AC 2010-1564: SMARTER TEAMWORK: SYSTEM FOR THE MANAGEMENT, ASSESSMENT, RESEARCH, TRAINING, EDUCATION, AND REMEDIATION OF TEAMWORK

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SMARTER Teamwork: System for Management, Assessment, Research, Training, Education, and Remediation for Teamwork

Abstract

The rapid adoption of Team-Maker and the Comprehensive Assessment of Team Member Effectiveness (CATME), tools for team formation and peer evaluation, make it possible to extend their success to have a significant impact on the development of team skills in higher education. The web-based systems are used by over 700 faculty at over 200 institutions internationally.

This paper and its accompanying poster will describe strategies for broadening the scope of those tools into a complete system for the management of teamwork in undergraduate education. The *System for the Management, Assessment, Research, Training, Education, and Remediation of Teamwork* (SMARTER Teamwork) has three specific goals: 1) to equip students to work in teams by providing them with training and feedback, 2) to equip faculty to manage student teams by providing them with information and tools to facilitate best practices, and 3) to equip researchers to understand teams by broadening the system's capabilities to collect additional types of data so that a wider range of research questions can be studied through a secure researcher interface. The three goals of the project support each other in hierarchical fashion: research informs faculty practice, faculty determine the students' experience, which, if well managed based on research findings, equips students to work in teams. Our strategies for achieving these goals are based on a well-accepted training model that has five elements: information, demonstration, practice, feedback, and remediation.

Different outcomes are expected for each group of people. For the students, both individual outcomes, such as student learning, and team outcomes, such as the development of shared mental models, are expected. For the faculty, individual outcomes such as faculty learning and faculty satisfaction are expected. The outcomes for researchers will be community outcomes, that is, benefits for stakeholders outside the research team, such as generating new knowledge for teaming theory and disseminating best practices. Measuring these outcomes is the basis for the project's evaluation plan.

Research Overview. The broad and deep scope of the proposed SMARTER Teamwork research is summarized in Figure 1. The figure addresses the project's three broad research goals, people impacted, strategies for achieving the goals, and measureable outcomes.

Goals. The proposed work has three goals: 1), equip students to work in teams; 2), equip faculty to manage teams; and 3), equip this research team to understand student teams. These goals support each other in hierarchical fashion: research informs faculty practice, faculty determine the students' experience, which, if well managed based on research findings, should equip students to work in teams.

People. People are the groups that will use the proposed system: students, faculty, and researchers. The hierarchy of people reflects the hierarchy of goals: the work of the research team supports the work of faculty, which in turn supports the work of students and their teams.

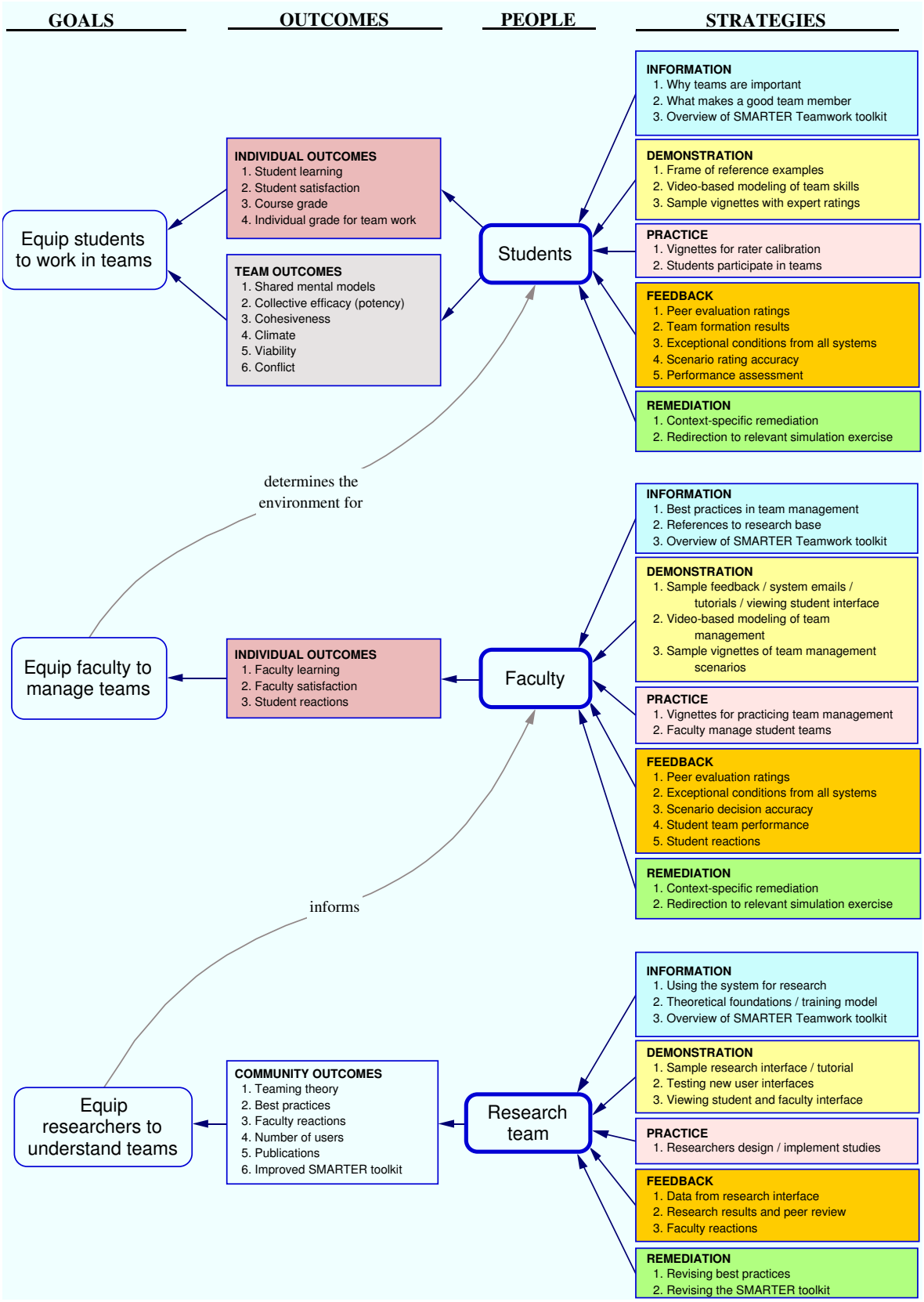

Figure 1. System for the Management, Assessment, Research, Training, Education, and Remediation for Teamwork

Strategies. For each group of people — students, faculty, and researchers — we developed strategies for achieving our goals based on a well-accepted training model that has five elements: information, demonstration, practice, feedback, and remediation. By following this model, we will enable the people affected by the system to become proficient in teamwork (all users), managing teamwork (faculty and researchers) and creating new knowledge about teamwork (researchers).

Outcomes. Different outcomes are expected for each group of people. For the students, both individual outcomes, such as student learning, and team outcomes, such as shared mental models, are expected. For the faculty, individual outcomes such as faculty learning and faculty satisfaction are expected. The outcomes for the research team will be community outcomes, that is, benefits for stakeholders outside the research team, such as generating new knowledge for teaming theory and disseminating best practices. Measuring these outcomes is the basis for the project's evaluation plan.

HIGHLIGHTS OF THE PAST YEAR

- Continued growth of the CATME and Team-Maker user base;
- Completion of a usability study of the existing system;
- Progress toward development of the SMARTER system;
- Development of material for training vignettes;
- Progress on databases of literature on team formation and (separately) peer evaluation;
- Team-Maker and CATME were submitted for consideration for the Premier Award for Excellence in Engineering Education Courseware;
- Administration of a survey of faculty users; and
- Two workshops promoting the system were conducted, and more have been scheduled.

CONTINUED GROWTH OF THE CATME AND TEAM-MAKER SYSTEMS

The growth in users of CATME and Team-Maker system has been substantial. There are currently 516 instructors using the system (460 by steady growth plus an additional 56 added all at once) at 152 different institutions and over 20,000 unique student users. As shown Figure 2, system use has grown dramatically.

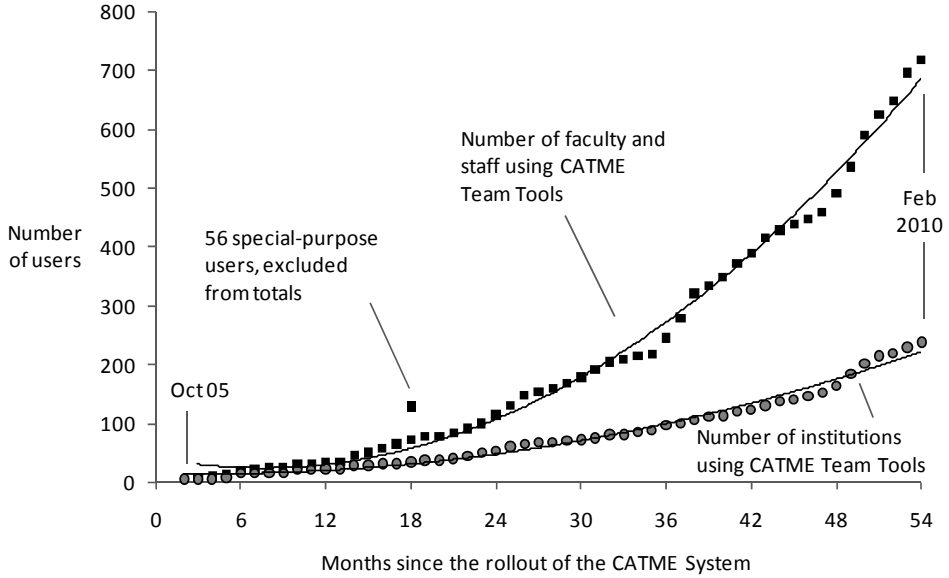

Figure 2. Growth in the Number of Faculty and Institutions using CATME Team Tools.

The most recent growth in system use has introduced an interesting complication—as the user base expands, it extends beyond "early adopters," who are comfortable manipulating the interface with little guidance. Rather, the most recent users are more likely to seek help getting started, which can be quite time-consuming. Rather than divert resources to technical support, a usability study of the interface (scheduled as part of this project) has revealed opportunities to make the interface more accessible to a broader audience.

USABILITY STUDY OF EXISTING SYSTEM

UCF has focused efforts on the usability of the existing tool. This includes a four-phase usability evaluation:

1) Workflow Evaluation
2) Think Aloud Verbal Protocol
3) Heuristic Evaluation
4) Remedy Prescription

Below, we detail our results on each of the phases.

1. Phase I

In the first phase, the workflow evaluation was performed by creating a hierarchical tree of functionality of the website. We plotted possible workflow routes through the navigational tree. Additionally workflow and function items were examined for redundancy.

2. Phase II

In the second phase, we conducted a think aloud verbal protocol task to assess user perceptions of the site. This includes using the workflow from the workflow evaluation and creating a series of tasks for users. Twenty-one subjects were recruited (eight novice web users and thirteen experts – based on self-report). Participants were instructed to communicate their thoughts actively while working through tasks with the site. Audio was recorded for analysis. Recorded audio was transcribed and analyzed to determine common bottlenecks in user performance and areas of uncertainty within the website.

3. Phase III

The third phase is the heuristic evaluation. This was conducted simultaneous to the cognitive walkthrough data collection. The website was evaluated utilizing established web usability guidelines. We developed a list of top usability problems drawn from the literature and this list served as the rubric for evaluation. Violations of these guidelines were noted.

4. Remedy Prescription

Based on the information collected through user and heuristic evaluation, a variety of edits to the site were recommended and implementation is planned.

DEVELOPMENT OF MATERIAL FOR TRAINING VIGNETTES

The use of critical incident analysis

The development of training vignettes is a central strategy for this project. Our plan was to use a critical incident methodology to identify a wide variety of team behavior to include in the vignettes. Originally developed by Flanagan (1954), the critical incident technique gathers specific, behaviorally focused descriptions of work or other activities. Bownas & Bernardin (1988) assert that "a good critical incident has four characteristics: it is specific, focuses on observable behaviors exhibited on the job, describes the context in which the behavior occurred, and indicates the consequences of the behavior." Thus, a good critical incident describes behaviors, rather than traits or judgmental inferences. Normally, critical incident data are collected by asking subject matter experts to describe particularly effective or ineffective behaviors from their experience, a content analysis identifies underlying dimensions of performance, and the critical incidents are rewritten to highlight the underlying dimensions that were found. In this work, a critical incident was used to develop the behaviorally anchored rating scale for the CATME instrument as well as the sample vignette developed earlier. In this stage of the research, it is important to develop additional vignettes, but subject matter experts close to this work were struggling to identify enough critical incidents to support the development of a large pool of behaviors aligned with the dimensions of the CATME instrument.

Identifying behavioral descriptions from student comments

The research team has identified another source of behavioral descriptions that can be used for vignettes—from student comments about their teammates. Large numbers of peer evaluations have been conducted, and the research team has access to a large volume of comments students have made about their teammates. These comments are a rich source of behavioral descriptions. A large volume of student comments has been processed by two undergraduate researchers to distill those comments down to essential behaviors. This task is ongoing and has been taken over by a graduate assistant at Purdue. This process requires:

- Deleting non-behavioral comments (e.g., "Nice guy!" and "nothing to say, really.");
- Eliminating redundant phrasing to isolate a superset of unique behavioral descriptions;
- Reducing all comments to the most basic elements representing a single behavior; and
- Removing all names and pronouns.

Building vignettes from individual behavioral comments

As the comments are processed, graduate students at the University of Central Florida will convert those behavioral elements into phrases that remain gender neutral, but are complete sentences. Calibration ratings for each behavioral phrase will be determined by subject matter experts. Where there is significant disagreement about the category to which a behavior is assigned or the rating level, behaviors will be deleted as ambiguous. In preliminary work, the software developer has designed a system that will piece together a collection of behavioral phrases into a comprehensive vignette that spans all the behavioral dimensions measured by CATME.

TEAM-MAKER AND CATME WINS PREMIER AWARD

A subset of the research team (Layton, Loughry, Ohland, Pomeranz) prepared a submission package nominating the Team-Maker / CATME integrated system for the Premier Award for Excellence in Engineering Education Courseware, the software was selected to receive the award, and the award was presented at the 2009 Frontiers in Education Conference.

ADMINISTRATION OF A SURVEY OF FACULTY USERS

A survey of end users was administered, yielding valuable information about how faculty already engage with the system. This will help us assess the best ways to reach out to faculty with enhanced material to support teams in the classroom. This is especially critical as our reach extends to a more novice market. As we prepare for implementation of the broader system, it will be critical to assess current team management practice even as we guide faculty to better practices. The interface that has a large number of users presents an opportunity to gather such data on current practices, including how faculty intervene with students and teams and what results follow from instructor actions. We feel it is better to get open-ended feedback first, and plan to build another survey into the faculty interface. Other sources of ongoing feedback will be the development of user groups and an online forum. As we develop additional training facilities, faculty practice will be captured in those settings as well. Based on feedback from faculty in the survey that was already administered, as we migrate to a more intensive training system, some important features will be:

- Including “why are you asking this question?” explanatory text throughout the interface;
- Changing the default of how race is handled to reflect the needs of communities outside engineering education. Other default choices and weights may need to be reviewed.
- Modules for faculty training will be most useful if they are discipline specific and context-specific. The appropriate methods of managing teams differ from engineering to business, large classes to small classes, diverse classes to homogenous classes, etc.

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