Using a computer learning environment for initial training in dealing with social-communicative problems

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Abstract
The most widely practised instructional method for the development of interpersonal skills is role-play. Role-play is supposed to be a complex learning environment for novices to develop interpersonal skills. The learning environment is complex because of two factors. Firstly, the cognitive load is high during social-communicative problem solving because the execution of all steps has to be taken immediately in a goal-directed dialogue. Moreover, social-communicative problem solving is acted out in a play. A computer learning environment for initial training in dealing with social-communicative problems is suggested to simplify and facilitate learning. A learning environment with computer-based role-plays has been piloted and evaluated. Two experiments have been examined the effect of the learning environment on interpersonal skill development. The results are described. The main conclusion is that the learning environment is considered as having the potential to assist in realizing effective gradual lead-into interpersonal skill development and instruction for novices.

Introduction
Initial training in dealing with social-communicative problems
The use of role-play in interpersonal skills training is widespread. In order to develop interpersonal skills, the students need to solve social-communicative problems. The students are active and construct a sequence of necessary steps to reach a goal. From the information that is provided in advance and while being engaged in solving social-communicative problems, the students learn. For the solving of social-communicative problems, the students need to acquire knowledge and problem-solving procedures. The solution of a problem leads to the (re-)construction of social-communicative
knowledge and problem-solving procedures. A skill is learned and practised when this problem-solving behaviour is often used in complex learning environments like role-plays and real conversations.

But why is role-play supposed to be a complex learning environment for novices to develop interpersonal skills? This paper states that conventional role-plays are complex because of two factors. First, the cognitive load is high during social-communicative problem solving, because the execution of all steps has to take place immediately in a goal-directed dialogue. Second, social-communicative problem solving is acted out in a play. A play is complex for novices, because the data to be considered for a successful performance are often overwhelming. Further, novices may also fail to develop and practice the intended skills due to a lack of repeated exposures. Only few students can participate in any enactment in role-playing. It is supposed that complexity confuses novices and thus influences learning negatively.

A computer learning environment with computer-based role-plays, is designed and developed which simplifies novices’ initial training in dealing with social-communicative problems. Simplification is described as an efficient strategy for lessening the cognitive load in conventional role-plays. It entails the development of expertise, firstly by simple yet representative kinds of social-communicative problems to solve. The issue is how to alter and simplify the solving of social-communicative problems more than in conventional role-play, in order to facilitate learning.

In computer-based role-plays, the interaction between the role-players took place on two physically separated but electronically joined computers. The processes of sending and receiving messages occurred through typewritten text in a text-window and bubbles on the computer screen. This dialogue-screen is depicted in Figure 1. The messages were exchanged by Local Talk Network after clicking on a send-button.

For training purposes, the choice of the use of only computer-based role-plays is not advisable. It is suggested to use the program as a gradual lead-in to role-play. Empirical support for the effect of computer-based role-plays on the development of interpersonal skills is given. This paper ends with conclusion and discussion.

*High cognitive-load during solving social-communicative problems*

The students must learn to solve social-communicative problems. Problem solving refers to the activities that are performed by a student in a particular situation in order to reach a goal that deviates from the current situation (VanLehn, 1989). The cognitive-load is high during social-communicative problem solving because (a) social communicative problems are ill-defined, (b) the execution of all steps has to start immediately and (c) the steps are executed in a goal-directed dialogue.

Firstly, most social-communicative problems are ill-defined problems (eg, Greeno, 1978; Simon, 1973; Voss, 1990) because: (a) Defining the problem requires more information than is initially available; (b) the nature of the problem unfolds over time; (c) there
Figure 1: The dialogue screen with a conversational model for the fifth role-play to practice
is not just one right way to get that information; (d) as new information is obtained, the problem changes; (e) decisions must be made in the absence of definitive knowledge; (f) there may never be certainty about having made the right decision; and (g) the problems have an ill-defined goal state (ie, several acceptable solutions exist) and an ill-defined initial state (ie, it is not clear which information is relevant to the solution of the problem).

Secondly, the main processes in most social-communicative problems share certain similarities. The process of solving social-communicative problems includes a number of necessary steps in a certain sequence. These steps are (a) gathering relevant information from the other, (b) analysis of the present circumstances, (c) reconstructing the problem history, (d) setting goals for interpersonal interaction, (e) listing of possible solutions, (f) selecting the solution which is most satisfactory and (g) performance of the interpersonal skill(s) by executing a sequence of steps to achieve those goal(s). The last step (g) is an essential and complex step dominating all other steps. All steps have to be executed immediately. For example, in some instances, an open question (“Could you tell me more?”) may be most appropriate, another time, it may be more useful to reflect feelings (“Looks like you feel terribly upset over the situation with Bob”). Again, there are other times when direct advice may be what is needed (“I suggest you try.”).

Thirdly, in order to solve the problem, the steps are executed in a goal-directed dialogue. The novices are engaged in a conversation. A dialogue involves at least two persons. The goals of the persons engaged in the dialogue are important. Not only the novices’ own goals are pursued, but the goals of the other person participating as well. If these goals concur, this will facilitate social interaction, but if they conflict, interaction can become more difficult. The mediating factors, such as cognition, feelings and emotions, are also important in the interactions. They affect the way the other is perceived and responded to. The dialogue takes place in a rich referential field. Personal factors, like age, background, affect the interaction. For these reasons, Kass, Burke, Blevis and Williamson (1993, 1994) categorise interpersonal skills as complex. Their main criteria for such a label is that the task is not transparent (ie, the important variables are not immediately observable).

The performance in a play
In role-play, students are quite literally “thrown into” their first role-play with a long list of situation- and role-descriptions, caveats, and concepts of the problem involved. Students are expected to sort out all this information, take their roles and act effectively in the play. Novices are overwhelmed by data and therefore often find their first role-play confusing (Kessels and Smit, 1990). They frequently have trouble in defining their own role and in getting the “significant other” (eg, client, patient, other professional) to talk.

Further, the play may also fail to build the intended skills due to a lack of repeated exposures. Only a few students can participate in any enactment in role-playing. The
other students listen and observe the play. Playing a role a few times does not build up a skilful performance (Georges, 1989). Moreover, it is assumed that the human mind has a limited cognitive processing capacity. The importance of preventing memory overload is emphasised (eg. Schneider, 1985). Students can only process seven plus or minus two bits of new information at a time.

**Using a computer learning environment for initial training**

Holsbrink-Engels (1998) designed and developed a computer learning environment for initial training of the interpersonal skill “Telling bad news”. The social-communicative problems had to be solved in a computer-based role-play (see Figure 1). A computer learning environment, computer-based role-plays with two instructional strategies the use of a conversational model and opportunities for reflection has been piloted and evaluated.

Four social-communicative problems had to be solved in computer-based role-plays. The “telling bad news” problems provided different real-world conversations to realise variable performance. The following interpersonal problems were presented. Tell another person that (a) he/she has been turned down for a trip to Australia, (b) his/her report is rejected, (c) he/she has to accept another (lower) position because of reorganisation, and (d) he/she has to accept another (lower) position because of personal dysfunctioning.

For each role-play the following six stages occurred: (1) an introductory computer-screen with a picture of the building where the conversation should take place; (2) a text-screen with a description of the social situation; (3) a text-screen with a description of the role; (4) a dialogue-screen for role-playing (typing and reading messages); (5) a print-screen to make a printout of the dialogue, and (6) debrief the dialogue by the printout. After finishing the first role-play, the same six stages occurred for the second role-play and so forth. Two video examples were given before practising the role-plays.

The instructional-design strategy regarding the use of a conversational model indicates that instruction should offer practice in the solving of interpersonal problems under guidance of a conversational model. Adequate solving of social-communicative problems depends on the sequence of the execution of the necessary steps to solve the problem. The instructional-design strategy, the use of a conversational model, focuses the attention on the necessary steps to solve social-communicative problems. A conversational model should explicitly specify the problem solution. In Table 1, the conversational model of the interpersonal skill “telling bad-news” used in the current study is presented.

The use of a conversational model was realised in two ways. First, before role-playing each student studied a description of the interpersonal skill with a conversational model. Second, during computer-based role-playing, the conversational model was in view at all times and was shown on the screen next to the current section the student was working on.
Table 1: A conversational model for telling bad news: six actions for the bearer more closely examined through an example

<table>
<thead>
<tr>
<th>To tell bad-news, the bearer must:</th>
<th>An Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tell the bad-news straight away after a short introduction STOP and wait for the receiver’s reaction.</td>
<td></td>
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</tbody>
</table>
Peter: Brenda, you wanted to see me.  
Brenda: Yes Peter, let’s sit over there.  
Uh Peter, I have to tell you something you will certainly dislike. Your application for group manager has been dismissed. (wait)  
Peter: What?  
Brenda: The reason for the dismissal is that the staff has decided that we should get someone well educated in computerization. |
| 2. Listen and reduce frustration – by reflections, – repeat the bad-news. |  
Peter: Just a moment, Brenda. You are telling me that I am not an eligible group manager, whereas I have been a substitute for ten years.  
Brenda: Peter, I can understand your indignation very well. The decision to dismiss you has been taken after much deliberation.  
Peter: Yes? |
| 3. Give necessary background information. |  
Brenda: But let me explain why this decision has been taken, what the backgrounds are.  
Peter: Uhum.  
Brenda: Peter, it is very urgent for our department to become computerized. The longer we ignore this, the more our monthly backlog increases. We need a manager with practical experience; very much experience in the field of computerization. Well, these job-requirements have priority over seniority or familiarity with the current job. They choose Sylvia van der Meer of the main office. |
| 4. Listen and reduce frustration again. |  
Peter: You can’t be serious! It was almost certain that I would get the job.  
Brenda: I get your reaction very well because you did well in running for the appointment. That’s true. I myself have nominated you, but the staff has decided on someone else.  
............................................  
Peter: Yes, and sorry to have troubled you, Peter and pick up your current job in a motivated way. Now, I have had enough and I quit. There now!  
Brenda: Yes Peter, I understand your reaction. You are angry, disappointed. Your prospects are at stake. You have doubts about your motivation to carry on.  
Peter: Yes, yes, yes, are you surprised?  
Brenda: But I really hope you do not turn into a sulk or become frustrated or unmotivated. Peter, our teamwork is close and good. I would like to continue in spite of this adversity.  
Peter: Well now, that is easy to say.  
Brenda: Yes, you are right. But I mean what I say. (Silence) |
The instructional-design strategy regarding opportunities for reflection indicates that instruction should offer students enough time to consider their actions by conscious use of analytical reasoning and planning. Opportunities for reflection were realised in several ways. Students can revise each message (delete and make corrections) and determine when the next messages is exchanged (no or less pressure to respond quickly). Further, it was possible to read back the dialogue, the descriptions of the social situation, and the description of the role. Students could answer questions on the application of the conversational model (reflection-stimulating questionnaire before “running the computer-based role-play”) and their performances (reflection-stimulating questionnaire after “running the computer-based role-play”). Looking for empirical support for computer-based role-playing, two experiments have been conducted to explore and evaluate the usefulness of the learning environment. The results of both experiments are reviewed in the next sections.

Experiment 1: Practice with and without computer-based role plays
A first experiment (Holsbrink-Engels, 1997a) examined the effect of the learning environment on the development of interpersonal skills. The learning environment involved: (a) the use of a conversational model, (b) providing opportunities for reflection, (c) offering individual training and (d) capturing individual contribution and learning. It enabled individual training by running as many simultaneous role-plays for each student as possible. It provided also opportunities to control what is learned and the order in which it is learned by offering record-keeping facilities for monitoring and recording the contributions of individual students (logfile registration).
To explore and evaluate the learning environment, an experiment was conducted in which one group received an instructional program with the use of computer-based role-plays. The program simultaneously provided each student with four different role-plays. These plays involved different conversations, which allow students to practice. Students had access to the printouts of the dialogues of each role-play. A control group also received an instructional program without computer-based role-plays. Both groups were studied with regard to their effects on learning outcomes.

Method experiment 1

A pretest-posttest control group design (Cook and Campbell, 1979) was used to evaluate learning outcomes. Both groups received a pre- and post-test. All 41 subjects were students at the University of Twente and were paid for their participation in the present experiment. There were 24 females and 17 males with a mean age of 21 years (ranging from 18 to 28 years of age). Students were randomly assigned to one of both groups and individually tested.

All sessions took place in a computer class equipped with a network of six (two groups of three) Macintosh personal computers. The students were told to work individually, in their own way, and at their own pace. The same two experimenters, final-year students in Instructional Technology who had attended interpersonal skills training, conducted all sessions. They had two conversations at the same time. All procedures were identical for both groups. The experiment consisted of eleven sessions of four students and two experimenters. Separate seating prevented interactions between the two groups. Learning outcomes were measured by three pre-and post-tests with logfile registration. All tests were performed individually. Tests two and three were identical in the pre- and post-tests. The individual answers given in these tests were checked against a scoring key and one point was assigned for each correct response.

The first pre- and post-test, the Performance in a Computer-Based Role-Play, consisted of two social-communicative problems. The problems were to tell another person that he/she (a) has to move from The Hague to Maastricht to keep his/her job, and (b) has to move to Atlanta for a year to keep his/her position. The two problems were counterbalanced, so that half of each group received problem (a) and the other half problem (b) in the pre-test and reversed in the post-test. Prior to the experiment, a coding plan was developed based on the technique of protocol analysis (Ericsson and Simon, 1980, 1984; Nisbett and DeCamp Wilson, 1977). The coding plan consisted of 31 dichotomy items concerning the presence or absence of concrete typed messages in the printouts of the conversation. An item was for instance, “announces the bad-news after a short introduction: Yes or no”. Scores on 31 items were added together for each student, so the maximum possible score obtainable on the first tests were 31. High scores represented high conversation skills.

The second pre- and post-test, the Knowledge Test, contained six open questions about essential characteristics of the interpersonal skill. For instance, telling bad-news is called a closed conversation. Why? Give the answer and click on OK. The maximum
possible score obtainable on the knowledge test was six. The third pre- and post-test, a Classification Test, consisted of ten yes-no questions. The students had to classify whether a conversation is a bad-news conversation or not. For instance, Els expects to have a business trip to Mexico. It is decided that her colleague will take this trip. You tell Els. In the case of a bad-news conversation, click on yes. In the case of another conversation-type, click on no. The maximum possible score obtainable on the classification test was 10.

Results experiment 1

Figure 2 showed the mean scores on the three pre- and post-tests. The differences on the pre-test scores were not statistically significant. Wilcoxon Signed-Rank scores on the Performance Test for the role-play and the control groups were \( Z = -2.4 \) and \( Z = -2.6 \), both \( p < .01 \), and on the Knowledge Test \( Z = -3.6 \) and \( Z = -3.1 \), both \( p < .01 \). This shows that both groups improved significantly on the Performance Test and the Knowledge Test. The role-play group improved on the Classification Test \( (Z = -1.9, p < .05) \), but the control group cannot be shown to have done so \( (Z = -0.9, p < .35) \).

The difference score (score post-test minus scores pre-test) for both groups were analyzed by Mann-Whitney U-tests. The students of the role-play group performed better on the Knowledge- and Classification Tests. The difference on the Knowledge Test is significant, \( U(38) = 94.5, p < .01 \). The Classification Test showed a trend in the same direction, \( U(38) = 121, p < .10 \). The Performance Test had no significant effect on the condition \( U(38) = 165.5 \). The content of the exchanged messages contained factual information, reflections, several types of questions, expressions of emotions (mostly expressed between parentheses) and jokes.

Discussion experiment 1

In experiment 1, the results indicate that both programs are beneficial for the learning outcomes. The group with computer-based role-plays performed significantly better on the Knowledge test and tended also to do so in the Classification test. The Performance test showed no difference between the treatments. One major finding was that computer-based role-playing fosters interpersonal skills development by: (a) Practising the use of a conversational model, (b) offering opportunities for reflection, (c) performing four protagonists roles, and (d) capturing individual contribution and learning.

Experiment 2: Conversational model and reflection-opportunities

Within computer-based role-plays, the effects of two instructional strategies (the use of a conversational model and opportunities for reflection) on learning outcomes were studied. A conversational model informed students about the main moments and actions in conducting a bad-news conversation. Opportunities for reflection offered students enough time to consider their actions by conscious use of analytical reasoning and planning. Opportunities for reflection were realized by reducing the complexity of the problem situation and by diminishing time constraints of a real-life dialogue. For explorative reasons, the effect of sex as independent variable was studied too. Holsbrink-Engels (1997b) expected that the conversational model-present groups and the high
Figure 2: The main scores on the three pre- and post-test (A = Performance Test, B = Knowledge Test and C = Classification Test)
reflection groups would show more effective interpersonal skill development, knowledge acquisition, and a more complete understanding of the skill (better tests results) than the conversational model-absent groups and the low reflection groups.

Method experiment 2
A 2 × 2 factorial design was used, with Conversational Model (present (C+) vs absent (C–)) and Reflection-Opportunities (high (R+) versus low (R–)) as independent variables. The dependent variables were learning outcomes. Subjects were 120 students (67 females and 53 males) and five substitute students (three females and two males, explained later) from the University of Twente with a mean age of 21 years. Students were stratified by gender to ensure proportional representation and randomly assigned to couples of two in one of four instructional treatments (R+C+ = 30 (17 females and 13 males), R+C– = 30 (17 females and 13 males), R–C+ = 30 (17 females and 13 males), R–C– = 30 (16 females and 14 males)) and tested individually. The students were paid for their participation in the experiment (30 Dutch guilders, approximately $18).

All 104 students received training existing of information about and video examples of the skill “telling bad news”, four computer-based role plays and feedback. The students were, -in duos- based on two dichotomies, divided over four conditions. The learning outcomes were measured using the same three post-tests with small modifications in the first experiment (Performance in a role-play, Knowledge test, Classification test) and a new developed Conversation-sequence test. The fourth post-test, Conversation-Sequence Test, contained a social-communicative problem. The problem was to tell another person to stay in Bolivia instead of returning to the Netherlands to keep his job. This test asked students to place six pronounced sentences of the protagonist in a right conversation sequence. The number of sentences each sentence correctly proceeded was counted. One of the 15 items was for instance, “Are the sentences six-four-two correctly ordered”. Each item was worth one point. So, the maximum possible score obtainable on the Conversation-Sequence Test was 15.

Results experiment 2
The mean scores for the learning outcomes are displayed in Figure 3. MANOVA revealed a significant interaction between Conversational Model and Reflection Opportunities, $F(4,91) = 2.69$, $p < .05$. Univariate analyses revealed that the interaction was significant for the Knowledge Test of the learning outcomes, $F(1,94) = 9.55$, $p < .01$. As shown in Figure 3, in the C+ condition, students receiving the R+ treatment attained more knowledge from the training program than the R– treatment. In the C– condition, there were no apparent differences in knowledge acquisition when the R+ and R– treatment were compared. Scheffé multiple comparison tests revealed that students in the C+R+ group ($M = 10.9$) and students in the C+R– group ($M = 9.8$) obtained significantly more knowledge than those in the C–R+ group ($M = 5.7$) and than those in the C–R– group ($M = 6.5$). No other differences were found.

In addition to the interaction, MANOVA indicated a significant main effect for Conversational Model, $F(4,91) = 29.38$, $p < .001$. Univariate analyses revealed that the
main effect was significant for two tests of the learning outcomes: Performance in a Computer-Based Role-Play, $F(1,94) = 8.79, p < .01$ and the Knowledge Test, $F(1,94) = 115.28, p < .001$. Students in the C+ groups ($M = 9.8$) performed significantly better in a computer-based role-play than the C− groups ($M = 8.6$). Also on the Knowledge Test, students in the C+ groups ($M = 10.3$) performed significantly better than students in the C− groups ($M = 6.1$).

MANOVA indicated an other significant main effect for Sex, $F(4,91) = 3.31, p < .01$. Univariate analyses revealed that the main effect was significant for two tests of the learning outcomes: Performance in a Computer-Based Role-Play, $F(1,94) = 7.26, p < .01$, and the Knowledge Test, $F(1,94) = 6.35, p < .05$. Females ($M = 9.7$) performed significantly better in a computer-based role-play than males ($M = 8.7$). Also on the Knowledge Test, females ($M = 8.9$) performed significantly better than males ($M = 7.7$). MANOVA did not reveal other interactions (C×Sex, R×Sex, C×R×Sex) and nor a significant main effect for Reflection Opportunities was found.

**Discussion experiment 2**

The main conclusion of experiment 2 was that knowledge acquisition is influenced by a combination of the use of a conversational model and opportunities for reflection. This finding resulted in a suggestion for refinement of the hypotheses about influence of the opportunities for reflection on the learning outcomes. It was expected that, only in combination with the use of a conversational model, the R+ groups would show more effective interpersonal skill development, knowledge acquisition, and more complete understanding of the skill than the R− groups. This refinement had consequences for the training strategy reflection opportunities: instruction should only offer opportunities for reflection in combination with the use of a conversational model that offers a general guide that reflections may refer to.

The use of a conversational model only affects the learning outcomes. C+ groups performed significantly better than C− groups on a computer-based role-play and on the Knowledge Test. This finding supported one of the hypotheses of this experiment. A conversational model accommodates the students’ need for guidance, for directing in solving social-communicative problems. The guidance may direct students’ attention to relevant information in memory they already know and which is highly integrated with knowledge that already exists. This information can be helpful to the performance of the skill.

It is also likely that sex affects the learning outcomes. Females performed significantly better than males in a computer-based role-play and on the Knowledge Test. Research findings suggest that males and females differ in their communication styles (eg, Coates, 1993; Cowan, Wilcox and Nykodym, 1990; Penley, Alexander, Jernigan and Henwood, 1991; Smith and DeWine, 1991; Tannen, 1994) which indicate that females are more competent on some communication items (Luketich, Colliver and Galofré, 1992; Stillman, Regan, Swanson and Haley, 1990). The sex of the students in the current study may have influenced their skill development, but future study is needed to interpret this finding.
Figure 3: The mean scores for the learning outcomes as a function of the presence or absence of the conversational model and opportunities for reflection

General conclusion and discussion

The result of the presented research had shown that a computer learning environment with computer-based role-plays could be used to lessen high cognitive load during solving social problems. A computer learning environment can be used to assist the realisation of an effective gradual lead in learning to solve this category of problems and to gradually develop the interpersonal skills involved. Both instructional strategies were found to affect the students’ interpersonal skill development.

These results have practical implications for training. They give significant support to the assumption that a conversational model “gives support and guidance” to trainees. A conversational model helps novices to acquire the sequence of the execution of the necessary steps to solve a social-communicative problem at very early stages of learning. Through a lot of practice, novices will understand the goals of the activities as well as how the conversational model relates to the solution(s). Once they have acquired the model, it may primarily help to integrate new knowledge with the knowledge that already exists. This increases the chance that the model can be helpful to the performance of the skill.

The presence of a conversational model significantly improved the students’ performance of the skills, and their performance on the knowledge test. When also given “opportunities for reflection” the students’ performance in a role-play and on the knowledge test improved even more. The computer learning environment containing a conversational model in combination with opportunities for reflection was therefore considered as having the potential to assist in introducing parts of interpersonal skills learning and instruction for novices. These learning environments are seen as new instructional methods that in coherence with and as a supplement to existing instructional methods can be used. Computer-based role-plays are recommended in the beginning of training on account of more practice with less cognitive load for more students at the same time. Future studies are needed to explore other possible applications of this learning environment. To leave no doubt, there is quite a lot work to do for those who would like to use a computer learning environment to assist in realising effective interpersonal skills development.

References


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