). Veldhuis-Diermanse (2002) defined collaborative learning as ‘...a learning situation in which participating learners exchange ideas, experiences and information to negotiate about knowledge in order to construct personal knowledge that serves as a basis for common understanding and a collective solution to a problem.’ Dillenbourg (1999) stated that ‘...collaborative learning describes a situation in which particular forms of interaction among people are expected to occur, which would trigger learning mechanisms, but there is no guarantee that the expected interactions will actually occur. Hence, a general concern is to develop ways to increase the probability that some types of interaction occur.’ Veldhuis-Diermanse (2002) contended that collaborative learning stimulates student learning while it affords students to criticize their own contributions and those of peers, to invite peers to explain their contributions, to express other opinions and reasons for that. Additionally, in a collaborative learning setting students can motivate and help each other to finish learning tasks. In their meta-analysis, Qin, Johnson and Johnson (1995) found that 87% of the studies they included in their analysis, cooperation and collaboration showed better learning results. Also based on another meta-analysis of the research in this field Van der Linden, et al, 2000) concluded that ‘...cognitive achievement of students working in this field is usually higher than of students who are learning in traditional, individual or competitive education programs.’ Furthermore, Bossert (1998) stated earlier that cooperation and collaboration can improve motivation, self-confidence and mutual relations in student groups.

Apart from social constructivism, the use of computer technology is also influencing educational practice to a large extent. Various researchers have combined the two as computer-based learning can also be effectively done in student teams. Several researchers believe that when the impact of technology (like ICT) in education is assessed, instructional and learning strategies should be studied in relationship with the use of computer technology, and attention

should be paid to the way in which teachers teach and students learn (Lowerican, 2006).

Thornburg (1999) emphasized that the question as to how technology is being used is far more important than the question regarding the use technology as such, and Clark (1994) pointed out that the method of teaching explains the value added of the technology used to a large extent.

Some researchers believe that having computer tools available is, by itself, not enough. Computer tools can only be effective learning instruments if they are embedded in an ‘appropriate pedagogy’ (Laurillard, 2002). However, advocates of the implementation of technology in education think that the introduction of interactive and dynamic computer applications (Shuell & Farber, 2001) can help educational innovation in the direction of constructivist student-centred learning, replacing former teacher-centred education (Jonassen & Reeves, 1996; Kent & McNergney, 1999).

The features of e-learning environments can stimulate and facilitate processes of knowledge construction in various ways. McCombs (2000) stated that computer technology can cater diverse student needs and capacities and affords greater student learning control. Online education by use of both asynchronous (such as email, threaded discussions) and synchronous (such as chat, video teleconferencing) communication facilitates this process.

Numerous studies have suggested that perceptions of learners of learning environments will guide their attitudes, behaviour and ways of knowledge construction in that environment (Dart et al., 1999; Fraser, 1998). Paris (2004) has stated that teachers have known for long that there is a positive relationship between student attitudes towards learning situations and their reactions to them, and that they (the teachers) have the ‘dynamic task’ to improve the curriculum and the teaching and learning process, to influence the attitudes of students in a positive way, and thus, influencing the learning results. Lowerison (2006) goes on in stipulating a positive relationship between student perceptions of education and educational effectiveness, more

specifically between the use of computer technology in a course and perceived course effectiveness.

Student attitudes toward the use of information and communication technology in education was the topic of several studies, and factors such as perceived added value, perceived usefulness, perception of learning, student characteristics, learning experiences, learning strategies, instructional techniques, actual computer use in the course, ease of use, student confidence or lack of confidence, and satisfaction were studied by researchers in the field (Anandarajan, Simmers & Igbaria, 1998; Collis & Pals, 2000; Shuell & Farber, 2001; Laurillard, 2002; Dewiyanti et al 2004; Wen, Tsai, Lin & Chuang, 2004; Cheung & Huang, 2005; Goodyear, Jones, Asensio, Hodgson & Steeples, 2005). On the other hand, Ma et al (2005) stated that, although attitude appeared to be a significant determinant of behavioural intention in various studies in social sciences, and that it also was a strong mediator for motivational variables which predict behavioural intention of computer technology use, recent studies have shown that the importance of attitude in behavioural intention to computer technology use is decreasing.

Nevertheless, it can be expected that the use of computer technology increases the effectiveness of learning and instruction as perceived by students, particularly when this use of computer technology stimulates active learning and reflection (Lambert & McCombs, 1998). Lowerison, Sclater, Schmid & Abrami (2006a), in a study in postsecondary education, found (counter-intuitively) no significant relationship between the use of computers in education and global course evaluations, nor between the effectiveness of computer use as perceived by students and general course evaluations. However, they did find positive relationships between the amount of computer technology used in postsecondary education courses, perceived effectiveness of students of the use of this technology, and general course evaluations. They reported that students indicated that they appreciated the use of computer technology for learning.

In a related study, Lowerison et al (2006b) also reported that perceived course effectiveness is related to the use of computer technology and active learning.

Asynchronous online discussion and collaboration is one of the e-learning functions and computer applications that facilitate processes of collaboration and learning. In asynchronous online discussion and collaboration in contrast to face-to-face discussion and collaboration, students are required to put their thoughts in writing. Theoretically this leads to more reflection on the subject and a deeper involvement in the particular subject. The results of these processes are permanently recorded in the environment. Students and teachers can access these products of discussion and articulation at any time (Wu & Hiltz, 2004). Wu & Hiltz (op cit) pointed at advantages of online bulletin boards, computer conferencing, and online discussion and collaboration platforms such as ‘convenience, place-independence, time-independence, and the potential for users to become part of a virtual community’ that may persuade teachers to include asynchronous discussion and collaboration in their online classes. They also reviewed studies of Phillips & Santoro (1989), Larkin-Hein (2001), Harasim (1990), and Althaus (1997). Phillips & Santoro (op cit), already years ago, regarded asynchronicity as the major benefit of computer mediated communication, and stressed the opportunity to rapidly transfer questions and answers, which seemed to facilitate participation. Larkin-Hein (op cit) claimed that ‘...the use of online discussion groups offers a relatively new avenue through which the learner can take an active role in the learning process.’ Harasim (op cit) showed that students perceived more learning in online interactions than in face-to-face classes. Althaus (op cit) stated that, ‘...in theory, online discussions help more students learn better by placing them in an intellectual environment that encourages active, thoughtful, and equal participation ...’ In another study, in secondary education, Kay (2006) found that students gain useful information from a discussion board and their participation in the discussion board was significantly positively correlated with their

learning achievement. Kay also mentioned that some students reporting relatively positive perceptions of online discussion use and concluded that more positive attitudes and higher ability, might lead to increased use of online discussion. Schellens & Valcke (2004) have studied collaborative learning in asynchronous discussion groups with 300 students in 38 electronic discussion groups. They found that students in this online environment are very task-oriented and that they show more instances of knowledge construction.

Based on this explorative research literature review, we conducted a study to better understand how an asynchronous online collaborative blended course environment and learning in that environment is perceived by groups of on-campus students in higher education. The specific questions addressed in this study were:

1. Are on-campus students satisfied with performing learning tasks in this asynchronous online collaborative course environment (AOCCE)?
2. Do on-campus students perceive any added value of performing learning tasks in an asynchronous online collaborative course environment (AOCCE)?
3. What factors influence student satisfaction with and perceived learning in this asynchronous online collaborative course environment (AOCCE)?

2. Materials and Methods /Methodology

2.1. Participants/Subjects

The subjects participated in this study included a total of 151 graduate and undergraduate students who enrolled in 7 courses over two study years at Wageningen University in the Netherlands. Table 1 shows the course titles and the number of participants in the courses. Except for the course ‘Applied environmental education and communication’, which was an intensive course, the participants met each other almost once a week over a period of 7-8 weeks. All courses required students to work in small groups and to submit a group product. To facilitate communication within groups, the courses used ‘Blackboard’ as an asynchronous online collaboration environment.

During the first class of the courses the objectives of the study were introduced to the students and they were invited to participate. All students were divided into small groups consisting of 4-6 persons and were asked to do 2-3 different online collaborative tasks over 5-8 weeks. Except of the course ‘Education in developing and changing societies’, participation in the online collaborative activities was part of their final mark. However, students were free to choose another task instead of online collaborative work if they were not able (for example because of RSI) or willing to participate in the study. At the end of each period (study periods typically last 8 weeks) students were requested to complete a questionnaire regarding their experiences with the online collaborative learning activities. A total of 148 students responded to the survey representing a 98.5% response rate.

Insert Table 1 about here

Since Wageningen University is a very international university, participants came from sixteen different countries, however, the majority of the students came from the Netherlands; 97% had access to a computer with a high-speed internet connection at home. They were all competent in working with computers and the internet and received specific instruction about asynchronous online collaborative learning tasks during the first week of each period. The language of all courses was English, which was the second language for 91% of the participants. However, most of them claimed they did not have problems in communicating in the English language. The students were enrolled in programs in the fields of environmental, animal, plant, food and social sciences.

The experience of the respondents with using the internet varies from 4 to 10 years and 84% of them had experienced an e-learning environment before the study. Whilst 37% of participants were involved in a general online forum for their own interest before the study, just 26% of them had experiences an online discussion and collaboration environment for learning purposes.

2.2 Instrument

An instrument was constructed which comprised four main sections and 74 items. The first section (6 items) assessed students' previous experiences with computers, internet, e-learning and online discussion and collaboration. The second section (11 items) captured students' preferences of online collaboration and modes of teaching and learning. The third section (26 items) collected information on students' learning approach and their preferences regarding pedagogical practices. The fourth and last section (31 items) assessed student

satisfaction with and perceived learning from performing the asynchronous online collaborative learning tasks in the course. All 57 items of sections three and four of the questionnaire used a five-point Likert scale (1=strongly disagree; 5=strongly agree). In section two students were asked to specify their preferences on a five point scale ranging from to what extent different ways of teaching and learning contribute to their learning (1=not at all; 5=very important).

The questionnaire was administered at the end of the course, using some open-ended questions at the end of the questionnaire. The students were asked to write their comments as to the online tasks of the course. The questionnaire was piloted to determine its reliability and validity.

Validity of the questionnaire has been improved by an expert consultation in the field and teachers in the university. In order to develop a valid and reliable instrument for the study, first several indicators and items were adopted from a previous study (Mahdizadeh, Mulder, Biemans, 2006), and literature and previous research in the field (Passig, & Levin, 2000; Spellman, 2000; Liaw, 2002; Williams & Pury, 2002; Race, 2003; Paris, 2004; Wu & Hiltz 2004; Chou & Liu, 2005; Goodyear, Jones, Asensio, Hodgson & Steeples, 2005; Madden, Ford, Miller & Levy, 2005).

2.3 Data analysis

In addition to descriptive statistics, exploratory factor analysis using principal components factor extraction and VARIMAX rotation was conducted to identify factors in section three and four of the instrument. The four commonly used decision rules were applied to identify the factors (Hair et al. 1995): (1) minimum Eigenvalue of 1; (2) minimum factor loading of 0.4 for each indicator item; (3) simplicity of factor structure; and (4) exclusion of single item factors. Items that did not

fulfil above mentioned rules were deleted. Then the reliability of each factor was evaluated by Cronbach's alpha.

The identified factors in the research were further analyzed using a bivariate correlation test. Pearson's correlation coefficient was computed, showed how the various factors are related to student satisfaction with and perceived learning from the online learning tasks. Furthermore, a multiple regression analysis showed which factors can be used as predictors of student satisfaction with and perceived learning from the online learning tasks.

3. Results

The results of this study are presented in the following three sections of this contribution. First, student satisfaction with and perceived learning from the asynchronous online collaborative learning tasks in the courses are described. Second, the factor structure of all items and their relationships with student satisfaction and perceived learning are addressed. Third, the results of the correlation test between the identified factors in the study and the results of the multiple regression analysis are explained.

3.1. Student satisfaction with and perceived learning from the online tasks

Table 2 shows the agreement scores of students with statements indicating satisfaction with and learning in the asynchronous online collaborative course environment. As the results

show, over half of the students think AOCCE can facilitate learning of students (54% agrees or strongly agrees with this statement (2); Mean=3.41; sd=.961), the majority of the students is also satisfied with their own learning (44% agrees or strongly agrees with this statement (1); mean=3.45; sd=.621) and one third is satisfied with working in online groups (33.8% agrees or strongly agrees with this statement (4); Mean= 3.32; sd=.702). However, nearly half of the students (46.6%; Mean 3.37; sd .843) thought that AOCCE took more time than face-to-face collaboration. Nevertheless, nearly 40% of them reported that AOCCE had added value for the students (39.9%; Mean 3.30; sd=.830), whereas 11.5% thought it did not have added value.

Insert Table 2 about here

On the other hand, only 12.1% (Mean 2.68; sd=.825) of the students said they felt that the quality of online collaboration was higher than face-to-face collaboration. Furthermore, 12.9% (Mean 2.72; sd=.962) (strongly) agreed with the statement that AOCCE provided useful social interaction. And only 18.9% (Mean 2.74; sd=.941) (strongly) agreed with the statement that in AOCCE they learned more from their fellow students. These results suggest that a mix of online learning and face-to-face learning is more effective for on-campus students than asynchronous online collaborate learning only.

3.2. Factor structure of the item lists regarding general learning attitudes and performing asynchronous online collaborative learning tasks

As stated, section three of the questionnaire measured general student attitudes towards learning and preferences regarding pedagogical practices. All 26 items were selected from previous studies and their reliability and validity were positively evaluated. To explore factors which might explain student satisfaction with and perceived learning effects the AOCCE part of the course (research question 2), an exploratory factor analysis was conducted. Based on the available data, 5 factors were identified (see Table 3). Together, these factors explain 75% of variance.

Insert Table 3 about here.

Items which did not load in the identified factors were deleted. The first factor which is labeled Knowledge Construction Learning Approach (KCLA) consisted of four items and Cronbach alpha for this construct is .922, indicating more than sufficient reliability. The second factor, labelled Attitude regarding F2F Learning Activities (F2F-LA) is comprised of 4 items and it's Cronbach alpha value is .844 which is also more than sufficient. The third factor is labelled Attitude regarding Web-assisted Learning Activities (WA-LA); this construct consists of four items, with a Cronbach' alpha value of .894, also more than sufficient. The fourth construct is Lack of Self Confidence (LSC), which consists of three items with a Cronbach alpha of .897, also more than sufficient. The fifth and last construct comprises three items and is labelled Traditional Teaching and Learning Attitude (TT-LA); this factor has a Cronbach' alpha .of 700, which is also sufficient.

As stated, section four of the questionnaire measured student satisfaction with asynchronous online collaborative learning tasks and the perceived learning of performing those

tasks. The exploratory factor analysis resulted in a list of 21 items which were significantly loaded in four factors with an Eigenvalue of over 1, which together explain 67.35% of total the variance (see Table 4).

Insert Table 4 about here

The first factor which is distinguished is labelled as Perceived Effects of AOCCE (PE), and consisted of ten items. Cronbach's alpha of .931 indicates a high internal consistency for the set of items. The second factor is labelled as Attitude towards E-learning (ELA) and comprises 4 items with a Cronbach's alpha of .834, which also represents good reliability. The third factor was labelled Ease of Use of the AOCCEE (EU), and consists of three items with a Cronbach's alpha of .908, also indicating high reliability. The fourth factor was labelled Satisfaction with the OACC (SO), and consisted of four items with a Cronbach's alpha of .826, which is also more than sufficient.

The number of items per factor, the Eigenvalue of the factors, the amount of explained variance and the reliability indices are listed in Table 5.

Insert Table 5 about here

3.3 Correlation and relationship between factors

To see to what extent the identified factors in the study are related to students' satisfaction with (SO) and perceived effects (PE) through performing tasks in the AOCCE, bivariate Pearson correlation coefficients were computed. In this section the correlations will be presented.

First of all, it can be noted that the correlation between SO and PE is high ($r=.73$; $p=.000$). This implies that students who are more satisfied with AOCCE also perceive more learning effects from asynchronous online collaborative learning tasks.

Secondly, SO and PE are also strongly related to the general attitudes of students towards e-learning (ELA). For the relationship between ELA and SO $r=.815$ ($p=.000$), and between ELA and PE $r=.764$ ($p=.000$). This means that general attitudes regarding e-learning influence the way in which asynchronous online collaborative learning tasks are being perceived to a large extent. The general attitude towards e-learning (ELA) is also strongly related to the ease of use of AOCCE ($r=.674$; $p=.000$), and to a lesser degree to the attitude towards web-based learning activities ($r=.348$; $p=.000$). ELA is negatively related to the traditional teaching and learning attitudes of students ($r=-.331$; $p=.000$) and the lack of self confidence (LSC) ($r=-.192$; $p=.019$).

Experience with asynchronous online collaborative learning activities in other courses is not significantly related with ELA ($r=-.082$; $p=.321$), SO ($r=.027$; $p=.741$) or PE ($r=.007$; $p=.930$).

Table 6 shows the correlations coefficients between factors 1-5 and 8 and SO and PE (factors 6, 7 and 9 are PE, ELA and SO respectively).

Insert Table 6 about here

The data in the table indicate that the ease of use of asynchronous online collaborative learning tasks is the most strongly related to both SO and PE. Both correlations are .680 ($p=.000$). The other correlations are much lower, and do not exceed $r=.363$ ($p=.000$) for the relationship between the attitude towards web-assisted learning activities (WA-LA) and the perceived learning effects of the asynchronous online collaborative learning tasks. The attitude towards face-to-face learning (F2F-LA) and PE ($r=.283$; $p=.000$), and the attitude towards knowledge construction and PE ($r=.172$; $p=.036$) are also positively correlated. As for SO, the only other positive correlation exists with WA-LA ($r=.181$; $P=.028$). There is also a negative correlation between the lack of self confidence (LSC) and SO ($r=-.321$; $p=.000$) although not with PE ($r=.052$; $p=.533$). This means that students with a higher lack of self confidence regarding issues that are relevant for the AOCCE are less satisfied with the AOCCE, and vice versa. This implies that student self confidence regarding AOCCE needs careful attention when asynchronous online collaborative learning tasks are implemented in courses. Given the factor composition, this first of all holds for student concerns about their written English (which is understandable since the meaning of the written contributions should be clearly understood, otherwise effective interaction gets impossible). Secondly, attention should be paid to students who have the feeling that they have little or nothing to contribute to discussions. If this is a general feeling of students, it can indeed negatively influence their participation in and satisfaction with online discussions, but it is a concern that should be further investigated, as the question is whether the students indeed can or cannot contribute much or anything to the discussion. Teacher interventions based on

monitoring of the discussions may help to stimulate contributions from students who otherwise have the feeling that they cannot contribute much.

The same inverse relationship with SO exists for the factor Traditional Teaching and Learning Attitude (TT-LA); for this factor $r = -.276$ ($p = .001$). However, the relationship between TT-LA and PE is also negatively significant, and even higher than for SO ($r = -.337$; $p = .000$). This means that on average, the more traditional the attitude of students towards teaching and learning (such as indicated in the items in Table 3), not only the lower their satisfaction with AOCCE, but also their perceived learning results in AOCCE. This result also needs careful attention, and maybe further discussion is needed with the students concerned about principles of knowledge construction and social-constructive learning, although the differences in attitudes of students regarding individual and social learning, and lectures and discussions, reflect fundamentally different epistemologies regarding cognitivist and constructivist learning.

3.4 Multiple regression analysis

To determine to what extent each factor explains student satisfaction with and perceived learning from asynchronous online collaborative learning tasks, two multiple regression analyses were conducted, one for student satisfaction with, and one for perceived learning effects in AOCCE. For the regression analysis a backward elimination method was used. The results of this analysis are described in this section.

First of all, student satisfaction with asynchronous online collaborative learning tasks in the course (SO) was taken as dependent variable. Previous experience with e-learning

environments and the factors that resulted from the factor analyses were included in the equation. This resulted in a regression model that retained Previous Experience with e-learning environments, Web-assisted Learning Attitude (WA-LA), E-learning Attitude (ELA), Lack of Self Confidence (LSC), and Ease of Use of AOCCE (EU) as statistically significant predictors of student satisfaction with AOCCE ($R^2=.749$; $F(5,142)=84.77$; $p=.000$) (see Table 7).

Insert Table 7 about here

Secondly, perceived effects of the asynchronous online collaborative learning activities (PE) was taken as dependent variable. Again, previous experience with e-learning environments and the factors that resulted from the factor analyses were included in the equation. This resulted in a regression model that retained Face-to-Face Learning Attitude (F2F-LA), E-learning Attitude (ELA), Lack of Self Confidence (LSC) and Ease of Use of AOCCE (EU) as statistically significant predictors of perceived effects of AOCCE (PE) ($R^2=.701$; $F(4,143)=83.79$; $P=.000$) (see Table 8).

Insert Table 8 about here

Combining the results from the two regression analyses, it can be observed that the attitude toward e-learning (ELA) predicts most of the variance of student satisfaction (SO) with as well as

their perceived effects (PE) of asynchronous online collaborative learning activities (PE). Ease of Use of AOCCE (EU) is the second factor that explains most of the variance of SO and PE. Lack of Self Confidence (LSC) is interestingly a negative predictor of SO, whereas it is a positive predictor of PE. Students who reported a higher lack of self confidence apparently were less satisfied with the AOCCE, but did perceive added value of it.

4 Conclusions

The purpose of this study was to investigate the student satisfaction with and perceived learning effects of performing asynchronous online collaborative learning tasks in courses in higher education. Descriptive statistics were used to see to what extent students were satisfied and perceived learning effects. An exploratory factor analysis was conducted to identify factors in the research instrument which might explain student satisfaction (SO) and perceived effects (PE). Furthermore, multiple regressions were conducted to see which factors predict SO and PE. In this section conclusions will be drawn related to the research questions in this study.

4.1 On-campus student satisfaction with performing learning tasks in the AOCCE

Our findings have shown that over forty percent (44.0%) were satisfied with their own learning in AOCCE. Around one third (33.8%) of the students were satisfied with working in an asynchronous online group.

Based on these findings it can be concluded that these on-campus students were rather satisfied with performing collaborative tasks in asynchronous online learning environments. Although the research design did not allow to compare student satisfaction with performing learning tasks in a face-to-face situation with asynchronous online collaborative teamwork, but participants were asked to indicate (based on their experience) the differences between regular face-to-face collaborative teamwork and asynchronous online collaborative teamwork. Students stated there were no differences between F2F and asynchronous online collaboration in terms of difficulty of performing tasks and perception of learning. These results lead to the conclusion that students evaluate the quality of asynchronous online collaborative learning equally good as that of F2F learning.

4.2 On-campus student perceptions of effects of performing learning tasks in the AOCCE

More than half of the participants stated (54%) that student learning can be facilitated by working in online groups. On a five-point scale, the average agreement (as indicated: 1=strongly disagree; 5=strongly agree) on the statement that AOCCE had value added for students was 3.30, on the statement that it helped student learning a lot from their peers 3.27, and on the statement that it improved the quality of student learning was 3.22. However, on the statement that students learned more through AOCCE than by F2F collaboration, the average agreement was 2.97, and interestingly, the average agreement with the statement that students themselves learned more from their fellow students was 2.74, and on the statement that the quality of online collaboration was higher than F2F collaboration 2.68. However, these results are on average still above the critical line of 2.5 in 5-point Likert scales, which means that the results which seem relatively

negative are in fact in the range of 'neither agree, nor disagree'. These results lead to the conclusion that the perceptions of the effects of performing tasks in an asynchronous online collaborative course environment are moderate to positive. Reversely, we can conclude that based on these results AOCCE should not be rejected because of a negative evaluation of perceived learning effects by students, although at detailed level further research is necessary to elaborate on the mixed feelings about online collaboration.

4.3 Factors which influence on-campus student satisfaction with and perceived learning effects in performing learning tasks in the AOCCE

As mentioned earlier, philosophies of constructivism and knowledge construction have influenced theories of education and changed the perspective on students as passive receivers of information towards active collaborative knowledge constructors. The exploratory factor analysis in this study yielded two factors which are related to philosophies of (or attitudes towards) teaching and learning students hold. These are the Knowledge Construction Learning Attitude (KCL-LA) and the Traditional Teaching and Learning Attitude (TT-LA). The results have shown that while KCL-LA is positively correlated with perceived learning effects that result from learning tasks in an asynchronous online collaborative environment, TT-LA is negatively related to both student satisfaction with and perceived learning results in that environment. From the above mentioned results two conclusions can be drawn. First asynchronous online environments can foster students to be more active in the process of learning. It gives them the opportunity to change the traditional idea of being a passive receiver and container of knowledge towards being an active constructor of new knowledge. It is widely believed that e-learning environments

facilitate processes of such knowledge construction. Secondly, the AOCCE seems to be better for students with a knowledge construction and learning attitude. At least, these students benefit more from the AOCCE.

Regarding the F2F learning attitude, previous studies have shown that collaboration and activation lead to better learning results. In this study it was found that the more students believe in F2F collaborative team work, the more they are satisfied with and perceive learning results in the AOCCE. One might think it is obvious that faith in F2F learning is one of the main conditions for working in AOCCEs. However, it should be noticed that it is not clear to what extent students are happy with collaborative team work and to what extent this factor can help with predicting student satisfaction and learning. For instance, some participants in the study were not satisfied with working in groups. The F2F learning attitude was also retained as a factor in the final regression model, which explains its importance in this study.

As to the E-learning attitude of students (ELA) and the Web-assisted Learning Attitude (WA-LA), the results of this study indicate that ELA and WA-LA are positively correlated with both satisfaction with and perceived effects of the AOCCE. Student experiences with the AOCCE seem to be influenced by their general opinions about E-learning environments and Web-assisted learning opportunities in general. This needs special attention during the implementation of AOCCE. Students should be made aware of the power of this learning environment in a careful and convincing way, as many of them already have negative experiences with the early introductions of e-learning in their study programs.

Regarding Lack of Self Confidence, since the last two decades anxiety with respect to working with computers was one of the main issues in research on computer use among teachers and students. In this study this factor was also identified and retained in the regression model for both depending variables (satisfaction and perceived learning effects). It seems that students need

to learn how to work in such an environment. In an AOCCE environment participants should write their ideas and comments, and it is possible that students are more careful and cautious about what they write. Also it was found that students in a F2F situation can simply be silent during the discussion and collaboration but in an OACCE they are under pressure of their peers and teachers to be active. Whereas in F2F communication inactive students remain somewhat hidden, in an AOCCE their silence is very visible from their lack of contributions to discussions. Furthermore, when processes of discussion and collaboration proceed very often students need to think deeper about the topic. If they cannot cope with this, their underperformance also shows which can make them reluctant to participate in this learning environment.

Ease of use (EU) was one of the aspects of AOCCE and this influenced both student satisfaction and perceived learning results in the AOCCE. It was also a factor that was retained in the final regression models of the study. This factor represents a recurrent issue in CSCL and e-learning design and implementation especially with respect to the way in which users can work with these innovative learning environments, and this part of our findings confirms the importance of it.

Finally, although our results have shown that there are students who are not positive about performing asynchronous online collaborative learning tasks in their courses, on average, students are positive about it. However, the way in which this way of learning is implemented is more important than the technology. We do believe – and this study confirms this belief – that AOCCEs have the potential to play a very important role in on-campus learning situations, especially since more and more students have different commitments which cause pressure on their agendas. Functional integration of asynchronous online collaborative learning in courses is more important than just using the learning environment itself.

The most obvious reason for functional integration is independence from place and time in distance learning. But for on-campus students the value added of AOCCE is that it can enhance the quality of the learning process and results. AOCCEs can help teachers to reduce the disadvantages of face to face collaborative work and prepare students to working in virtual teams, which is becoming ever more important in the knowledge work.

But again, careful implementation is necessary. Wrong and inappropriate use of this attractive and powerful learning technology can turn student attitudes toward it the other way around.

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Table1. Numbers of students included in the study by academic year and course

	Course	Year	Number of students
1	EDU-51806: Education in developing and changing societies	2004-2005	14
2	EDU-20806: Didactic skills	2004-2005	12
3	EDU-31806: Applied Environmental Education and Communication	2004-2005	23
4	EDU-51306: HRD-Learning & Career Development	2004-2005	27
5	EDU-57206: Human Resource Management	2005-2006	24
6	EDU-31806: Applied Environmental Education and Communication	2005-2006	23
7	EDU-51306: HRD-Learning & Career Development	2005-2006	25
	Total number of students		148

Table 2. Agreement of students with statements indicating satisfaction with and learning in the asynchronous online collaborative course environment (1= strongly disagree; 2=disagree; 3=neither agree, nor disagree; 4=agree; 5=strongly agree; Av=Average; Sd=Standard Deviation)

	Aspects of evaluation of learning in the asynchronous online collaborative course environment	1 --	2 -	3 +/-	4 +
1	I am satisfied with my learning	0	2.7	53.4	39.9
2	It can facilitate students' learning	4.1	13.5	28.4	45.9
3	It took more time than face-to-face collaboration	3.4	8.1	41.9	41.2
4	I am satisfied with working in asynchronous online team and group	0	7.4	58.8	27.7
5	It had value added for students	3.4	8.1	48.6	34.5
6	It helped me to learn a lot from peers	4.7	5.4	54.1	29.7
7	It improved the quality of my learning	5.4	7.4	54.7	25.0
8	It was suitable for my learning	3.4	8.8	55.4	27.7
9	It motivated me to do good work	3.4	8.1	57.4	26.4
10	It made me more interested in the topic	3.4	8.1	57.4	27.0
11	It broadened my knowledge	4.7	13.5	48.6	27.0
12	I am satisfied with final product of my group	1.4	15.5	55.4	23.0
13	I am satisfied with the quality of collaboration in my group	2.0	13.5	52.7	31.8
14	It motivated me to learn	4.7	16.2	54.1	19.6
15	Students learned more through online collaboration than by face to face collaboration	7.4	21.6	39.9	29.1
16	It was more difficult than face to face collaboration	3.4	26.4	48.6	14.2
17	It improved my communication skills	7.4	26.4	43.2	15.5
18	I learned more from my fellow students	11.5	23.6	45.9	16.9
19	It provided useful social interaction	10.8	25.7	50.7	6.8
20	I felt that the quality of online collaboration was higher than face to face collaboration	6.8	32.4	48.6	10.1
	Average				

Table 3. Factor loadings of agreement scores on learning attitudes regarding pedagogical practices (varying from traditional to e-learning approaches) (F1=Factor 1, etc.)

Item	Factors	F1	F2
	<i>Knowledge construction Learning Attitude (KCL-LA)</i>		
1	Learning should involve social negotiation and mediation	.912	
2	Students should construct their own knowledge through their activities in the course	.836	
3	Teachers serve primarily as guides and facilitators of learning, not as instructors	.819	
4	Students should be encouraged to become self-regulatory	.844	
	<i>F2F Learning Attitude (F2F-LA)</i>		
5	Students learn more during performing group collaborative tasks		.853
6	I think learning can be facilitated by students working in groups		.858
7	Collaborative teamwork are suitable learning methods		.740
8	I like to learn in teams or small groups		.694
	<i>Web-assisted Learning Attitude (WA-LA)</i>		
9	Students learn more using web-assisted activities than using paper-assisted activities		
10	Web-assisted activities are more interesting than paper-assisted activities		
11	Finding the way around a website is easier than finding the way around a book		
12	If I had a choice I would prefer to learn from a book than from a website		
	<i>Lack of Self Confidence (LSC)</i>		
13	I was concerned about the quality of my written English		
14	I did not feel as if I had anything to add to what people had already said		
15	I prefer to post my contributions anonymously		
	<i>Traditional Teaching and Learning Attitude (TT-LA)</i>		
16	I prefer lectures to discussions		
17	I prefer to study with traditional education methods		
18	I prefer individual tasks (such as presentations and writing papers) above group tasks		

Table 4. Factor loadings of agreement scores on statements about satisfaction regarding and learning within the asynchronous online collaborative course environment (F1=Factor 1, etc.)

Nr	Item	F1	F2	F3	F4
	<i>Perceived Effects of AOCCE (PE)</i>				
1	It motivated me to learn	.855			
2	It provided useful social interaction	.895			
3	It broadened my knowledge	.830			
4	It improved my communication skills	.825			
5	It improved the quality of my learning	.816			
6	It had value added for students	.818			
7	It was suitable for my learning	.837			
8	It made me more interested in the topic	.698			
9	It motivated me to do good work	.850			
10	It helped me to learn a lot from peers	.617			
	<i>E-learning Attitude (ELA)</i>				
11	The quality of student learning is improved by using computers		.795		
12	The quality of student learning is improved by using the internet		.809		
13	I really enjoy using computers to support my learning		.782		
14	I really enjoy using the internet to support my learning		.836		
	<i>Ease of use of AOCCE (EU)</i>				
15	Using the asynchronous online collaborative course environment was easy			.776	
16	Working with the asynchronous online collaborative course environment was clear and understandable			.887	
17	It takes only a short time to learn how to use the asynchronous online collaborative course environment			.845	
	<i>Satisfaction with AOCCE (SO)</i>				
18	I am satisfied with my learning during performing asynchronous online collaborative learning tasks				.674
19	I am satisfied with working in an asynchronous online team and group				.756
20	I am satisfied with the final product of our group				.613
21	I am satisfied with sharing my knowledge with peers in online groups				.774

Table 5. Number of Items (NI), Eigenvalues (EV), Variance Explained (R^2) and reliability index (CA=Cronbach's Alpha) of factors based on sections three (learning attitudes) and four (satisfaction with and learning from AOCCE) of the research instrument

	Factor name	NI	EV	R²	CA
1	Knowledge construction Learning Attitude (KCL-LA)	4	4.1	22.52	.922
2	F2F Learning Attitude (F2F-LA)	3	2.2	12.20	.700
3	Web-assisted Learning Attitude (WA-LA)	4	2.5	13.61	.894
4	Lack of Self Confidence (LSC)	3	1.2	6.80	.897
5	Traditional Teaching and Learning Attitude (TT-LA)	4	3.5	19.38	.844
6	Perceived Effects of AOCCE (PE)	10	7.4	35.35	.931
7	E-learning Attitude (ELA)	4	2.6	12.36	.834
8	Ease of Use of AOCCE (EU)	3	2.2	10.50	.908
9	Satisfaction with AOCCE (SO)	4	1.9	9.15	.826

Table 6. Correlation coefficients between identified factors and Satisfaction with AOCCE (SO) and Perceived Effects of AOCCE (PE)

	Factors	SO		PE	
		R _p	Sig	R _p	Sig
1	Knowledge construction Learning Attitude (KCL-LA)	.041	.622	.172	.036 *
2	F2F Learning Attitude (F2F-LA)	-.050	.544	.283	.000 **
3	Web-assisted Learning Attitude (WA-LA)	.181	.028 *	.363	.000 **
4	Lack of Self Confidence (LSC)	-.321	.000 **	.052	.533
5	Traditional Teaching and Learning Attitude (TT-LA)	-.276	.001 **	-.337	.000 **
8	Ease of Use of AOCCE (EU)	.680	.000 **	.680	.000**

R_p= Pearson correlation coefficient

Sig=Significance (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 7. Regression analysis; dependent variable is student satisfaction with the AOCCE

	B	Std. Error	Beta	T-Value	Sig
Constant	1.008	.543		1.86	.065
Previous Experience with e-learning and learning in a AOCCE	.361	.157	.097	2.30	.023
Web-assisted Learning Attitude (WA-LA)	-.058	.017	-.164	-3.50	.001
E-learning Attitude (ELA)	.129	.011	.666	11.61	.000
Lack of Self Confidence (SC)	-.084	.027	-.137	-3.16	.002
Ease of Use of AOCCE (EU)	.131	.028	.279	4.66	.000

R= .865, R²= .749, F (5,142) =84.77, P=.000

Table 8. Regression analysis, dependent variable is perceived learning effects in the AOCCE

	B	Std. Error	Beta	T-Value	Sig
Constant	3.885	1.168		3.33	.001
F2F Learning Attitude (F2F-LA)	.134	.050	.147	2.66	.009
E-learning Attitude (ELA)	.212	.023	.585	9.43	.000
Lack of Self Confidence (LSC)	.177	.064	.154	2.75	.007
Ease of Use of AOCCE (EU)	.265	.056	.301	4.71	.000

R= .837, R²= .701, F (4,143) =83.79, P=.000