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A SYSTEMS ACQUISITION SIMULATION: USING VIRTUAL TEAMS IN HEALTH CARE INFORMATICS

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Abstract:

The paper describes a systems acquisition simulation using virtual teams in a health care informatics course. The simulation enables virtual teams to participate in a systems acquisition decision for an electronic health records (EMR) system. Each virtual team used a web-based team communications discussion board to assess the attributes of each system, to discuss alternatives, and to reach a decision. The purpose of the research was to determine if high-performing virtual teams were distinguishable from low-performing teams in terms of the content and volume of task-related communications. The qualitative and quantitative analysis of team communications illustrated differences in the volume and content of electronic communications between high- and low-performing teams. Since health care professionals work increasingly in virtual teams, understanding and developing communications skills in this domain are important to improving the quality and effectiveness of systems acquisition decisions.

Keywords: virtual teams, health informatics, systems acquisition, communications effectiveness

I. REVIEW OF THE LITERATURE

Effective teams are important for effective decision-making in health care, and increasingly, health care teams work as virtual teams. This is because health care professionals work in decentralized and satellite units to accomplish specific tasks. There is limited information on the characteristics of effective virtual health care teams, and this study will address the issue of team performance from the standpoint of communications effectiveness.

The challenges faced by virtual teams include difficulty establishing trust (Coppola, Hiltz, and Rotter, 2004, Jarvenpaa and Leidner, 1999, Jarvenpaa, et. al, 2004), difficulty establishing shared team identity (Armstrong and Cole, 2002, Cramton, 2001), difficulty sharing knowledge (Cramton, 2001, Griffith et. al., 2003), and difficulty maintaining awareness of members' activities (Hinds and Mortensen, 2005). In a virtual team setting, establishing leadership is also a challenge. This leads to difficulty coordinating member team efforts (Maznevski and Chudoba, 2001, Malhotra et. al., 2001) and difficulty managing conflict (Hinds and Mortensen, 2005, Montoya-Weiss, Massey and Song, 2001).

These challenges can be addressed through effective communications. Effective communications enhances shared-team identity (Hinds and Mortensen, 2005) and increases trust (Jarvenpaa, et. al., 1998). Predictable communication and regular feedback improves team performance (Jarvenpaa, et. al., 1998; Jarvenpaa and Leidner, 1999, Kayworth and Leidner, 2000; Maznevski and Chudoba, 2001, Connaughton and Shuffler, 2007, Powell et al 2004).

Team effectiveness, innovativeness, and overall performance are strengthened through a climate of support for innovation (Bain, et. al., 2001). In design teams, a team climate for innovation enhances team performance in terms of creativity and the quality of design. Participative safety, which is depicted by diversity of opinion and constructive conflict, fosters high-quality outcomes (West, 1990). Participative safety (West, 1990) facilitates communication, improves cross-fertilization of ideas, and heightens the likelihood of creativity (Mumford and Gustafson, 1988). Teams engaging in constructive conflict are better performing teams, because the critical debate of ideas reduces the chance of "group think."

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II. THE SYSTEMS ACQUISITION SIMULATION

The context for the study of virtual teams was a systems acquisition simulation project involving four health care teams. The systems acquisition simulation was an exercise in a course in Healthcare Informatics. Since health care professionals participate on steering committees responsible for making system acquisition decisions, the ability to participate effectively on these teams is important for quality decision-making. Quality decision-making in this environment is critical to quality health care.

In this project, each team was given responsibility for analyzing and selecting a vendor to provide the hospital with a new billing/financial system and a new electronic medical record (EMR) system. Each team was given the charge to make recommendations on which vendor to recommend for the financial system and which vendor to recommend for the clinical system. The members of each of four virtual teams interacted using an electronic discussion board over a period of two weeks. Using electronic communications among the team members, the teams assessed the attributes of each system, evaluated the alternatives, and made a systems acquisition decision.

Each of the teams were given:

1. A statement of functional requirements that the new system should support, including:
 - a. Bill consolidation from multiple sources;
 - b. Single-point entry of patient demographic information and access to this information throughout the organization;
 - c. Analysis of data for quality assurance;
 - d. Decision support functions to improve problem-solving at the point of care.

2. A listing of the attributes of electronic health records systems to be considered in making an evaluation of alternative EHR software packages, and a description of what attributes System A's electronic medical record system and System B's electronic medical record system support, using these categories:
 - Y = the capability is supported
 - D= the capability is under development
 - P= the capability is planned but not currently under development
 - C= the vendor is capable of offering this capability but it is not yet at the planning stage
 - N= the capability is not supported
 - NA= no response from the vendor on this attribute

The evaluation packet included a matrix of the EMR attributes supported by System A and System B using the above-mentioned categories.

3. Guidelines for the virtual team project, including:
 - a. Each team member reviewed the information on each System (System A and B) and the extent to which each system supports the functional requirements of the hospital.
 - b. Each team made an assessment of each System (System A and B) in terms of its attributes for providing an electronic medical record (EMR) and in terms of its attributes for providing a billing/financial system.
 - c. Each team discussed the two Systems using an electronic discussion board system with a start-time and complete-time of two weeks.
 - d. One additional piece of information is that the hospital system recently purchased System B's laboratory information system.
 - e. Each team made a recommendation to management about which System or Systems the team members recommend that the hospital should purchase for the billing/financial system and for the electronic medical record (EMR) system, along with their rationale for the recommendations. The team(s) can recommend a single vendor for the billing/financial system and the electronic medical record system, or

multiple vendors. The recommendation will be submitted electronically by one member of each team by the deadline.

III. RESEARCH QUESTIONS

- 1) Are high-performing virtual health care teams distinguishable from low-performing teams in terms of task-related communications?
- 2) What are the differences between the content of team communications between high-performing and low-performing health care teams working in a virtual setting?

IV. METHODOLOGY

Participants and Team Composition

The participants in the health informatics class were 25 health care professionals, including clinicians, nursing professionals, and health care consultants. They worked for a major hospital system, and the course in Health Informatics was offered during the spring, 2008 semester as a part of the hospital systems professional development program. The specific position descriptions of the participants included the following. A complete listing of the position descriptions is shown in Appendix A.

Nursing professional	Clinical applications specialist
Lab technical coordinator	Clinical information systems coordinator
Medical lab technician	Pharmacy information systems (IS) coordinator
Project manager	Financial manager
Nursing manager	Clinical nurse manager
Home healthcare coordinator	Trainer
Case management supervisor	Operating room information systems analyst
Healthcare information systems analyst	

The class was organized into teams consisting of a cross-section of position descriptions. The members of each virtual health care team participated in the systems acquisition selection process using an electronic discussion system providing postings of contributions by team members, interaction, document sharing, and collaborative work.

The team reports were evaluated by an expert referee. The judgment of the referee took into account a number of factors, including:

- a. Analysis of attributes supporting functional requirements.
- b. Prioritization of attributes ("need" vs. "want").
- c. Analysis of the trade-off's between functionality and integration.
- d. Analysis of vendor support for attributes—actual vs. under-development.
- e. Effectiveness of presentation.

V. ANALYSIS AND FINDINGS

Assessment of Team Performance

The assessment of team performance was used to identify the high-performing vs. low-performing teams. The assessment process used five criteria to assess the effectiveness of each team in making the systems acquisition decision. These five criteria were: meeting functional requirements, prioritization of attributes, analysis of actual features vs. features under-development, examination of functionality vs. integration, and effectiveness of the team presentation:

1. Functional requirements: an assessment of the extent to which each of the systems (System A and System B) met the functional requirements of the hospital.
2. Prioritization of attributes: an assessment of the extent to which the attributes characterizing the systems were prioritized in terms of importance (“need” vs “want.”).
3. Actual features vs. features under-development: an assessment of the relevance and impact of selecting a system with actual features vs. features which are under-development. The assessment would analyze the trade-off’s between existing and planned attributes.
4. Functionality vs. integration: an examination of the trade-off’s between selecting a single-source/single-vendor solution offering better integration or a best-of-breed vendor solution, whereby one system can be selected to meet one set of requirements (e.g. financial system) and another system can be selected to support another set of requirements (e.g. clinical system). The analysis of single-source vs. best-of-breed raises a number of issues, including integration, maintenance, upgrade path, technical support, and cost.
5. Effective presentation: an assessment of the effectiveness of the presentation of recommendations, including the rationale for systems selection and the choice of a single-vendor vs. best-of-breed approach.

The expert referee gave scores to each team, using the above-mentioned criteria. The scoring used a Likert scale, with 5 = “met expectations to a high extent” to 1 = “did not meet expectations.” The scores were translated into percentage of expectations met for each criteria used in the evaluation of team performance. As you can see from Table 1, Team 4 was the highest-performing team and scored 80% on the overall assessment. Both Teams 2 and 3 were low-performing teams, scoring 32% on the assessment(s).

Table 1: Qualitative Analysis of Teams

Criteria for Evaluation	Team 1	Team 2	Team 3	Team 4
Functional requirements	20%	16%	16%	20%
Prioritization of attributes	8%	4%	4%	16%
Actual features vs. under dev.	8%	4%	4%	4%
Functionality vs integration	8%	4%	4%	20%
Effective presentation	12%	4%	4%	20%
	56%	32%	32%	80%

Using the assessment of team performance, the next step was to analyze the volume and content of communications using an analysis of communications patterns.

Analysis of Communications Effectiveness

A content analysis methodology was used to code the messages into content categories. The coding scheme for categorizing messages was developed from Ocker and Fjermestad’s work (Ocker and Fjermestad, 2008).

Coding scheme

- Design: Initial idea or suggestion dealing with the advantages and disadvantages of the two Systems under consideration.
- Coordination: A reference to managing the activity, including scheduling, tasks, and status of work.
- Summary: A summarization or review of prior discussions.

- Debate: Offering arguments or different perspectives on previously communicated ideas of team members.
- Supportive: Providing positive feedback to other team members' comments.

The analysis of communications patterns and differences between the high-performance and low-performance teams included both a quantitative and a qualitative analysis. A transcript of all of the electronic messages exchanged by each of the four teams was used as the basis for the analysis.

First, the quantitative analysis provided a compilation of word count in the messages generated by each team. The quantitative analysis showed that the messages exchanged by the high-performing team (Team 4) had the highest word count (3225 words), as compared with the other teams. In fact, the word count of messages exchanged by Team 4 was over three times the word count of messages exchanged by Team 1 (1080 words), Team 2 (1271 words), and Team 3 (799 words).

Second, the qualitative analysis was used to determine the percentage of messages in each category, including Design, Coordination, Summary, Debate, and Support. The qualitative analysis provided an assessment of the extent of analytical thinking, active debate, argumentation, exchange of ideas, review, feedback, summarization of ideas, and continuous assessment of members' contributions. See Table 2.

Table 2: Coding Results by Team

Message Category	Team 1		Team 2		Team 3		Team 4	
	Total #	%	Total #	%	Total #	%	Total #	%
Design	614	56.85%	794	62.47%	457	57.20%	772	23.94%
Coordination	136	12.59%	57	4.48%	155	19.40%	655	20.31%
Summary	188	17.41%	0	0.00%	0	0.00%	793	24.59%
Debate	129	11.94%	0	0.00%	45	5.63%	582	18.05%
Support	13	1.20%	420	33.04%	142	17.77%	423	13.12%
	1080	100.00%	1271	100.00%	799	100.00%	3225	100.00%

The qualitative analysis demonstrated that different types of messages were exchanged among members of the high-performing team as compared with the other teams. As you can see from Table 2, the high-performing team exchanged a greater variety of messages, and a greater percentage of messages in the Coordination (20%), Summary (24.5%), and Debate (18%) categories. In contrast, the lower-performing teams spent the greater percentage exchanging messages in the Design Category, with 56.8% Design messages for Team 1, 64.5% Design messages for Team 2, and 57% Design messages for Team 3. The lower-performing teams exchanged relatively few messages in the Debate Category, with no percentages in the Debate Category for Team 2 and only 5.6% in the Debate Category for Team 3.

As you can see from these findings, the high-performing team was successful in addressing the complex issues through problem-solving, analysis and evaluation. The high-performing team participated in back-and-forth conversation and debate and used summary comments to keep track of progress resolving the issues raised in the discussion. In contrast, this type of assessment and give-and-take was not a part of the e-discussion of the other team members, who concentrated on sharing facts and viewpoints but did not integrate and analyze this knowledge to any extent.

VI. CONCLUSION

The objective of this study was to distinguish between high-performing and low-performing teams in the virtual world through an analysis of their communications in the context of a systems acquisition case in the healthcare domain. The results illustrated that the high-performing teams participated more actively

in coordination, summary, and constructive debate as compared with the low-performing teams, which spent most of the time exchanging information with each other.

As more and more health care professionals participate on virtual teams, it will be important for them to use problem-solving and analytical processes in their electronic discussions of issues, alternatives, and ideas. At first, argumentation and debate may be difficult for individuals in a virtual environment. Much of the electronic communications to which individuals are accustomed is based in email exchange, and a good deal of email is used to transmit factual information. Virtual team members may need to practice electronic problem-solving in order to improve overall team effectiveness.

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