UDC:004.7
Original scientific paper

# ASSESSMENT OF COMPUTER MEDIATED COMMUNICATION COMPETENCE: THEORY AND APPLICATION IN AN ONLINE ENVIRONMENT

**Goran Bubaš, Danijel Radošević, Željko Hutinski**
University of Zagreb,
Faculty of Organization and Informatics, Varaždin
*{gbubas, darados, zhutinsk}@foi.hr*

**Abstract:** *Theoretically based factors of computer mediated communication (CMC) competence are analyzed in the context of education for effective use of internet technology in online interpersonal communication and group interaction. An empirical analysis was performed of two versions of a newly developed CMC competence self-assessment measure. The first version of this measure was applied in a paper-and-pencil form and the second version was administered online. A critique and suggestions for the improvement of the CMC competence self-assessment measure are provided alongside an elaboration of the empirically uncovered factors of CMC competence that closely correspond to some dimensions of face-to-face/off-line interpersonal communication competence. Finally, some remarks are made concerning the online testing procedures for web-based assessment systems related to CMC competence, and also about education for CMC competence as a part of education for participation in the information society.*

**Keywords:** *computer mediated communication (CMC), self-assessment, online testing, factor analysis, internet, computer literacy, education for information society.*

## 1. INTRODUCTION

The number of people who use the internet worldwide has grown from 16 million in 1995 to over 600 million in 2002, with 165 million users in the US alone [19]. It can be projected that the worldwide online population will surpass one billion in 2005 [10]. According to the Pew Internet and American Life Project [20, 21], among the most common online interaction activities performed by users in the US are *e-mail* (93% have used it at least once, and 52% use it daily), *instant messaging* (47% have used it at least once, and 14% use it daily) and *online chat/discussion* (25% have used it at least once, and 4-6% use it daily).

The latest trends indicate a growing interest for types of interaction via the internet that are more immediate than e-mail, like IRC (*Internet Relay Chat*) and ICQ (*"I seek you"*). Diverse forms of computer supported *interpersonal* interaction are commonly denoted as *computer mediated communication* (CMC), even though the still predominant mode of such information exchange is via *text-only* communication channels. However, other types of

message features are also available through the use of *e-mail attachments* (in the form of audio, pictorial, and video files), as well as by internet-based communication technology designed for a more multimedia type of information exchange, like *NetMeeting* [17] and complex forms of interaction by use of *groupware systems* like *Oracle Collaboration Suite* [15].

Various theoretical approaches have been applied to account for the diverse phenomena related to interpersonal interaction, relationship development, and group communication by technologically-based systems and the internet (i.e.: [31; 13]). However, some overviews of the existing CMC theories have found them to be more descriptive than prescriptive in terms of effective communicative behavior online [2] and more concerned with the characteristics of media themselves than about variables like users' motives, communication style, context, or the degree of user participation in interaction [14]. Nevertheless, the *user-related variables* have recently been brought into greater focus by several new theoretical approaches to CMC (i.e.: [22; 18, pp. 172-203]).

Perhaps the most elaborated approach to the theoretical analysis of the interaction between user-related variables with media and communication context variables is that pursued by Spitzberg [25] in a conceptual framework for mediated communication competence that integrates the variables related to the *individual* (knowledge, motivation, skills) with *situational* variables (media, message, context) and interaction *outcomes* (appropriateness, effectiveness, satisfaction, co-orientation, productivity/efficiency). Not only is there potential for this CMC competence theory to bridge at least some of the disparity between CMC theories developed by *media scholars* and theories that were introduced by scholars who were more involved in *face-to-face and interpersonal* types of analyses of interaction, but it could also *prescribe* and not only *describe* effective CMC related behavior. Furthermore, Spitzberg has supplemented the theoretical model with a *self-report measure* that may be used for the *assessment* of various CMC competence variables.

Competence in CMC may be placed in the context of *computer literacy* [4]. In the era of the internet it is difficult to avoid the assumption that effective use of computer technology is increasingly associated with competence in *computer-assisted* interpersonal and group communication. This emphasizes the need for the development of *interaction skills in computer-mediated communication environments* and for a more systematic educational effort to enhance CMC competence in the academic and professional arena.

However, competence development in CMC cannot be related only to the *netiquette* type of principles of effective and appropriate interaction using specific technologies like e-mail (as in: [24]). A more detailed and elaborate approach is needed for explanation, prescription and training for competent communicative interaction in diverse technologically-mediated settings. Furthermore, there is growing demand for novel theoretical advancements regarding technologically-mediated communication, since up-to-date and forthcoming telecommunication and computer technology is reducing the difference between (mobile) phone and computer mediated interaction, and with the introduction of two-way simultaneous video communication the gap between face-to-face and such new types of technologically-mediated interaction is partly being bridged.

## 2. THE MODEL OF CMC COMPETENCE

The recently developed model of CMC competence [25; 18, pp. 172-203] is outlined in *Figure 1* and consists of factors that are related to the *individual*, as well as factors that are related to communication *media*, *message*, and *context*. According to Spitzberg, the interactions of these elements create the *outcomes* of CMC. This model has a strong foundation in a well-established theory of *interpersonal communication competence* [28]

that is extended with media and message factors for the purpose of a theoretical analysis of CMC.

According to the *CMC competence model* presented in *Figure 1*, the ***individual factors*** that can be attributed to users of CMC technology are motivation, knowledge and skill. ***Motivation*** is important since motivated communicators tend to better activate their potential for effective communication (e.g. their related knowledge and skills) when they interact with others, and this can make them appear more competent in CMC. Also, motivation can be associated with goal-directed behavior that makes the individual more aware of the communication process and of the available means for achieving the desired goal, as well as more inclined to apply such means for *self-directed* or *other-oriented* purpose. ***Knowledge*** can be related to familiarity with computer and telecommunication technology, but also with experience in CMC and awareness of unwritten rules of conduct when using specific CMC technology for interacting with people of a different status, culture, gender, or educational background. However, knowledge *per se* is not a guarantee of effectiveness and appropriateness in CMC. ***Skills*** are repeatable behaviors that are usually goal driven and intentional (e.g. set off by motivation factors) and that facilitate the utilization of diverse types of knowledge (factual, strategic/tactical, scripted, routine, tacit) for the achievement of goals in concordance with the criteria of competence in CMC.

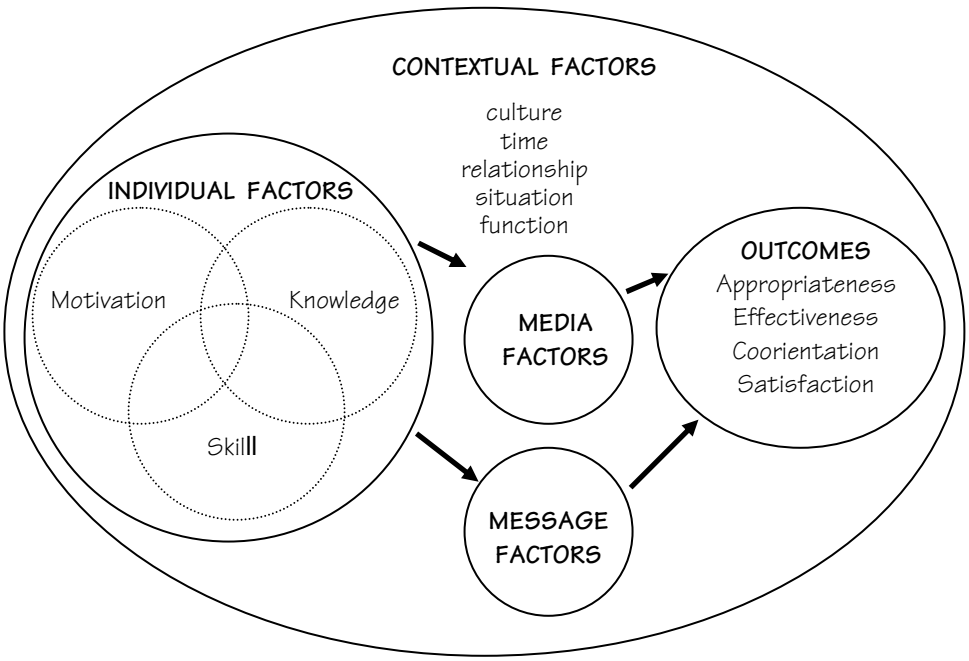


Figure 1: The theoretical model of computer mediated communication (CMC)

Skills that are associated with competence in CMC are attentiveness, composure, coordination and expressiveness. ***Attentiveness*** is rather difficult to enact in CMC and is manifested by showing interest/concern for the other person, attention to his/her message, and personal touch by adapting one's own interaction to the other person, and displaying more affection for him/her. ***Composure*** means being comfortable, confident and in control when using specific CMC technology, as well as assertive/persuasive in messages that are directed toward others in the interaction. ***Coordination*** is related to the management of

some interaction-relevant components like timing and initiation/closure of conversations, topic choice/change, and perhaps even to the means for conversation repair. ***Expressiveness*** is an attribute of the message that makes it appear verbally and nonverbally vivid, alive, and animated, as well as emotionally colored and with more apparent *telepresence* of the sender.

The other elements of the CMC competence model (that interact with the individual factors) are context, media and message factors. The ***context factors*** that are related to CMC are culture, chronemics, relationship, environment, and function. Interaction occurs in a milieu of intersected semantic modalities/spaces produced by previous history, actual state, and potential actions/changes in the co-actors and their surrounding. The content, meaning and pattern of CMC are influenced by ***culture*** related attributes (ethnicity, religion, gender, etc.), ***chronemic*** aspects (i.e. timeliness of response), ***relationship*** quality (intensity, type, reciprocity), ***environment*** features (concrete settings for interaction), and ***function*** of the interaction process (e.g. purpose and pressures, like conflict versus cooperation).

Common ***media factors*** are interactivity, adaptability, and efficiency. Finally, ***message factors*** are task vs. socio-emotional content, frankness, as well as quantity, equivocality, and complexity.

Individual competence in CMC can be assessed by the ***outcomes*** of interaction. The *criteria* for assessing the outcomes of interaction are coorientation, appropriateness, effectiveness, satisfaction, and productivity/efficiency. ***Coorientation*** is related to the level of the understanding/accuracy of the message, or, in other words, to the degree of correspondence between the intentions of the sender and the interpretations of the receiver(s) of the message in CMC. ***Appropriateness*** is a common criterion of competence in CMC that refers to the degree to which certain communicative behavior is perceived as suitable to the (predominantly social) context. ***Effectiveness*** is viewed as the degree to which various (and sometimes conflicting) communication goals are realized (or optimized) in CMC. ***Satisfaction*** is the positive response (usually affective) of an individual to the realization of certain communication-related needs, aspirations and objectives by CMC. ***Efficiency*** means that the realization of communication goals can be assessed from the perspective of economy, e.g. as a consequence of a more or less optimized/rational investment of resources. ***Relational development*** is associated with diverse attributes of a relationship that may be attained or preserved through CMC.

Most of the elements of the previously outlined CMC competence model are represented by the specific *self-evaluation scales* of the two versions of the CMC competence measure that were constructed by Spitzberg in 1997 and 2002. These two measures of CMC competence were empirically evaluated and analyzed in two studies that are presented in this paper. The first CMC competence measure was developed in 1997 and consists of 17 subscales with a total of 114 items. The second CMC competence measure is an improved version of the first and was developed by the same author in 2002. It consists of 15 subscales with a total of 90 items. The two measures were applied in different forms and on different sets of subjects.

## 3. EVALUATION OF A CMC COMPETENCE ASSESSMENT INSTRUMENT

Two versions of the CMC competence measure developed by Spitzberg were analyzed in different modalities (the paper-and-pencil versus online environment) and on different sets of subjects. The results of these empirical analyses are presented separately as *Study 1* and *Study 2*.

**STUDY 1**

In the fist study the CMC competence questionnaire developed by Spitzberg in 1997 was applied in a paper-and-pencil form on a total of 227 Croatian college students in January and April 2002. The subjects were predominantly in their first year of college, aged 18-22, and about 2/3 of them were male. These subjects voluntarily and anonymously participated in the study. All of the subjects were internet users. This first study is divided in two phases and addresses the issues of (a) scale analysis and (b) underlying factor structure of the CMC competence measure.

The 1997 version of the CMC competence measure consists of 114 items distributed in 17 self-assessment scales. For most of the scales of this measure the subjects used a response scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) to indicate how much they agree or disagree with each statement in the measure. The scale labels and the number of items for each scale are presented in *Table 1* and the measure is available online (see *Appendix A*). The constructs that were intended to be measured by these scales are briefly outlined in the previous section of this paper. It must be noted that this is a *preliminary version* of the scale that has to be *psychometrically* examined (and improved) before it is used for the measurement of CMC-related constructs and for diagnostic purposes.

For the purpose of construct measurement, an assessment scale should be *reliable* in the form of *internal consistency* of items, and should manifest different forms of *construct validity*. Construct validity was not the subject of this study, even though it has great importance for the correct interpretation of the results of the application of a specific scale for scientific investigation and for diagnostic assessment. However, close inspection of the items that compose the scales of the CMC competence measure leads to the conclusion that most of these scales have apparent *face validity*. This type of validity can be assumed if item content has a reasonable semantic relationship with the construct the items in a scale are supposed to measure.

*Internal consistency* of a scale, as a criterion of reliability, indicates that (at least most of) the items in a scale (more or less) measure the same characteristic of the individual (specific ability, trait, skill etc.). This type of reliability is also called *homogeneity* and is commonly estimated by the *Cronbach alpha coefficient* which is calculated as a measure of interrelation between all of the items in a specific scale. It is common practice to consider a scale designed for the measurement of personality traits or similar constructs to be of acceptable reliability if the Cronbach alpha coefficient is .70 or above. An important part of scale construction is to achieve an alpha coefficient of .70 (or higher), before testing (or assuming) the construct validity of a scale or using it for diagnostic purposes. Poor internal consistency of a scale means that its items measure entities so different that the total scale score is unlikely to reliably represent a specifically defined construct. However, internal consistency can be improved by adding items that are in high correlation with other items in a scale, or by excluding items that are not in sufficient correlation with the total score of a scale. *(For an explanation of the statistical and multivariate analyses that were performed in this paper, see* [29]*.)*

Despite the apparent *face validity* of most of the scales of the CMC competence measure, only the following scales had an acceptable level of *internal consistency* in *Study 1* (see the reliability data in *Table 1* for these scales): *Efficacy, General Usage, Motivation, Knowledge,* and *Media Factors*. For each scale of this initial version of the CMC competence measure, three categories of possible actions were suggested to increase internal consistency (see *Table 1*): adding new items (I+), excluding poorly performing items (E), and revision/reconstruction of a scale (R). It must be noted that the format of items of the *Adaptability* scale was not suitable for the calculation of internal consistency,

and the recommendation was to reconstruct the scale to give it a format comparable with other scales in the CMC competence measure. See *Appendix A* for details about *online access* to this measure.

Table 1: Scale labels, number of items in a scale, reliability, and evaluation of the of the CMC competence questionnaire (developed by Spitzberg in 1997; N=227)

| Scale label (number of component parts) | Number of items | Reliability in Study 1 | Action to increase reliability | Estimated value (1-5) | |
|---|---|---|---|---|---|
| | | | | Diagnostic | Educational |
| Coordination | 6 | .53 | I+, E | 3 | 5 |
| Expressiveness | 6 | .49 | I+, E | 3 | 4 |
| Attentiveness | 6 | .11 | R, I+, E | 1 | 4 |
| Composure | 6 | .29 | I+, E | 2 | 3 |
| Efficacy | 14 | .81 | E | 5 | 4 |
| General Usage | 5 | .73 | I+ | 4 | 4 |
| Motivation | 6 | .69 | I+ | 4 | 4 |
| Knowledge | 6 | .72 | I+ | 4 | 4 |
| Contextual Factors (6) | 12 | .16 | R | 1 | 5 |
| Message Factors (3) | 6 | .44 | R, I+, E | 3 | 4 |
| Media Factors (6) | 9 | .85 | - | 5 | 5 |
| Co-orientation | 5 | .56 | I+, E | 3 | 4 |
| Productivity/ efficiency | 6 | .39 | I+, E | 2 | 4 |
| Satisfaction | 6 | .57 | I+, E | 3 | 3 |
| Appropriateness | 3 | .34 | R, I+, E | 2 | 3 |
| Effectiveness | 3 | .61 | I+ | 3 | 3 |
| Adaptability | 9 | - | R | - | 5 |

The *diagnostic value* of the scales of the CMC competence measure was estimated on the basis of scale reliability and the number of items in a scale. A larger number of items in a scale gives a greater opportunity to differentiate between subjects with a different level of specific trait/skill and, also, more precision in estimating the level of an individual trait/skill in relation to the group of subjects that were included in the sample for the calculation of diagnostic norms. The diagnostic value was estimated on a 1-5 point scale (*totally inadequate* - 1; *inadequate with potential for improvement* - 2; *inadequate and easily improved* - 3; *almost adequate* - 4; *adequate* - 5). As presented in *Table 1*, only two scales with high reliability and a sufficiently large number of items were estimated to have adequately high diagnostic value: *Efficacy* and *Media Factors*. It can be concluded that with the suggested type of improvement most of the scales of the CMC competence measure could reach an acceptable level of diagnostic value. This would enable this instrument to be used for the *measurement of individual differences* regarding overall CMC competence and related specific traits/skills. Having in mind that up to now this is the only *composite measure* of this kind in the field of interpersonal and mediated communication, it could be of exceptional importance for CMC-related self-assessment, education and training of the large population of internet users.

Since there is great potential to use the CMC competence measure for an educational purpose, the content of each scale was also evaluated on the basis of the informative value for *education and training in CMC competence*. A 1-5 point scale was used for the estimation of education value with the following labels for numerical categories: *very low* - 1, *low* - 2, *acceptable* - 3, *high* - 4, *very high* - 5. This evaluation is performed because the *theoretical CMC competence model* is well represented by the *scales* of the CMC competence measure and the self-assessment procedure is likely to make the respondent much more aware of diverse factors that influence his/her competent use of various *computer mediated channels and/or technologies* for interpersonal interactions. The estimated *educational value* of the scales included in the CMC competence measure is presented in *Table 1*. As can be concluded from data in *Table 1*, most scales have *high* or *very high* educational value, despite the poor *diagnostic value* of some of the rated scales. The presented estimates of the educational value of the scales (in *Table 1*) included in the CMC competence measure can be reviewed by visiting the website with the online version of this measure (see *Appendix A* for details).

In the second phase of *Study 1* the *items* from the selected scales of the CMC competence measure were factor analyzed to investigate possible *dimensions* or *underlying factors* of CMC competence. Factor analysis was not performed using the *total scores* of the scales that constitute the *first version* of the CMC competence measure because of the inadequate reliability (below .70) of most of the scales. The *items* from the following scales were selected for factor analysis (an abbreviation to denote scale items in *Table 2* is added after the scale label): Coordination *(COORD)*, Expressiveness *(EXPRE)*, Attentiveness *(ATTEN)*, Composure *(COMPO)*, Efficacy *(EFFIC)*, General Usage *(GENUS)*, Motivation *(MOTIV)*, Knowledge *(KNOWL)*, Coorientation *(COORI)*, Productivity/efficiency *(PREFF)*, Satisfaction *(SATIS)*, Appropriateness *(APPRO)*, Effectiveness *(EFFEC)*. Since the scales labeled *Contextual Factors*, *Message Factors*, *Media Factors*, and *Adaptability* have somewhat different forms of item wording/format than the previously listed scales, only the items from the previously listed scales were used for factor analysis. Therefore, most of the variables used for factor analysis were related to *Individual Factors* and *Outcomes* of the CMC competence theoretical model (see the earlier theoretical analysis and *Figure 1* for details). For each of the items/variables presented in *Table 2* the *item number* is added (as it appears in the paper-and-pencil form of the CMC competence measure) after the abbreviation for the scale label. Also, the items that are *reverse scored* are denoted with "R" in *Table 2* immediately after the item number. The variables without factor loading of .40 or above on at least one factor were omitted from *Table 2*.

A total of 78 variables that represented the items of selected scales of the CMC competence measure were factor analyzed with a principal component analysis and in the initial solution 24 components were found with *eigenvalues* above 1.0. However, a *Scree test* indicated that a factor solution with 4-5 factors should be preferred and, after *Varimax rotation* of factors, the four factor solution was found to be superior with respect to consistency and theoretical relevance of factors. This factor solution with four factors is presented in *Table 2*. The content of the items that load predominantly on the *first factor (F1)* is related to familiarity with CMC technology, or CMC literacy and adoption (e.g. the ability to learn how to use and to utilize CMC technology). The *second factor (F2)* is predominantly composed of variables/items that denote skillful CMC interaction. The variables/items that have the highest projection on the *third factor (F3)* are related to intensive use of CMC and motivation, as well as to dependency on CMC and socializing via CMC. Finally, the variables/items with highest loading on the *fourth factor (F4)* are mostly associated with dissatisfaction and frustration regarding engagement in CMC, and

also to ineffective or erroneous use of CMC. In addition, it must be emphasized that almost all of the items related to the fourth factor were reversely scored.

The following labels were assigned to the four uncovered factors: **F1** - *CMC technological literacy/adoption;* **F2** - *CMC interaction skill(s);* **F3** - *CMC dependency/motivation;* **F4** - *CMC (dis)satisfaction.* There is much resemblance between these uncovered factors and the components of the CMC competence model [25; 18, pp. 172-203] labeled *knowledge*, *skill*, *motivation*, and *outcomes* shown in *Figure 1* and thoroughly elaborated in interpersonal communication literature [28; 27; 26].

Since data on only 227 subjects were used for the factor analysis of 78 variables, another analysis was performed (*post hoc!*) with only 51 variables presented in *Table 2* to meet the criterion that the number of cases for factor analysis be at least five times greater than the number of variables. Again, a factor solution with four factors was produced that closely resembled the rotated factor structure in *Table 2*. It is concluded that a similar factor structure would very likely be found if comparative factor analyses were performed with larger sets of subjects, but this assumption still needs to be empirically verified.

Another test was performed using the variables/items that had the greatest projection (factor loading of .30 or above) on a specific previously uncovered factor (most of these variables are presented in *Table 2*). Such variables/items were factor analyzed separately for each of the four uncovered factors to investigate their possible subcomponents. In fact, as a result of these additional analyses it was found that the second factor *F2 - CMC interaction skills* is composed of two *subcomponents* that are commonly found in the structure of interpersonal competence and which can be denoted as (1) *communication effectiveness*, and (2) *other-orientation* (see: [3]). However, if the CMC competence model is used [25], these factors resemble the skills labeled (1) *composure*, and (2) *attentiveness*. The first of these subcomponents is associated with *effectiveness* in using CMC communication for attaining *self-directed goals*, while the second subcomponent could represent skills and behavioral orientations that are directed toward *relational goals* in CMC interaction. In other words, this finding is at least in partial concordance with the theoretical CMC competence model regarding the components of the *individual factors*.

Finally, close examination of the items in *Table 2* and of their abbreviations that denote the scales they originate from may indicate problems with *construct validity* of at least some of the scales of the 1997 version of the CMC competence measure. All of the uncovered factors in *Table 2* are comprised of items from diverse scales and it is possible that some sets of two or more scales from the CMC competence measure have common underlying factors. Also, it is possible that for several scales some items project on two or more *substantially different underlying factors* that are *not* in correspondence with the scale labels (e.g. related constructs).

Table 2: Results of factor analysis of items from selected scales of the CMC competence measure (version 1997; N=227; only factor loading above .30 is displayed)

| Abbreviation | ITEM (Factor label) | F1 | F2 | F3 | F4 |
|---|---|---|---|---|---|
| | **F1 – CMC technological literacy/adoption** | | | | |
| KNOWL50 | I am very knowledgeable about computer-based communication techniques. | .73 | | .33 | |
| EFFIC26 | I feel completely capable of using almost all currently available CMCs. | .65 | .31 | | |
| EFFIC27 | I am confident that I will learn how to use any new CMCs that are due to come out. | .63 | .32 | | |

| | | | | | |
|---|---|---|---|---|---|
| KNOWL53R | I generally can't diagnose or fix what the problem is when my e-mail doesn't work. | .63 | | | |
| EFFIC34 | I can almost always figure out quickly how to use a new CMC. | .62 | | | |
| EFFIC28R | I am nervous when I find I have to learn how to use a new communication technology. | .61 | | | |
| EFFIC37 | I usually master a new CMC before most of my friends or colleagues. | .61 | | | |
| KNOWL51R | I simply don't understand CMC hardware or software very well. | .59 | | | |
| KNOWL52 | I am very familiar with e-mail and communication networks. | .57 | | .32 | |
| SATIS27 | I am very satisfied with my communication abilities using computer media. | .56 | | | |
| EFFIC30 | My colleagues/friends look to me frequently for help with their CMC questions or needs. | .52 | | .34 | |
| EFFIC29R | I am generally the last person of friends and colleagues to adopt or purchase a new CMC. | .50 | | | |
| EFFIC33R | I find changes in technologies very frustrating. | .41 | | | |
| EFFIC25R | I don't feel very competent in learning and using communication media technology. | .40 | | | |

**F2 – CMC interaction skill(s)**

| | | | | | |
|---|---|---|---|---|---|
| COMPO19 | I display a lot of certainty in the way I write my CMC messages. | | .65 | | |
| EXPRE07 | I am very articulate and vivid in my CMC messages. | | .60 | | |
| COORI18 | My interactions using CMC are consistently accurate and clear. | | .57 | | |
| COORI17 | I get my ideas across clearly when I use CMC. | | .57 | | |
| ATTEN13 | I send comforting messages to others when I sense they are down. | | .56 | | |
| ATTEN18 | I am skillful at showing concern for and interest in the person I'm conversing with in CMC. | | .54 | | |
| EXPRE12 | I am skillfully expressive in my CMC conversations. | | .54 | | |
| COMPO21 | I have no trouble expressing my opinions forcefully on CMC. | | .52 | | |
| COMPO24 | I am skillful at revealing composure and self-confidence in my CMC interactions. | | .50 | | |
| COORD06 | I manage CMC interactions skillfully. | | .49 | | |
| COORD04 | I am good at managing the timing of my CMC conversations with others. | | .41 | | |
| EFFEC36 | I generally get what I want out of my CMC interactions. | .33 | .40 | | |
| APPRO35 | My CMC interactions are always very appropriate to the relationship. | | .40 | | |

**F3 – CMC dependency/motivation**

| | | | | | |
|---|---|---|---|---|---|
| GENUS42 | I am a heavy user of computer mediated communication. | | | .69 | |
| MOTIV48 | I look forward to sitting down at my computer to compose messages. | | | .65 | |

| | | | | | |
|---|---|---|---|---|---|
| PREFF21 | I get a tremendous amount accomplished through CMC. | | | .65 | |
| GENUS40 | I use computer-mediated means of communication almost constantly. | | | .61 | |
| GENUS39 | I rely heavily upon my CMCs for getting me through each day. | | | .58 | |
| GENUS41R | I can easily go a week without any CMC interactions. | | | .58 | |
| MOTIV46R | I am not very motivated to use computers to communicate with others. | | | .57 | |
| MOTIV44 | I enjoy communicating via computer media. | | | .52 | |
| MOTIV49 | I like tinkering with options to make my CMC messages more effective. | | | .51 | |
| EFFIC31 | I spend a lot of time just exploring CMCs just to see what I can do with them. | .33 | | .48 | |
| PREFF24 | I am more efficient using CMC than other forms of communication. | | | .48 | |
| GENUS43R | If I can avoid using a computer for communicating, I do. | | | .45 | |
| PREFF23 | My CMC interactions are more productive than my face-to-face interactions. | | | .45 | |
| EFFIC32 | I am excited by the prospect of getting and learning new CMCs. | | | .45 | |

**F4 – CMC (dis)satisfaction**

| | | | | | |
|---|---|---|---|---|---|
| EFFEC37R | I find most of my CMC conversations frustrating. | | | | .63 |
| PREFF26R | I end up wasting a lot of time trying to get things done on CMC. | | | | .57 |
| COORI19R | My projects are often screwed up because the medium is too restrictive. | | | | .54 |
| SATIS30 | My CMC conversations are very satisfying. | | | | .50 |
| KNOWL54R | I never seem to know how to say things the way I mean them using CMC. | | | | .49 |
| SATIS28R | I don't enjoy my CMC relationships as much as I would like. | | | | .48 |
| APPRO34R | I often end up saying things in CMC that turn out to offend the other person. | | | | .47 |
| MOTIV45R | I get nervous using CMC. | | | | .46 |
| PREFF22R | I spend more time learning about and fixing CMCs than actually using them. | | | | .44 |
| PREFF25R | Communication media often don't allow me to get my work done. | | | | .44 |

## STUDY 2

The second study of the CMC competence questionnaire used the version of this measure that was developed by Spitzberg in 2002. This is a substantially improved version of the previous instrument developed in 1997, with a more *consistent form* of items in different scales and with a more *homogenous item content* in each scale. This new version of the CMC competence measure consists of 90 items that are distributed in 15 scales. Not only were the inadequate items from the scales of the earlier version of the CMC competence measure excluded from this new version of the instrument, but novel items

were added to some scales, and reverse scoring was avoided throughout the measure. Furthermore, the subjects responded to items in all of the measurement scales using a 1-5 point response scale (1 - *"totally untrue"*, 2 - *"mostly untrue"*, 3 - *"neither true, nor untrue; undecided"*, 4 - *"mostly true"*, 5 - *"totally true"*) that was somewhat different from the response scale of the earlier version of the measure.

The new version of the CMC measure was administrated online (see *Appendix B* for details on the online version of the instrument) in June 2003 to 62 Croatian college students. The subjects were first-year college students, aged 18-21, and about 3/4 of them were male. The subjects participated voluntarily and anonymously in this study. All of the subjects were internet users and were tested in a group environment on equal hardware and software configurations of personal computers that were connected to the college server. This second study was devoted only to *preliminary analysis of scale reliability* of the new version of the CMC competence questionnaire developed by Spitzberg in 2002. Other data analyses were not performed because of the insufficient number of subjects that were available for group testing. Furthermore, after inspection of the raw data collected during the online administration of the questionnaire, it was found that about 40% of the subjects did not complete the questionnaire or provided obviously erroneous responses. Therefore, only data collected from 38 subjects remained for the calculation of scale reliability. Because of the relatively small number of items in most of the scales of the new version of the CMC competence measure, it is estimated that, despite the lack of subjects in *Study 2*, the reliability calculations based on the *Cronbach alpha coefficient* could provide an initial insight into the improvements that were realized in relation to the earlier version of this measure.

As can be observed in *Table 3*, the reliability of most of the scales of the new CMC competence measure has substantially improved, and all of the scales, except scale *General Usage*, were found to have the *Cronbach alpha* type of reliability (e.g. *internal consistency*) above the critical point of .70. This enables the scales to be used for the investigation of CMC-related interaction processes, as well as for the testing of *concurrent validity* (e.g. correlation with other measures of CMC-related phenomena and interpersonal communication), *predictive validity* (e.g. prediction of intensity and effectiveness in various forms of CMC-related behavior), and *construct validity* (e.g. confirmation that a specific scale measures the designated phenomena). However, the *diagnostic value* of a self-assessment measure depends not only on reliability or internal consistency, but also on the *potential to discriminate between subjects* with a different level of measured trait/skill. This cannot be performed with sufficient precision when a scale consists of a small number of items, since the distribution of test scores is too narrow, and a response to only one item or a small number of items can create too much difference for an accurate appraisal of the score of an individual subject. It must be noted that *norms* can be developed only when there is an adequate distribution of scores to compare the individual score to the standardization sample.

The estimated *diagnostic value* of the new version of the CMC competence measure is presented in *Table 3*. This improved measure also has numerous self-assessment scales (most of them with a good theoretical foundation) for the measurement and analysis of CMC-related behaviors, and the enhanced diagnostic value of the scales could multiply the potential for *practical use* of this instrument. As can be concluded from the comparison of data in *Table 1* and *Table 3*, the *diagnostic value* of the scales has improved predominantly because of increased reliability. Still, for each scale of this improved version of the CMC competence measure three categories of possible actions were suggested to further increase diagnostic value (see *Table 1*): adding new items (I+), excluding poorly performing items (E), and substitution of acceptable items with more construct-related items (S).

The estimated *educational value* has also improved for some of the scales (compare *Table 1* and *Table 3*) and this could be attributed to the greater *homogeneity* and *face validity* of the scales after the exclusion of inadequate items from the earlier version of this measure, as well as because of the rephrasing of items to avoid reverse scoring.

Finally, the problems related to the *online application* of the CMC competence measure must also be addressed. A substantial percentage of subjects did not complete the measure or they provided obviously inadequate responses. This may indicate that applying as much as 90 items online may be in discrepancy with the motivation and expectation of some subjects regarding their typical online behavior. Some of the subjects may prefer much briefer versions of online questionnaires or surveys. However, a reduction in the number of items is opposed to the need to increase the diagnostic value of scales. This problem could be resolved by (a) excluding the theoretically or practically less relevant scales from the measure, (b) by splitting the CMC competence measure in 2-3 parts, (c) by providing immediate feedback or other potentially motivating information to subjects after each scale is administered online, or (d) by enabling subjects to respond only to those scales that they prefer or that they are interested in.

Table 3: Scale labels, number of items in a scale, reliability, and evaluation of the of the new version of the CMC competence questionnaire (developed by Spitzberg in 2002; N=38)

| Scale label | Number of items | Reliability in Study 2 | Action to improve diagnostic value | Estimated value (1-5) | |
|---|---|---|---|---|---|
| | | | | Diagnostic | Educational |
| Motivation | 6 | .85 | I+, S | 4 | 4 |
| Knowledge | 6 | .90 | I+, S | 4 | 5 |
| Coordination | 6 | .78 | I+ | 4 | 5 |
| Expressiveness | 6 | .74 | I+ | 4 | 5 |
| Attentiveness | 6 | .82 | I+ | 4 | 5 |
| Composure | 6 | .88 | I+ | 4 | 5 |
| Efficacy | 10 | .85 | S | 5 | 4 |
| General Usage | 5 | .65 | I+ | 3 | 5 |
| CMC Interactivity | 8 | .87 | I+ | 5 | 5 |
| Task Orientation | 6 | .77 | I+ | 4 | 5 |
| Appropriateness | 5 | .87 | I+ | 3 | 5 |
| Effectiveness | 5 | .85 | I+ | 3 | 4 |
| Satisfaction | 5 | .78 | I+ | 3 | 4 |
| Co-orientation | 5 | .80 | I+ | 3 | 4 |
| Productivity/ efficiency | 5 | .72 | I+ | 3 | 4 |

## 4. APPLICATION OF THE CMC COMPETENCE MODEL IN EDUCATION

Computer mediated communication (CMC) is an important means for *interpersonal interaction* in the private and professional life of internet users. However, despite several attributes that make *e-mail* superior to the use of the *telephone* [6], this form of CMC requires much more *technical competence* and *communication skill*. In many aspects the rules of *written communication* may be found to apply to e-mail (and instant messaging), but the *frequency* and *synchronicity* of interaction episodes in electronic communication are much greater than when *"snail-mail"* is used, e.g. the internet creates a very different

communication task environment. Even though internet-based communication is highly ranked in relation to other communication channels (including *face-to-face*) when it comes to fulfilling various *specific communication needs* [9], it is generally rated as inferior in terms of the broadly-defined competence criteria of *effectiveness* and *appropriateness* in relation to face-to-face and the telephone as channels for interpersonal communication [32]. Therefore, having in mind the statistics on worldwide internet adoption, importance should be given to assessment and education that is directed toward competence in CMC.

The previously examined measure of CMC competence developed by Spitzberg in 2002 (see *Study 2*) may provide effective means for assessment and self-evaluation. However, greater *personal awareness* of one's competence level in this form of communication does not necessary imply the advancement of effectiveness or appropriateness in its use. Therefore, let us now briefly examine how the theoretical framework for CMC competence developed by Spitzberg [25] may be tailored for education/training for greater CMC competence.

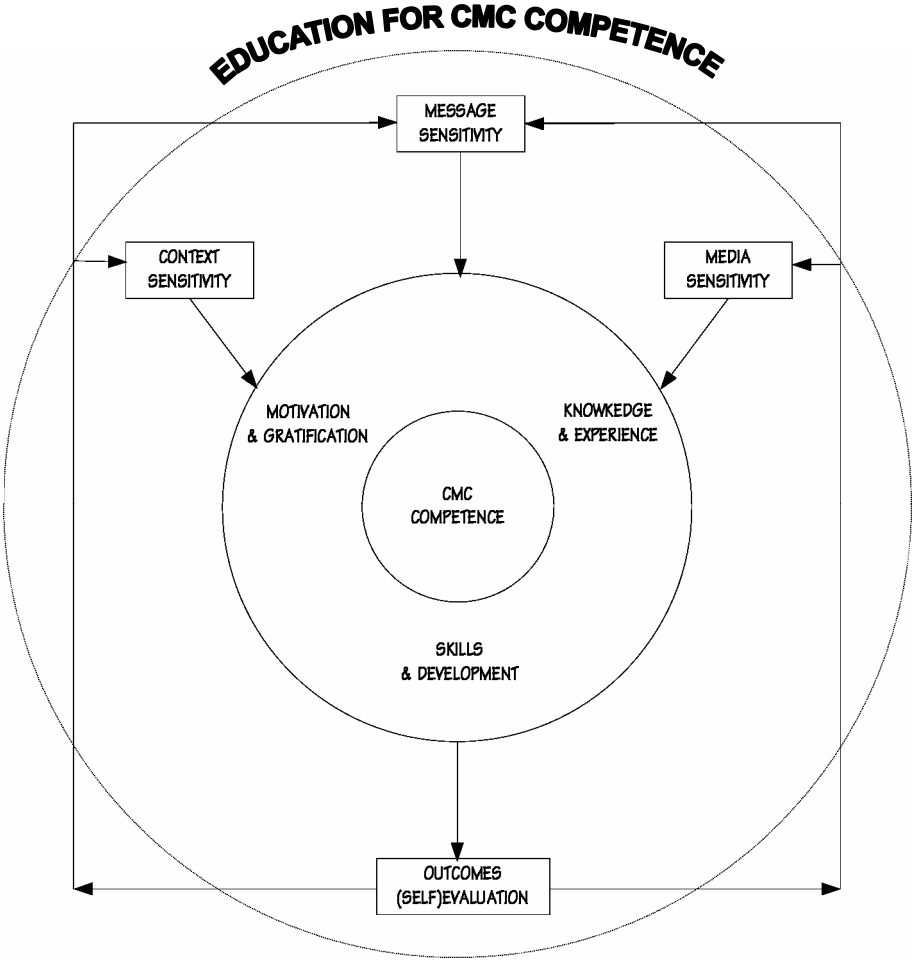


Figure 2: Means for advancing education/training for CMC competence (modeled after Spitzberg, 2004)

Computer literacy, insight into the CMC-related processes, netiquette type of rules, and practice in internet use for interpersonal communication are some of the factors that may increase the *Knowledge & Experience* component (see *Figure 2*) of education for CMC competence/literacy. There should be no doubt that knowledgeable and experienced users would be more frequently online and more effective in the use of CMC for interpersonal interaction (confirmation regarding training the elderly for internet use can be found in [5]). In fact, a significant correlation was recently reported between the *knowledge* construct of the CMC competence scale and *e-mail fluency* [4].

There are diverse factors that influence *motivation* for internet use or *internet affinity* [3]. The *Motivation & Gratification* component of education for CMC competence (see *Figure 2*) may be influenced by positively and negatively valenced factors. While *negative motivation* (caused for example by *internet anxiety*; see: [33]) could be reduced by solving the problem of insufficient knowledge/skill and inadequate internet access, *positive motivation* could be stimulated by insight into and exploration of the *potential benefits and satisfaction* from engaging in various online activities (for diverse types of online activities see: [20; 21; 30, p. 31]).

The *Skills Development* component of education for CMC competence (see *Figure 2*) is probably the most important factor for the advancement of individual effectiveness and appropriateness in *mediated social interaction*, alongside *knowledge/literacy* regarding the involved *medium* and the mediated *process*. Social skills training may imply diverse forms/methods/programs and could be based on divergent theoretical approaches [23]. Also, the list of basic CMC competence-related skills (e.g. *attentiveness*, *composure*, *coordination*, and *expressiveness)* that were outlined in this paper may need to be supplemented with at least a few other more specific interpersonal skills like *social support* and *interaction management* [31], as well as *impression management* and *self-disclosure* [2]. In any case, with the prevailing use of the internet, CMC competence could be found to significantly intersect with the general concept of social skill, at least for those who regularly engage in such a form of mediated interpersonal interaction.

*Outcomes Evaluation* is a proposed component of education for CMC competence (see *Figure 2*) that considers competence in CMC not only as a *state* or *trait* type of phenomenon, but as an *evolving process* emerging in sequences of technologically-mediated social interactions in which the actor incrementally gains additional knowledge and increases the level of skill on the basis of feedback he/she receives through the perceived effects or consequences of previously produced specific communication behaviors in a given social and technological environment. Both *knowledge of performance* and *knowledge of results*, as forms of performance *feedback*, are important factors in the development of skillful behavior [11]. Feedback effects in CMC may increase not only *knowledge and experience*, but also incite and assist *skill development*, and stimulate *motivational factors* like *gratification* from CMC experience. Clearly, knowledge of the criteria of CMC outcomes and the (self)assessment of *appropriateness*, *effectiveness*, *coorientation* and *satisfaction* in the performed CMC interactions may positively influence CMC competence. However, the *Outcomes Evaluation* component of education for CMC competence may relate to context, media and message factors.

*Media Sensitivity* is also suggested as a necessary component of education for CMC competence (see *Figure 2*), and is defined as the awareness of different characteristics of communication media that affect *how* and for *what purpose* a medium is used to perform specific communication acts that could be judged both as *appropriate* and *effective* in achieving *explicit* and *implicit* communication objectives [18, p. 178]. *Media Sensitivity* is related to optimal medium choice for diverse interpersonal tasks (see: [32]) and is affected by *medium factors* like *interactivity*, *adaptability* and *efficiency* [25]. Other factors that should influence medium choice and pattern of use are typical media attributes like

*richness*, *speed*, level of *social presence*, and *accessibility*. Education and training in *Media Sensitivity* may include methods that positively affect *motivation*, *knowledge* and *skills* as aspects of CMC competence, as well as the use of the component *Outcomes Evaluation*, since performance feedback when different media are used can induce improvement in *Media Sensitivity*.

*Context Sensitivity* is a component of education for CMC competence (see *Figure 2*) directed toward awareness of diverse factors like culture, time, relationship, environment, and function of interaction, as well as toward *motivation*, *knowledge* and *skills* that facilitate the optimization of communication goal(s), means, medium choice, and message(s) in accordance with the specific contextual attributes of interaction. Context influences how the message is perceived/understood and plays an important role in the proper reception and production of messages in CMC.

Messages differ in relation to various content elements, e.g. they can be more *task-oriented/aloof*, or more *personal/emotional*. Also, their content may differ in *openness/sincerity*, and also vary in *quantity* and *complexity*. In CMC it is important to craft the *outgoing* message to the attributes of the communication channel and receiver(s), and also to decipher the *incoming* message bearing in mind both the channel and sender features. Some of the related elements are present in *netiquette rules* for different forms of CMC that can be found on many locations on the World Wide Web (i.e. [12]). These factors constitute *Message Sensitivity* as a component of education for CMC competence (see *Figure 2*). Like *Media Sensitivity*, both *Message Sensitivity* and *Context Sensitivity* can be positively influenced by *Outcomes Evaluation*.

Communicative *adaptability* is the ability to adapt one's communicative behavior to the physical, relational and social context. *Communicative adaptability* and *communication flexibility* are observed as central qualities of competent communication [8; 16]. Therefore, *Outcomes Evaluation*, *Media Sensitivity*, *Context Sensitivity*, and *Message Sensitivity* should be observed as elements of *adaptability in CMC*, and as important components of education for CMC competence.

## 5. CONCLUSION

With the growth of the worldwide internet population, much importance is placed on the *theoretical analysis* of CMC, the *assessment* of CMC-related skills and traits, and *education* for competence in CMC. The recently developed theory of CMC competence [25; 18, pp. 172-203] can serve all three purposes, as demonstrated in this paper. It goes beyond the description of phenomena to develop a theoretical framework that can at least partly bridge interpersonal and media-oriented approaches to CMC. Together with a brief overview of the CMC competence theory, a detailed analysis is presented in this paper of the evaluation of two versions of a CMC competence measure developed by Spitzberg in 1997 and 2002. As can be concluded from *Table 1* and *Table 3*, the last version of this measure is a *considerably improved* assessment instrument that can be used for *education/training* in CMC, *scientific research* of CMC-related phenomena, and also, to some extent, for the *diagnostic purpose* of CMC competence measurement. However, it is important to further evaluate the measure in relation to various types of *construct validity* (as it has been to some extent performed by Buntz [4]). It must be noted that the prototypes of both versions of the CMC competence measure are accessible online (see *Appendix A* and *Appendix B)*.

Several comments are necessary concerning the *paper-and-pencil* versus the *online form* of the CMC competence measure. Despite the potential problems with online research data collection using a questionnaire, numerous potential benefits are available as well, especially when a questionnaire generator is used to speed up the application-building

process and reduce the cost of putting the questionnaire online (for details see [7]). However, a considerable proportion of the subjects in *Study 2* did not complete the questionnaire and some evidently responded to items in an erroneous manner. This implies that a careful observation of data collected online is necessary before statistical analysis is performed and that incomplete or potentially invalid records should be excluded from data analysis. Also, questionnaires with too many items may not perform well online and there should be some way to motivate subjects to properly complete a questionnaire that needs more than 5-10 minutes of their time and effort.

Perhaps the most intriguing empirical findings of this paper are presented in *Table 2* and in the discussion on the uncovered factors of CMC competence. The results of the factor analysis that are displayed in *Table 2* may not correspond much with the preliminary categorization of items into the scales of the *first version* of the CMC competence instrument, but they fit well into the *theoretical background* that initiated the scale development. In fact, the *knowledge*, *motivation*, and *skill* components of the elaborated theory of interpersonal communication competence [28; 27; 26] may have been to date most clearly empirically revealed (in a factor analysis) by the three uncovered factors in *Table 2* labeled *CMC technological literacy/adoption, CMC dependency/motivation,* and *CMC interaction skill(s).* Finally, the fourth factor labeled *CMC (dis)satisfaction* at least partly corresponds to the *Outcomes* component of the CMC competence theoretical model (see *Figure 1;* [25]). These four factors are important for educational efforts to increase CMC competence. They also broadly correspond to the results of factor analysis of *internet affinity* related variables in a study performed at a more mass-communication level [3] that also revealed factors related to knowledge/skills (e.g. *technological readiness*), motivation (e.g. *media content and associated needs of users*), and (dis)satisfaction (e.g. *confidence in the medium*).

It can be concluded that *computer literacy* is not the only educational imperative for those who are going to participate in the information society. Also important is the ability to *socially interact by novel technological systems* that seem to converge in a blend of computer technology, multimedia, and high bandwidth (wireless) telecommunication. Therefore, an effective theory in this domain may need to account both for the mediated interpersonal/social processes, as well as for the growing change in the technological milieu in which these processes take place.

## REFERENCES

[1] Bubaš, G. (2003): The structure of agency and communion dimension in interpersonal communicative interaction, In A. Schoor, W. Campbell, M. Schenk (Eds.), *Communication Research and Media Science in Europe*, Mouton de Grouyter, Berlin, Germany, 459-475.

[2] Bubaš, G. (2001): Computer mediated communication theories and phenomena: Factors that influence collaboration over the Internet, *3rd CARNet Users Conference*, Zagreb, Croatia, Retrieved June 30, 2003, http://www.carnet.hr/cuc/cuc2001/papers/b1.pdf

[3] Bubaš, G.; Hutinski, Ž. (2003): Conceptual model, empirically derived predictors and potential dimensions of Internet affinity, *53rd International Communication Association Conference*, San Diego, CA, U.S.A.

[4] Buntz, U. (2003): Growing from computer literacy towards computer-mediated communication competence: Evolution of a field and evaluation of a new measurement instrument, *Information Technology, Education, and Society*, 4(2), 53-84.

[5] Cody, M.J.; Dunn, D.; Hoppin, S.; Wendt, P. (1999): Silver surfers: Training and evaluating Internet use among older adult learners, *Communication Education*, 48(4), 269-286.
[6] Dimmick, J.; Kline, S.; Stafford, L. (2000): The gratification niches of personal e-mail and the telephone: Competition, displacement and complementarity, *Communication Research*, 27(2), 227-248.
[7] Dumičić, K.; Sajko, M.; Radošević, D. (2002): Designing a Web-survey questionnaire using automatic process and a script langugage, *Proceedings of the 13th International Conference on Information and Inteligent Systems* (IIS 2002), Varaždin, Croatia, 281-292.
[8] Duran, R.L. (1992): Communicative adaptability: A review of conceptualization and measurement, *Communication Quarterly*, 40(3), 253-268.
[9] Flanagin, A.J.; Metzger, M.J. (2001): Internet use in contemporary media environment, *Human Communication Research*, 27(1), 153-181.
[10] Global Reach (2002): *Global Internet Statistics (by Language)*, Retrieved June 30, 2003, http://global-reach.biz/globstats/index.php3
[11] Green, J.O. (2003): Models of adult communication skill acquisition: Practice and the course of performance improvement, In J.O. Greene, B.B. Burleson, *Handbook of Communication and Social Interaction Skills*, Lawrence Erlbaum Associates, Publishers, Mahwah, NJ, U.S.A., 51-91.
[12] Hambridge, S. (1995): *Netiquette Guidelines*, Delaware Technical & Community College, Newark, DE, U.S.A., Retrieved June 30, 2003, http://www.stanton.dtcc.edu/stanton/cs/rfc1855.html
[13] Haythornthwaite, C.; Wellman, B.; Garton, L. (1998): Work and community via computer-mediated communication, In J. Gackenbach (Ed.), *Psychology of the Internet: Intrapersonal, Interpersonal, and Transpersonal Implications*, Academic Press, San Diego, CA, U.S.A., 199-226.
[14] Kim, J. (2003): Interpersonal interaction in computer mediated communication (CMC): Exploratory qualitative research based on critical review of existing theories, *53rd International Communication Association Conference*, San Diego, CA, U.S.A.
[15] Kvitka, C.; Cronin, S. (2003): *Simplify and Consolidate Enterprise Communications and Information with Oracle Collaboration Suite* [White Paper], Oracle Corporation, Redwood Shores, CA, U.S.A., Retrieved June 30, 2003, http://otn.oracle.com/products/cs/pdfs/cs_bwp.pdf
[16] Martin, M.M.; Rubin, R.B. (1994): Development of a communication flexibility measure, *Southern Communication Journal*, 59(2), 171-178.
[17] Microsoft (2003): *Windows Netmeeting*, Microsoft Corporation, Redmond WA, U.S.A., Retrieved June 30, 2003, http://www.microsoft.com/windows/netmeeting/
[18] Morreale, S.P.; Spitzberg, B.H.; Barge, J.K. (2001): *Human Communication: Motivation, Knowledge, and Skills*, Wadsworth/Thomson Learning, Belmont, CA, U.S.A.
[19] Nua (2003): *How Many Online?* Nua Internet surveys, Scope Communications Group, Dublin, Ireland, Retrieved June 30, 2003,
[20] http://www.nua.ie/surveys/how_many_online/
[21] Pew (2003a): *Daily Internet Activities* [Data compilation table], Pew Internet and American Life Project, Washington, DC, U.S.A., Retrieved June 30, 2003, http://www.pewinternet.org/reports/chart.asp?img=Daily_Internet_Activities.htm
[22] Pew (2003b): *Internet Activities* [Data compilation table], Pew Internet and American Life Project, Washington, DC, U.S.A., Retrieved June 30, 2003, http://www.pewinternet.org/reports/chart.asp?img=Internet_Activities.htm

[23] Ramirez, A., Jr.; Walther, J.B.; Burgoon, J.K.; Sunnafrank, M. (2002): Information-seeking strategies, uncertainty, and computer-mediated communication: Toward a conceptual model, *Human Communication Research*, 28(2), 213-228.
[24] Segrin, C.; Givertz, M. (2003): Methods of social skills training and development, In J.O. Greene, B.B. Burleson, *Handbook of Communication and Social Interaction Skills*, Lawrence Erlbaum Associates, Publishers, Mahwah, NJ, U.S.A., 135-176.
[25] Spinks, N.; Wells, B.; Meche, M. (1999): Netiquette: A behavioral guide to electronic business communication, *Corporate Communications: An International Journal*, 4(3), pp. 145-155.
[26] Spitzberg, B.H. (2004): Preliminary Development of a Model and Measure of Computer Mediated Communication (CMC) Competence, *Paper submitted to the Western Speech Communication Association 2004 Convention*, Albuquerque, NM, U.S.A.
[27] Spitzberg, B. H.; Cupach, W. R. (1984): *Interpersonal Communication Competence*, Sage, Beverly Hills, California, U.S.A.
[28] Spitzberg, B. H.; Cupach, W. R. (1989): *Handbook of Interpersonal Communication Competence*, Springer-Verlag, New York, U.S.A.
[29] Spitzberg, B.H.; Cupach, W.R. (2002): Interpersonal skills, In M. L. Knapp, J. A. Daly (Eds.), *Handbook of Interpersonal Communication*, Sage Publications, Thousand Oaks, California, U.S.A., 564-611.
[30] StatSoft (2003): *Electronic Statistics Textbook*, StatSoft Inc., Tulsa, OK, U.S.A., Retrieved June 30, 2003, http://www.statsoft.com/textbook/stathome.html
[31] U.S. Department of Commerce (2002): *A Nation Online: How Americans Are Expanding Their Use of the Internet*, Economics and Statistics Administration, National Telecommunications and Information Administration, Washington, D.C., U.S.A., Retrieved June 30, 2003, http://www.ntia.doc.gov/ntiahome/dn/
[32] Walther, J.B.; Parks, M.R. (2002): Cues filtered out, cues filtered in: Computer-mediated communication and relationships, In M.L. Knapp, J.A. Daly (Eds.), *Handbook of Interpersonal Communication*, Sage Publications, Thousand Oaks, California, U.S.A., 529-563.
[33] Westmeyer, S.A.; DiCioccio, R.L.; Rubin, R.B. (1998): Appropriateness and effectiveness of communication channels in competent interpersonal interaction, *Journal of Communication*, 48(3), 27-48.
[34] White, C.; Scheb, J.M. II (2000): Impact of media messages about the internet: Internet anxiety as a factor in the adoption process in the USA, *New Media & Society*, 2(2), 181-194.

## APPENDIX A

The first version of the CMC competence measure that was developed by Spitzberg in 1997 is available as a *prototype* of the online questionnaire (in the English language) at the web address http://www.foi.hr/~darados/skale/prikaz.cgi

This first version of the measure was adapted for online assessment by Danijel Radošević. The data collected on 227 subjects in 2002 (see *Study 1*) were used for *provisional norms* so that, after completion of the questionnaire, subjects can receive feedback about their responses to each scale of the measure (except for the *Adaptability* scale that is not available online). Because of the low reliability of scales of the first version of the CMC competence measure it is suitable *only for educational purpose*.

## APPENDIX B

The second version of the CMC competence measure that was developed by Spitzberg in 2002 is available as a *prototype* of the online questionnaire (in the Croatian language) at the web address http://www.foi.hr/~darados/skale2/prikaz.cgi

This version of the measure was also adapted for online assessment by Danijel Radošević. There are no provisional norms for this measure and, after completion of the questionnaire, subjects do not receive feedback about their responses to the scales of the measure. Because of the initially high reliability of scales of this second version of the CMC competence measure, it may be suitable for research and diagnostic purposes, and not only for an educational purpose like the first version of the measure. The responses of the subjects are available to researchers online for data analyses and this makes the measure available for scientific investigation wherever there is proper computer hardware/software and an internet connection.

**Received**: 17 December 2003
**Accepted**: 3 July 2004