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Work in Progress - Automated Discourse Interventions and Student Teaming

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Abstract - **The ability to successfully work in teams is a crucial part of an engineer's workplace success. Engineering education can be improved through a better understanding of how effective teamwork develops. A (patent pending) software tool that "listens" to team conversations and generates automatic interventions into team discourse can effectively mimic the actions of a skilled facilitator. Automated facilitation tools may help students improve their team skills by providing a simplified model for conversational interventions, which students can readily imitate. This paper describes this tool and presents preliminary findings from student reactions to the tool's use.**

Index terms – dialogue, human-computer interface, intelligent systems, teams.

INTRODUCTION

The need to develop team skills is recognized by ABET's General Criteria which states: '*Engineering programs must demonstrate that their graduates have…an ability to function on … teams (I.3.d)"* [Engineering Accreditation Commission, 1999]. Even so, team skills are often not explicitly taught as an integrated part of the engineering curriculum and team success or failure is not linked to specific behaviors. Mere placement in teams is no guarantee that these skills will be learned.

The inevitable diversity of perspectives in team members and the accompanying tradeoffs in work management often lead to conflict [Townsley, 1995]. While in some cases conflict may be dysfunctional, if managed effectively it can result in improved decision-making. This beneficial form of conflict is called "constructive controversy" [Tjosvold & Tjosvold, 1995] and can result in higher productivity, win-win outcomes, and free communication of diverse perspectives. Previous research [Rajappa, 2004] has shown that relatively simple, repeatable interventions into group dialogue can increase levels of constructive controversy in virtual teams working on a problem via internet chatspace.

This work-in-progress extends the concept of virtual intervention to an engineering context. An artificially intelligent system is described that will automatically intervene in team discourse. The software facilitation tool was applied to the course "Management for Engineers" in the Engineering Management and Systems Engineering department at the University of Missouri - Rolla. Student's reactions in preliminary system tests are presented.

INTELLIGENT AUTOMATED DISCOURSE INTERVENTION SYSTEM (IADIS)

A patent-pending IADIS system was developed to automatically "listen" to a team conversation for team members interacting in a virtual or face to face meeting. The system automatically generates a transcription of the conversation using supplemental speech-recognition software, and then intervenes into the conversation based on a simple set of rules. The system tool mimics the role of a facilitator for teams without the costs of human facilitation.

The system is based on research in team learning and group development that recognized the presence of "recipes for action" in group interventions [Putnam, 1991]. "Recipes" in this context describe relatively simple statements or questions that are triggered by particular words or phrases. These could be stated in terms of IF-THEN relationships. For example, one "recipe" can be expressed as "IF someone says 'I can't X', THEN ask 'What would prevent you from X'ing?'". Such IF-THEN interventions during team conversations has been shown to produce a significantly greater degree of constructive controversy for teams exposed than those not exposed [Luechtefeld, 2002]. Statistical analysis showed that constructive controversy mediated the relationship between the "recipe" interventions and team productivity [Rajappa, 2004]

When using the system, students participating in a team discussion wear a headset fitted with a microphone that is plugged into a notebook computer. Commercially available speech recognition software converts each individual's spoken words into text. The IADIS software connects each individual notebook computer with the others wirelessly and knits together each individual's text into a transcription of the group conversation. This transcription is then displayed on the screen of each notebook. The IADIS software scans the transcription for words or phrases that will trigger

interventions. When an IF-THEN rule is triggered, the appropriate question or statement is displayed on the screen of each users' notebook computer, accompanied by a chime.

While any sort of IF-THEN rules can be implemented as part of the IADIS software, currently the rules are those used in the previous research. They are designed to foster the surfacing of information. Table 1 provides a brief overview of the IF-THEN rules currently being used.

STUDENT REACTIONS TO IADIS

The software was used by two students in a group discussion held between ten (Senior and Master's level) students over two class periods as part of a "Management for Engineers" course at the University of Missouri Rolla,. (Only two students used the software because of a lack of availability of the necessary hardware (laptop computers with noise-canceling headphones) and speech recognition software.) The notebook computers were situated such that students seated on either side of the students using the software could view the screens and note the interventions generated by the system. On the second class period when the software was used, student seating was rearranged so that those who were not seated next to the software users during the first class period could view the notebook screen. Four students (the two users of the software and two observers) were asked to write a few paragraphs describing their reactions to the use of the software. In addition to notations of difficulties or limitations of the IADIS system and the rule set, they commented that

- word choices were sometimes intentionally modified to trigger or to avoid triggering the interventions,
- awareness of their word usage increased greatly, and
- additional interventions by the participants themselves were encouraged.

Furthermore, the students felt that the system had great potential usefulness and that it could improve the quality of a team discussion.

CONCLUSIONS

This work represents a preliminary implementation of the virtual IADIS tool and provides insights into its instructional use. It is the intent of the researchers to refine the tool based on student responses and to pursue studies with larger sample sizes in order to seek statistically valid results. The availability of an effective virtual tool could greatly expand the opportunities for developing team skills within engineering classes.

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Situation	Indicators (IF)	Questions (THEN ASK)
Deletion - Clearly and Obviously	-ly ending or "it was clear to me"	What leads you to see it that way? Can you give specific examples?
Deletion - Comparisons	-er, -est, more/less, most/least, etc.	Better (faster, etc.) than what? How, specifically, do you see it this way?
Deletion - Can't, Impossible, and Unable	can't, impossible, unable, no one can	What prevents you from doing so? (Does anyone see things differently?)
Deletion - Advocacy without illustration	"should, must, expect, encourage"	What leads you to see it that way?
Distortion - Forcing or Making	"I had to, you made me, you bore me	What experience had you had that leads you to believe X? What was done that makes you Y?

TABLE 1: EXAMPLES OF IF-THEN RULES WITHIN THE IADIS TOOL