RUNNING HEAD: Saturation of CMC Competence

Saturation of CMC competence: Good or bad news for instructors?

Ulla Bunz
Department of Communication
Florida State University
University Center C, Suite 3100
Tallahassee, FL 32301-2664
Email: ubunz@fsu.edu
Phone: 850-644-1809
Fax: 850-644-8642

Ulla Bunz (Ph.D., University of Kansas) is an Assistant Professor in Communication at Florida State University. Her main area of research focuses on technological aptitude. More information is available at http://bunz.comm.fsu.edu. For inquiries, please write to Ulla Bunz, Department of Communication, Florida State University, University Center C, Suite 3100, Tallahassee, FL 32306.

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Abstract

The purpose of this research was to investigate changes in computer-mediated communication (CMC) competence due to the exposure and active use of CMC technology for classroom purposes in order to discuss the implications for instructors' use and requirement of student use of technology for educational purposes. 39 students (59% female, average age 22) at two northeastern research universities participated in the study. Participants were enrolled in a senior-level mediated communication course at their respective university, but worked in virtual teams throughout the entire semester. Technologies used throughout the semester included email, chat, discussion board, Blackboard, and file transfer protocols. CMC competence was measured with the CMC competency scale (Bunz, 2003c). Results show a possible saturation effect of CMC competence. Both positive and negative implications for instructors are discussed. An overall social change is observed by comparing the current state of student CMC competence to previous research (e.g., Althaus, 1997).

In 1997, Althaus concluded that requiring participation in online components of a classroom poses difficulties, as not all students have the same level of technological expertise or motivation to engage with technology. Some students learn how to use any required classroom technology faster than others. Other students feel technological anxiety even with wide-spread technologies such as email. While students with greater technological competence can benefit greatly from the use of computer-mediated communication (CMC) technology in the classroom, there is always the danger of putting at a disadvantage those students who already are victims of one of the digital divides that can be drawn (e.g., along socio-economics, age, gender, social networks, geography). Reviewing publications such as *Syllabus Magazine*, or *The Technology Source*, or attending instructional communication conference panels, there is no doubt that as CMC technology has developed and that instructors are increasingly incorporating various technology-related instructional modules in their classrooms, such as emailing the instructor, using class listserves, or using online groupware systems such as Blackboard or WebCT. Even more creative approaches are gaining in popularity, such as taking exams in personalized chat rooms (Marta, 2002), or using wireless remote control units during lecture (Rice & Bunz, 2003). Students' technological expertise or competence thus, has become a more critical factor than ever in any classroom that requires use of computer-mediated communication, especially if the use is extensive.

Along those lines, a large body of research has examined issues of computer literacy and expertise. However, only a very limited number of measurement instruments have been able to accommodate the fast evolution of communication technologies by going beyond the computer alone in their investigation and incorporating Internet related technologies. The computer-mediated communication competency scale (Bunz, 2003c; Spitzberg, 2006) used in this research applies to a large variety of CMC technologies, including email, chat, and instant messaging. The instrument was used predominantly to compare participants' CMC competence at the beginning of the study to their CMC competence at the end of the fourteen-week study.

The purpose of this research, then, is to investigate computer-mediated communication competence in the context of a computer-mediated communication class that makes extensive use of a variety of CMC technologies. Specifically, the research investigates changes in CMC competence that may be attributed to the exposure and active use of CMC technology for classroom purposes in an inter-university, hybrid, senior-level CMC course on virtual teams. Analyses of the virtual team processes and effects of adherence to virtual team rules (or not) are reported elsewhere (Walther & Bunz, 2005). It is important to note that the purpose of the course was not aimed at increasing CMC competence. Models for this aim have been reported elsewhere (Cornelius & Boos, 2003; Jonas, Boos, & Sassenberg, 2002; Sassenberg, Boos, & Klapproth, 2001). The focus of the course reported on here was on virtual team processes that required intensive use of CMC technology. Thus, use of CMC was a taken-for-granted, and any changes of CMC competence would be a much-welcomed by-product. Results from such an analysis can then be examined from an instructional perspective and potentially influence instructional technology-use modules.

This research combines two areas of inquiry, based on diffusion of innovations theory: instructional technology, and computer- or technology-mediated communication competence. Previous research on technology-intensive classrooms such as virtual classrooms (e.g., Hiltz, 1986, 1994), and specifically on inter-university classrooms (Walther et al., 2001), has shown that students working in virtual teams have the tendency to blame either the technology, or the geographically dispersed team members in problem situations, rather than themselves and their own (in)effectiveness at team work, or their technological (in)competence. It has also been hypothesized that technology-mediated communication competence plays a large role in communicating effectively in mediated contexts (Bunz, 2003b). Similarly, instructional technology research has often focused on inclusion of students through technology (e.g., Carrell & Menzel, 2001; Witmer, 1998). By interweaving these two areas of inquiry and using diffusion of innovations as an explanatory theory, instructors gain valuable insight into students' capabilities so instructors may tailor their classroom use of technology to the maximum learning advantage of their students as indicated by changing levels of technology-mediated communication competence.

Related Literature

Diffusion of Innovations

Diffusion of innovations (Rogers, 2003) as a theory has been applied to thousands of research studies in many different disciplines. Though the theory has been criticized (e.g., Minstrom & Vergari, 1998; Rodger, Pendharkar, & Bhatt, 1996), it has continued to evolve and can be applied easily to the use of instructional technology.

The basic premise of diffusion theory is that an innovation, defined as any idea, product, or behavior perceived as new by an individual – spreads throughout a social system over time as it is transmitted through mass media and interpersonal channels. On a larger scale, organizations can force-implement an innovation. However, the ultimate decision to adopt or reject is usually made at the individual level, influenced by an individual's characteristics, and the characteristics of the innovation itself. For example, an instructor may decide to use Blackboard or WebCT in the classroom, but a student may still decide not to use the groupware system for a variety of personal or technological reasons. The process of rejecting a technology from the beginning without ever using it is called non-adoption. However, a student may also use the groupware system at the beginning of the semester, but may decide to stop using it at a later point, a process called discontinuance. Most innovations are rejected before they even reach a larger, critical mass. However, some innovations become adopted by increasing numbers of people, a trend often resembling an s-shaped graph. An innovation reaches saturation when, within a given social system, virtually no new users can be expected to adopt the innovation anymore. Everyone who conceivably may want to adopt, has adopted.

Within college classrooms, many different technologies are currently in the process of diffusing. Email has become ubiquitous, and groupware systems are gaining popularity every day. Other technologies, such as instant messaging, are used widely by students outside the classroom, but hardly within. Yet other technologies, such as wireless remotes (sometimes referred to as “clickers”), are used in innovative college courses, and – much as they resemble television remote controls – are never used outside the classroom by students as they are designed specifically as in-class, instructional tools. Given the technological onslaught that awaits a college student upon entering the classroom these days, examining the diffusion not of a particular instructional technology per se, but of students’ abilities to use these technologies is imminent. This leads to the first research question:

> RQ1: What is the current state of students’ computer-mediated communication competence?

Computer-Mediated Communication Competence

Communication competence has been well researched within the communication discipline (e.g., Spitzberg, 1993; Spitzberg & Cupach, 1984, 1989). The concept of computer-mediated communication competence has been less well documented. There is a vast body of research on computer anxiety, and an equally vast body of research on computer experience or literacy (for a review, see Bunz, 2003c). However, these bodies of research focus almost exclusively on the technology of the computer. They do not investigate Internet technologies such as email, the web, search engines, etc. Often, studies investigating technology in context measure competence simply by how long someone has used the technology (e.g., Hiltz, 1988, p. 1440; Hiltz, 1992, p. 197; Kraut, Patterson, Lundmark, Kiesler, Mukopadhyay, & Scherlis, 1998). Some authors (e.g., Althaus, 1997, p. 162) do not report measuring competency, but report assuming low levels of experience. Considering the complexity of the Internet and technology in general, such a measurement approach doesn't seem to suffice anymore. Jung, Qiu, and Kim (2001) even show how using a "time online" measurement rather than a more complex instrument can skew one's results. After all, it stands to reason that a person who has been online for only a year but has become familiar with a variety of online tools (e.g., chat, email, gaming, banking, downloading music) probably has more competency than a person who has been online for five years, but has never used any Internet technology except for email.

Only few and recent studies have begun to investigate CMC competence more in-depth, as a concept on its own (Bunz, 2003c; Morreale, Spitzberg, & Barge, 2001; Spitzberg, 1997; Spitzberg, 2006), in an instructional context (Bubas, 2001; Harper, 1999; Rice & Bunz, 2003), or other applied, technology-mediated contexts (Bunz, 2003a; Bunz, 2005; Parasuraman, 2000). Due to the focus on the computer and the scarcity of competence research with newer technologies, there is at this point not really a unified definition of the concept of CMC. For the purpose of this paper, computer-mediated communication competence is defined as one's ability to effectively use communication technologies (such as email, the web, instant messaging, discussion boards, groupware systems, wireless technology, etc.) both from a technical, skilloriented perspective, and in a more applied, interactive-communicative way. Ultimately, a high level of CMC competence implies the ability to appropriate a new technology easily based on experience gained from previously used technologies. Obviously, the concept of computer experience is related to CMC competence. However, I argue that these concepts are not synonymous. One can gain more experience with technology without actually gaining competence at it. Exposure in itself does not necessarily guarantee learning. This leads to the second research question:

RQ2: Does the intensive use of CMC technologies in the classroom have an effect on students' CMC competence? If so, in which direction?

The overarching question, of course, remains as to what any such results mean for instructors and their instructional use of technology in the classroom.

Methods

A semester-long computer-mediated communication course was taught at two separate major research universities in the northeast of the United States. The two courses acted as one. Both instructors designed the syllabus, all lectures, and the assignments collaboratively. Each instructor conducted class in his/her location, but due to geographical dispersion, students never met face to face. All student assignments were group projects and required online collaboration between students from both universities. The assignments included two short and one long group paper, and weekly reading reports.

During the course of the semester, students used email, a course website (Blackboard), chat rooms, message boards, file sharing options and other computer-mediated communication media in their collaborative group projects. Students completed a variety of research questionnaires, including the "Computer-mediated communication questionnaire" described below. This particular questionnaire was administered twice, once during the first week of the semester, and once 14 weeks later, during the last week of the semester. Questionnaires were matched through anonymous ID numbers provided on the first questionnaire. Because some students dropped the course and others lost their ID number during the semester, only 39 matched pre-post questionnaires were completed (*University 1*: 14; *University 2*: 25), though the total number of students enrolled was 44 (*University 1*: 16; *University 2*: 28). Overall, participants from both schools were similar in their demographics, as can be seen in Table 1.

[Insert Table 1 about here.]

Measurement Instruments

The computer-mediated communication questionnaire used in this study consisted of two main components plus demographic questions. The first part of the questionnaire investigated medium choice and is discussed in more detail elsewhere (Bunz, 2003a). The second main part of the questionnaire consisted of 43 questions on computer-mediated communication competence (see Bunz, 2003c, Appendix B for a copy of the questionnaire). The items fell into eight separate sub-constructs: comfort, contextual factors, efficacy, interaction management, medium factors, general usage, effectiveness, and rapport. Instructions asked participants specifically to "consider CMC to include all forms of email and computer-based networks (e.g., world wide web, chat rooms, personal data assistant, electronic bulleting boards, terminal-based video telephone, etc.) for sending and receiving written messages with other people" (quoted from questionnaire). Items were arranged on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Finally, the questionnaire included five demographic questions on age, gender, country of residence, ethnicity, and pre-tax annual income.

Other survey measurement instruments employed during the class are irrelevant to the study at hand and are described elsewhere (Walther & Bunz, 2005). However, one could consider the Blackboard site used during the course a measurement instrument. This groupware website records in its own database access data by student, date, and content area, and also keeps archival records of all discussion board postings, chat room sessions, and files uploaded. Students were generally discouraged from using email during the course, except to communicate with instructors, and the email function within Blackboard was disabled to prohibit group email interactions. Students were not allowed to use email or instant messaging for the first two group papers, but instead were restricted to the chat room and the discussion board within Blackboard. For the third group paper, students were allowed the use of any technology (including email and instant messaging) except for the telephone. There were two main reasons for this rule. First, research shows that email is not the most efficient way of communicating in virtual groups though many people seem to believe so (Cramton, 2001; Sproull & Kiesler, 1986). Second, Blackboard does not keep a record of emails sent from within it, and in order to keep a record of all interactions students needed to use a different interaction technology. Data mining in the Blackboard database and archive thus provides information on access, and technology use within the groupware site.

Results

Frequencies and Reliabilities

Reliability analysis using Cronbach’s coefficient alpha was conducted on all subscales and the total computer-mediated communication competency scale. Since subjects completed this scale twice (pre and post), two reliability alphas were determined for each construct. Reliabilities were generally high, ranging between .70 and .96 with two exceptions. The "interaction management" construct only approached acceptable reliability (.59 pre, .47 post). Also, the "contextual factors" construct showed no reliability (-.28 pre, -.29 post). The "contextual factors" construct has proved unreliable in other applications of this scale (see Rice & Bunz, 2003) and was thus excluded from further analysis in this study. It is questionable whether the construct should even be used in future applications of the CMC competency scale. Reliability alphas of the CMC competency scale are represented in Table 2.

[Insert Table 2 about here.]

In order to assess the frequency with which the online tools provided by Blackboard were used, and in order to get a better understanding of the applied component of the course, usage data was examined. On average, students scored 1447 "hits"[1] on Blackboard throughout the semester, ranging from 711 to 2996. Within their groups, students posted a total of 2750 discussion board messages across all groups and all three assignments. For assignment 1, all groups posted a total of 1126 messages, for a group average of 80.43. Groups had three (12 groups) or four (two groups) members. For assignment 2, all groups posted a total of 892 messages, for a group average of 63.71. Groups had three (12 groups) or four (two groups) members. Finally, for assignment 3, all groups posted a total of 732 messages, for a group average of 73.20.[2] Groups had four (7 groups) or five (3 groups) members. One can see a decline in postings after the first assignment. Three possible explanations come to mind. Either, students figured out how to work in groups, and thus required fewer interactions for the same end result, or students became discouraged and were less motivated to participate after the first assignment, or students relied more on email that was not measured by Blackboard. In order to gauge a possible answer to those possibilities, frequency information on other online tasks is helpful. Within their Blackboard group space, students were also able to attend group chat sessions, upload files using file transfer protocol technologies, and attach documents to their discussion board postings.

[Insert Graph 1 about here.]

As Graph 1 shows, on average students' use of these technologies changed over the course of the three assignments. Students used fewer synchronous chat sessions, a steady increase of discussion board posting attachments, and after a dip in assignment 2, a dramatic increase of uploaded documents despite the fact that students were allowed to use email for the third assignment, a technology that allows for easy document attachments. The visual representation of online behavior indicates a clear change in behavior and medium choice as the semester progressed. Thus, it is more likely that students learned from their group experiences and adapted their online behavior based on previous group interactions. The choice of one particular medium over another seems to have been influenced by group experience. Future studies on virtual groups ought to investigate the effect of getting used to virtual team work has on medium choice. If there are strong correlations, organizations may not have to invest in either technology or training of specific tools.

Current State of CMC Competence

Research question 1 asked, "What is the current state of students' computer-mediated communication competence?" Current state of CMC competence was measured by frequency scores on the CMC competency scale when it was first administered during the first week of classes. At both universities, the course was a senior-level communication elective, and at neither school was the course identified as particularly technology-intensive. Though both courses were identified as mediated communication courses and it can thus be argued that students who enrolled may have had at least a slight interest in the topic, this assumption should not be over-interpreted. The end-of-semester instructional rating survey showed that at least at *University 2*, students admitted to not having been particularly interest in the topic of the course before the beginning of the semester (mean of 3.14 on a 5-point Likert scale with higher ratings indicating more positive evaluation). Chances are high that the students in these two particular courses did not differ greatly in their CMC competence from other communication seniors at either university. However, there is no data to support this assumption.

Frequencies show that at the beginning of the semester, before any technology was used in either of the two courses, students' overall CMC competence was ranging between average and slightly elevated competence ($M = 3.74$, $SD = .59$, on 5-point scale; lowest score: 2.11, highest score: 4.72). Both in the pre ($t\ (37) = 2.96$, $p = .005$) and the post test ($t\ (37) = 4.30$, $p < .001$), students at *University 1* rated their competence slightly higher (pre: $M = 4.08$, $SD = .60$; post: $M = 4.18$, $SD = .54$) than students at *University 2* (pre: $M = 3.55$, $SD = .51$; post: $M = 3.46$, $SD = .48$). Overall, students estimated their CMC competence highest on the subscale "medium factors," measuring their ability to select the most appropriate medium depending on context ($M = 4.10$, $SD = .63$; lowest score: 3.00, highest score: 5.00). Students also thought they could use CMC technologies effectively ($M = 3.91$, $SD = .56$; lowest score: 2.50, highest score: 5.00), as measured by the "effectiveness" subscale. Students rated their specific competencies similarly to their overall CMC competence on three other subscales, "comfort" ($M = 3.74$, SD .67; lowest score: 2.00, highest score: 4.75), "efficacy" ($M = 3.85$, $SD = .72$; lowest score: 1.88, highest score: 5.00), and "general usage" ($M = 3.75$, $SD = .93$; lowest score: 1.50, highest score: 5.00). Finally, students evaluated their CMC competence lowest on the most interaction-applied subscales, "interaction management" ($M = 3.43$, $SD = .68$; lowest score: 2.00, highest score: 5.00), and "rapport" ($M= 3.39$, $SD = .86$; lowest score: 1.33, highest score: 5.00).

Though the mean scores on all subscales are only ranging within one scale point (3.39 – 4.10), attention should be paid to the range of scores within each subscale as they indicate that some students did not think they had particularly high CMC competency skills. In future studies, qualitative methods might be appropriate to investigate such students' experiences in more depth. Since these frequencies only provide one snapshot in time, a pre-post paired t-test was conducted to investigate change of CMC competence.

Change of CMC Competence

In order to investigate change over time, paired t-tests were conducted on the CMC competency scale and its subscales. There were no significant differences for any of the subscales, as can be seen in Table 3. The differences in mean scales were smaller than .2 in all cases. Power analyses with medium effect sizes shows that results would probably not have differed even with a larger sample. Research question 2 asked how exposure to CMC technology in a technology-intensive classroom affects CMC competence, and the answer, at least for the subjects in this study, seems to be, "It doesn't." The discussion section presents explanations for these results and discusses implications for instructors. Usually, non-significant results are frowned about, since no conclusive interpretations can be drawn. However, the discussion section explains why these results can be seen as both encouraging and frustrating for instructors.

[Insert Table 3 about here.]

Discussion

The purpose of this research was to investigates changes in CMC competence that may be attributed to the exposure and active use of CMC technology for classroom purposes in order to discuss the implications for instructors' use and requirement of student use of technology for educational purposes.

Mean scores of the CMC competency scale indicated a fairly high level of CMC competence among the 39 students surveyed. This may indicate a possible ceiling effect or state of saturation for students' CMC competence. However, the range of scores within specific constructs ought to be taken into consideration, as some students perceived their competence to be fairly low. A pre-post test of students' self-evaluation after a fourteen-week technology-intensive course showed no differences in any of the constructs used. From an instructional perspective, the results of this study can be interpreted in at least two ways, as encouraging, and as frustrating. The following paragraphs present arguments for both perspectives.

Above results can be seen as a frustrating outcome of quite intense instructional efforts. This class in particular aimed at providing students a technology-use experience as they may encounter in real-life business settings, such as virtual team work. However, students who perceived their CMC competence to be low at the beginning of the semester seem to have retained that opinion. As this study did not assess actual competence with using CMC technologies, but only perceived competence, there is no information on whether these particular students underestimated their abilities. However, a senior-level student who is not confident in his/her CMC competence is unlikely to pursue a technology-related career. Technology-related career opportunities are growing rapidly, and these students may never cross the digital competence divide that they themselves perceive, whether they actually fall prey to it or not. An instructor may believe that he/she has failed in providing students with a most valuable skill, even if the main focus of the class was not on increasing CMC competence at the skill level but at the interaction and use level.

However, a more positive attitude and perspective on these results leads to a different interpretation. One could argue that, though there are still students who perceive their CMC competence to be low, this perception did not prevent them from participating in the course successfully (Walther & Bunz, 2005). Also, perception of one's CMC competence may not predict one's actual abilities. Overall, results show that students' CMC competence has changed since Althaus' (1997) research. Instructors can now take for granted a certain level of experience with instructional technologies in their students. Instructors are not widening digital divides or putting less experienced students at a disadvantage when making use of technology in the classroom for instructional purposes. Results of this study support the argument made earlier that even the technology-intensive course discussed here did increase students' exposure to and experience with CMC technology, while not increasing their CMC competence. Preliminary support for this conclusion can be drawn from the course website used. *University 2* does not support Blackboard, but only WebCT and eCollege. Though these groupware show overlap in their applicability, actual interfaces differ significantly. One could have expected that learning how to use Blackboard would have increased *University 2* students' CMC competence. However, the experiences gained by using CMC technologies in general, and possibly using either WebCT or eCollege in other courses culminated in a competence level that allowed students to appropriate the new software without measurable impact on competence level, indicating a possible ceiling effect or saturation of CMC competence among these students. Students gained more diverse experience without increasing competence, showing that the constructs experience and competence differ.

When applying results and conclusions from this study to other student populations, several factors ought to be taken into consideration. One limitation to the study at hand is sample size. Combining students from both sections of the inter-university course, the sample consisted of only 39 subjects, all senior-level students located in the Northeast of the United States within approximately 220 miles from each other. A larger sample drawn from a more diverse population (geographically, and university level) may yield different results. A second limitation can be found in the absence of any students with self-identified disabilities in either of the two courses. Students with documented cognitive, mental, or physical disabilities may have significantly more difficulties at gaining CMC competence or mastering the requirements of a technology-intensive classroom.

Two additional considerations to be taken into account are the predictive validity of the CMC competency scale, which is still in the early stages of testing, and the technical abilities of an instructor who tries to incorporate technology into his/her classroom. Some evidence of the scale's predictive validity exists. Rice & Bunz (2003) show that CMC competence measured by the CMC competency scale does indeed predict adoption and positive evaluation of a wireless remote control technology for classroom use among students. The two instructors in the study at hand both had considerable experience with the use of a great variety of CMC technologies in the classroom, and actually taught their first joint inter-university course in 1999. However, some instructors may feel less confident about their own CMC competence. In that case, extensive use of classroom technologies should be considered carefully, as technology that substitutes for rather than supplements traditional instructional models adds no benefit to the classroom.

In conclusion, instructors should be encouraged to continue using CMC technologies in their courses, striving to apply various technologies for their pedagogical purposes and student needs. Unless a class is specifically designed to increase technical skill or CMC competence, there may not be a measurable change. However, as technology becomes ever-more entwined with everyday life, new instructional modules are likely to include technological components, as, for example, information is increasingly digitized. It is important to remember that though there was no statistically significant change observed in CMC competence in this fourteen-week project, a (non-statistical) comparison with previous research (e.g., Althaus, 1997) shows clearly that large-scale social change has occurred and can be observed every day, as student emails are pouring into instructional email boxes and as students research (and at times plagiarize) class papers on the Internet. Computer-mediated communication competence has diffused into and among student populations, and possibly reached a point of saturation. This macro-level change is surely good news for instructors.

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Footnotes

[1] Instead of recording the number of times that students accessed Blackboard, the software records hits. A hit is counted every time a student logs on, and/or accesses a new page in one of the four main areas: content, communication, group, student. Though an imprecise measure, one can still deduct that the student with the largest number of hits looked at a daily average of 31 pages, seven days a week, for fourteen weeks, while the student with the lowest number of hits looked at an average of only 7 pages per day over the same time span.

[2] It is likely that students also used email and instant messages for the third assignment. However, no record is available for study.

Table 1

Demographic information of participants

		University 1	*University 2*	Total
# of students		16	28	44
# of students who completed pre-post		14	25	39
Age	Range	20-30	20-26	20-30
	Mode	21	21	21
	Mean	22.1	21.6	21.7
Gender	Female	43%	68%	59%
	Male	57%	32%	41%
Ethnicity	European American	67%	58%	61%
	African American	11%	5%	7%
	Asian American	-	16%	11%
	Hispanic	-	5%	4%
	Other	22%	16%	18%

Table 2

Reliability alphas of the CMC competency scale and subscales, N = 39

	Pre-test, Week 1	Post-test, Week 14
Comfort	.83	.84
Contextual Factors	-.28	-.29
Efficacy	.91	.91
Interaction Management	.59	.47
Medium Factors	.84	.79
General Usage	.82	.93
Effectiveness	.75	.70
Rapport	.89	.88
CMC total, incl. cont. fac.	.93	.94
CMC total, excl. cont. fac.	.95	.96

Table 3

Pre and Post T-test Comparisons on the CMC Competency Scale

	t	df	*p*	power
Comfort*	-	-	-	-
Efficacy	.73	38	.467	.81
Interaction Management	<.001	38	1.00	1
Medium Factors	-.05	38	.958	.99
General Usage	.85	38	.399	.77
Effectiveness	<.001	38	1.00	1
Rapport	1.02	38	.314	.72
CMC total, excl. cont. fac.	.34	38	.734	.92

Note. A pre and post test for “comfort” could not be computed as the mean scores were the same for both times (*M* = 3.74, *SD* = .67). Power values (with d = 0.5) were calculated with GPower, available at http://www.psycho.uni-duesseldorf.de/aap/projects/gpower/index.html

Graph 1

Average of Interactive Tasks per Project