ERP POST-IMPLEMENTATION TRAINING PROGRAM ASSESSMENT
Identifying Key Factors that Improve Cognitive Outcomes

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Abstract: Enterprise Resource Planning (ERP) systems, such as SAP, feature a rich set of integrated business applications. To maximize the long term benefits from ERP implementations, organizations need to support end users with effective training during the post-implementation phase. Training programs that build the end-user's cognitive skills and business procedural knowledge are particularly important as they allow the users to understand the broader scope of the ERP system implementation and the strong integration of multiple business processes and functions. Given the high cost and variety of ERP training programs, there is a need to create validated models to assess content and benefits of such training programs. Using a field study of a collaborative, team-based training program with the ERPSim simulation tool, this paper develops and validates a fuzzy logic model to assess cognitive outcomes. The study finds that training team characteristics, particularly heterogeneity and cooperation, are most important in achieving higher levels of cognitive outcome. The results of the study imply that for ERP implementation success, the end-users must be given suitable training programs that allow them to share and integrate cross functional knowledge. Moreover, the success of such training programs needs to be periodically measured to assess cognitive outcomes.

1 INTRODUCTION

Enterprise Resource Planning (ERP) systems consist of an integrated set of co-operating business applications that enable an organization to configure, deploy, use and manage its business resources (e.g. materials, plants, human resources, capital). These systems allow an organization to operate cross functional business processes with shared "master data" and integrate information across the whole organization (Davenport, 2004). ERP systems establish a much tighter level of integration within an organization, such that the information flow between functional departments happens in real time. Prior to ERP system implementation, departments worked in silos and had longer lag times to fix transactional data issues. However, after ERP implementation, they can no longer take additional time to update functional data entries before those records start affecting other departments (Bingi et al., 1999). Due to the rich integrated functionality and complexity of ERP systems such as SAP, organizations typically use a "no customizations" implementation strategy, whereby the system is implemented off the shelf with limited changes. The organization then attempts to adapt their own business processes to match the embedded logic and "best practices" in the ERP system (Hirt and Swanson, 2001). Such adaptations require changes in established work practices that frustrate the end users (Soh and Sia, 2005); (Willis and Willis-Brown, 2002). These end-users typically have very limited visibility to the full scope of the ERP system implementation (Carr, 2003). Moreover the training provided to these users is mostly skill-based, highly procedural and narrow in scope, which does not allow the typical user to grasp the tight integration among business departments outside of their work area and job function (Macris, 2011).

ERP system implementation failures are widely reported in the IS (Information Systems) literature which includes the Fox Meyer Drug company's bankruptcy and Hershey's logistics issues (Carr,

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2002). Published research has associated inadequate end-user training with ERP implementation problems (Brown and Vessey, 2003). Conversely, among 18 factors, 'top management support' and 'training and education' are among the most frequently cited as being most critical to the successful implementation of ERP systems (Ngai et al., 2008). Post-implementation success is also improved by building firm specific resources and capabilities that include human resources (Groeke and Faley, 2009). The lack of user involvement exposes the firm to focus on technical issues rather than the nature of business process flow (Wright and Wright, 2002). End-user training is one of the most pervasive methods for developing human resources within the organization to effectively utilize an information system (Gupta et al., 2010). Vendor-provided ERP training can constitute roughly 5% to 50% of ERP Implementation budgets (Scott, 2005).

Current research reports that ERP system users must gain an understanding of the full impact of the system through post-implementation training programs in order to get business benefits from the system (Chang and Chou, 2011). There are three targeted goals of most end-user training programs: (1) skill-based goals (*tool procedural*) that target the user's ability to use the system, (2) cognitive goals (*tool conceptual or business procedural*) that focus on the use of the system to solve business problems and (3) meta-cognitive goals that focus on building the individual's belief regarding their own abilities with the system (Gupta et al., 2010). The difficulty with most ERP system training programs is that they focus on skills based learning, which does not achieve cognitive outcomes and hence cannot transfer to real-life, problem-solving contexts (Macris, 2011). Moreover, the heterogeneous, yet interdependent interests of ERP systems deployments on organizations imply that mere skills based training is inadequate to prepare end users to use the ERP system, necessitating greater emphasis on cognitive outcomes through team-based approaches.

Cognitive training goals focus on the mental awareness and judgement of the user and builds business-conceptual "big picture" knowledge that allows the user to apply the ERP tool to solve business problems (Gupta et al., 2010). However, it is difficult to assess the success of such training programs that focus on cognitive outcomes (Gupta et al., 2010). Benefits need to be measured over time, post training, once the user is back on their job. Published end user training research does not report any suitable measurement models that can be used during the training session to make cognitive outcome assessments, thus creating a gap in the ERP systems research literature.

1.1 Research Goals

The goals of this research are to develop a model to assess team based ERP post-implementation training programs and explore the factors that contribute to higher cognitive outcomes of such collaborative training programs.

Using a field study among SAP ERP end-users, who took part in a collaborative, team-based, post implementation training session with the ERPSim simulation tool (Leger, 2006), this study intends to support the following research goals:

- Build and validate a fuzzy logic multi-criteria decision making (MCDM) model of post implementation ERP training that can successfully predict the level of cognitive outcomes.
- Use the model to rank the participants of a training session with ERPSim simulation software by the level of their cognitive outcomes achieved from the training.
- Among three factors – (i) collaborative training content and support, (ii) team characteristics and (iii) individual characteristics, determine which factor(s) most increase(s) the cognitive outcomes of the training participants.

2 BACKGROUND THEORY

ERP system users must grasp and integrate cross-functional knowledge in post implementation training programs so that they can communicate and work cooperatively with users in other business functions (Chang and Chou, 2011). Wang and Ramiller (2009) report that ERP training programs must require that members reflect upon their learning and contribute their experiences, observations and insights back into the (user) community's collective discourse. Since ERP systems, through tighter integration of business processes, require users to work together, therefore post-implementation training can be made more effective when conducted in team-based collaborative settings (Uribe et al., 2003).

An example of collaborative team-oriented training in the ERP domain involves using simulation games (Foster and Hopkins, 2011). ERPSim is a simulation based educational tool developed to help teach the benefits of enterprise integration using a hands on approach (Leger, 2006). Team based training with ERPSim offers users a wider exposure to the functionality of the ERP system, a better sense of the strong integration of functional areas and a collaborative environment where users can reflect and share knowledge among each other (Hustad and Olsen, 2011); (Seethamraju, 2008). Published research has explored the pedagogical value of using ERPSim in educational programs at the undergraduate and graduate levels in higher education and found outcome benefits. However, research with actual users from real businesses who have undergone ERPSim training programs is still sparse.

While the potential benefits of using ERPSim to conduct collaborative post-implementation training with end users are promising, the beneficial effects of ERP training often fades away soon afterwards (Yu, 2005). A number of prior studies on ERP implementations suggest that ERP training should be continuous (Chien and Hu, 2009); (Davenport 1998). ERP training should not be an event that occurs once and for all (Chien and Hu, 2009). For example, periodic formal training and regular review sessions along with online content and support must be organized and executed so as to help end-users to have adequate knowledge if new system functions are added. A model that can assist in assessing the cognitive outcomes of such sessions and programs is needed and currently not reported in the research literature.

Theories that focus on the individual and social aspects of learning include shared cognition theory and situated cognition theory (Sharda et al., 2004). Situated cognition theory stresses that users learn particular concepts in real-world practical situations, where those concepts are actually being used. Simulation games, such as ERPSim, are particularly useful to immerse the trainee (end users) in a real world scenario where they are required to use SAP to run the full business cycle of a manufacturing company - plan, procure, produce, distribute and sell. The game requires the users to interact as suppliers to customers, receiving orders and fulfilling those orders by planning and acquiring raw materials and manufacturing and distributing their products (Foster and Hopkins, 2011). Participants in the game are grouped into teams and need to cooperate and share knowledge with each other to utilize data from SAP ERP to make business decisions and track their business results. The simulation game effectively creates the conditions in which participants jointly experience the complexity and ambiguity of operating in the real world and make them apply the skills they are taught to address various business situations. The participants have the opportunity to understand the operation of multiple business processes of a company and see the integration of these processes in SAP ERP (Leger, 2006). Collaborative training content refers to the presence of these characteristics of collaboration – joint work, the need for business problem solving and reflection and sharing of insights among the team members (Alavi et al., 1995).This is in line with the concepts of situated learning theory.

Shared cognition theory focuses on individual learning within a social situation, allowing for social interactions that supports the individual’s cognitive development with help from more capable team members and peers. All participant brings their own experience and expertise to share their knowledge with the team. There is a constant interaction and collaboration among participants that allows each individual to develop more improved skills in solving problems, than if they worked independently (Sharda et al., 2004). The experience allows each participant to see the training scenarios from other student’s perspectives and helps them to create new meanings and explanations through shared understanding and practical use. The broader context of the knowledge gained from training can enhance their ability to perform specific tasks (Chang and Chou, 2011). This experience also creates soft skills such as communication and negotiation skills.

Group theories suggest that many factors can influence the outcome of group-based training. This includes group characteristics, such as composition (level of homogeneity and heterogeneity), amount of group cooperation and the nature of group communications. Group norms and beliefs and trust are particularly important for effective team work in the training setting (Sharda et al., 2004). The repeated interaction between participants in the training program creates a set of norms, trust and mutual understanding that bind the participants together and facilitate better interactions during training as well as post training (Chang and Chou, 2011). The knowledge sharing and repeated interactions during collaborative ERP user training promote greater cooperation, bridging gaps in understanding and increased cognitive learning outcomes (Chang and Chou, 2011). Along with individual characteristics, such as motivation, interest and learning style, the group qualities can impact outcomes of training programs. In team based training programs, team members from different functional areas work together and allow team members to develop diverse knowledge and build broader perspectives that span business functions (Seethamraju, 2008). For successful cognitive outcomes, team characteristics must be optimized along with training content and delivery structures.

3 RESEARCH MODEL AND CONSTRUCTS

The research model is displayed in Figure 1. The research constructs are defined in the following subsections.

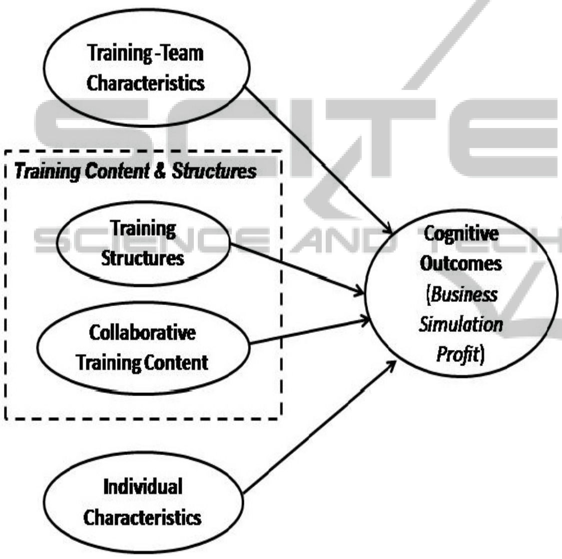

Figure 1: Research model.

3.1 Cognitive Outcomes (CO)

Cognitive outcomes (CO) focus on the mental awareness and judgements of the end-user and the levels of application of acquired knowledge towards operating business functions (Gupta, et.al, 2010). Cognitive outcomes also include the transfer of learning to new situations and understanding the interactions of multiple parts of a complex system such as SAP ERP. Using the ERPSim game, the end-users are allowed the opportunity to handle the complexity of running a real company using the SAP ERP system. Each team makes decisions on production, distribution and marketing variables. Participants in the training manipulate product price, product composition, marketing expenses and distribution channels to maximize the profitability of their simulated firm across two operating periods. The ERPSim simulator stores each team's financial performance by capturing the net profit for the simulation period. In this research study, the net profit for the overall simulation duration is used as the variable to measure cognitive outcomes. The team with the highest profit has the highest cognitive outcome and lowest profit has the lowest cognitive outcome. Since, the net profit represents the most effective way the "business" was operated by the team hence this measure is a suitable measure to represent the business procedural knowledge attained by the team members from the end-user training. The net profit value has also been used in prior field research with ERPSim (Foster and Hopkins, 2011).

3.2 Collaborative Training Content (CTC) and Training Structures (TS)

Collaborative training content (CTC) refers to instructional methods that encourage students to work together to accomplish shared goals, beneficial to all (Alavi et al., 1995); (Leidner and Jarvenpaa, 1995); (Gupta et al., 2010). Learning from peers is important component in collaborative training as "*peers contribute to task orientation, persistence and motivation to achieve*." ERP system users must grasp integrative knowledge in training programs so that they can communicate and cooperative closely with users in other business functions (Chang and Chou, 2011). The interactions within the team setting allow the members to interact, exchange knowledge and fill in gaps in their understanding of the SAP ERP system. Collaborative training content refers to the presence of these characteristics of collaboration – joint work, the need for business problem solving and reflection and sharing of insights among the team members (Alavi et al., 1995). Collaborative environments foster discussions and knowledge sharing. That allows end-users to fill gaps in their understanding and builds knowledge about how an SAP ERP system integrates various functional departments in the organization. "Soft skills" are also developed that allow members to learn collective beliefs and norms that help them develop confidence and knowledge in solving future business problems.

Training structures (TS) refer to the scaffolds that support the delivery of the training content. Also referred to as appropriation support (Gupta et al., 2010), they include the rules, resources and methods that support the elements of the collaborative training session. For this research study, the training structures include level of detail in the instructions given to participants, the guidance provided by the facilitator and the nature of the facilities and equipment used in the training session.

3.3 Team Characteristics (TC)

In collaborative learning, the team members share goals and learn together by working jointly and solving the problems posed in the training. The team composition plays a critical role in the learning environment through the size and heterogeneity of the team. The more diversity in the team, there is more likely to be integration of knowledge from multiple functional areas. Research has shown that when team members are from differing backgrounds, the discussions and knowledge sharing is more intense leading to create group decisions (Sharda et al., 2004). In teams, team members from different functional areas allow teams to develop diverse knowledge and build broader perspectives than span business functions (Seethamraju, 2008). Team characteristics (TC) is measured using questions on whether team members came from different functional areas (heterogeneity), and the nature of cooperation and the level of dialog achieved within the team. Greater cooperation and dialog among a diverse team allows them to build identification giving them a broader vision of the ERP implementation scope and also creates norms that help further enhance cross functional knowledge sharing (Chang and Chou, 2011).

3.4 Individual Characteristics (IC)

People prefer learning methods based on their specific learning styles (Nogura and Watson, 2004). Individual differences influence the formation of mental models, which affects the training process. "*States*" are general influences on performance that vary over time and include temporal factors such as motivation level and interest level (Bostrom et al., 1990). "*Traits"* are static aspects of information processing affecting a broad range of outcomes. Cognitive traits refer to learning styles such as a preference for procedural or abstract knowledge and an exploratory or reflective approach to instructional content delivery format (Bostrom et al., 1990); (Nogura and Watson, 2004). For this research study, the Individual characteristics (IC) variable is measured using motivation and interest as states and individual learning style as traits.

4 METHODOLOGY

In the ERPSim training program, the simulation system is coupled with ERP server access to deliver the entire training content. The simulation consists of a make-to-order manufacturing and distribution scenario. A total of 16 participants were divided into 8 teams each team with 2 members. The teams were asked to utilize the SAP ERP system to meet demand for a variety of custom products. Each team sets production plans, distribution plans, marketing plans and pricing levels to produce and sell their product through multiple distribution channels. The team performance was measured by using a team letter (A – H) and their net profit was recorded from the ERPSim simulator. The net profit was used to rank team performance. In addition, the participants were asked to fill out a survey, which had 12 items. Each item was measured on a 1-5 Liekert scale. The survey items were closely worded to the definition of the constructs and each construct (TCC, TS, TC and IC) was measured with 3 items on the survey. Participants rated each item on a 5 points scale consisting of strongly disagree, disagree, neutral, agree and strongly agree.

The research methodology consisted of using survey data from the training participants to create a training scenario for each team in Fuzzy Decimaker software to rank each team based on the four factors – team characteristics, collaborative training content, training structure and individual characteristics. The ranking from the Fuzzy software was compared to the ranking of the teams using the net profit measure from the ERPSim simulation tool. To validate the Fuzzy composite programming model, the team rankings from the model must match the ranking using the net profit measure.

For this research, 8 groups were ranked using net profit from the business simulation and compared against the four factors and their corresponding sub factors:

- Team Characteristics (TC). TC had three sub factors – team heterogeneity, team dialog and team cooperation.
- Collaborative Training Content (CTC). CTC had three sub factors – problem solving needed, joint work needed and the reflection and sharing of insights.
- Training Structure (TS). TS had three sub factors – Facilities and Equipment, Instructions and Guidance offered by the facilitator.
- Individual characteristics (IC). IC had three sub factors – Individual's motivation to participate in the

training, the individual's interest in the content and learning style.

The demographics of the 16 subjects of this research study, who participated in the ERPSim training session, are documented in Table 1. As seen in Table 1 the average professional experience and their years of SAP usage of the participants were 7.6 years and 2.4 years respectively. More than half of the participants have job responsibilities that are operational in nature and their functional areas and industry of work varied as seen in Table 1.

Table 1: Demographics.

Years of Exp	Average: 7.6 years (Min: 0; Max: 14)
SAP Usage	Average: 2.4 years (Min: 0; Max: 14)
Job Responsibility	Operational (10); Managerial (5), Strategic (1)
Functional Area	Sales/marketing (5); Service (3), IT (2), Accounting/Finance (4), Other (2)
Industry	Manufacturing (7); Retail (4); Service (3); Finance (1); Other (1)
Gender	Male (9); Female (7)

Analysing the impact of different factors on the cognitive outcomes of ERPSim training using statistical techniques is difficult, because the survey data collected from the training session has multiple issues:

- The measurement constructs are correlated (e.g. collaborative training content and team characteristics) and hence can also have conflicting values in the different items.
- The measurements often scatter around a certain range so statistical summarization of the data can lose information.
- The need to analyze mixed data - both qualitative data (survey data) and quantitative data (net profit from the ERPSim simulation tool).

Hence there is no effective way to comprehensively assess and rank different groups based on a multi-layered criteria using statistical analysis. However, there is a need for a comprehensive measure of cognitive outcomes of ERP training. A Multiple Criteria Decision Making (MCDM) tool can be used based on fuzzy logic in evaluating cognitive outcomes from the SAP training to resolve the problems in assessment under this conflicting, uncertain and hierarchical data situation.

5 FUZZY COMPOSITE PROGRAMMING MODEL

5.1 Fuzzy Composite Index

FCP is one of MCDM techniques, which can handle mixed indicator data (quantitative and qualitative), and also work with conflicting, uncertain and hierarchical criteria. FCP methodology was developed by Bardossy and Duckstein (1992). There have been a lot of successful applications of FCP in Information Systems literature including ERP Systems research (Onut and Efendigil, 2010). The indexes are normalized using the best and worst basic indicator values that are described by the following equation (Lee et al., 1992)

$$\beta_{ij} = \frac{f_{ij} - f_{ij}^-}{f_{ij}^+ - f_{ij}^-} \text{ (When } f_{ij}^+ \text{ is best)} \quad (1)$$

or

$$\beta_{ij} = \frac{f_{ij}^+ - f_{ij}}{f_{ij}^+ - f_{ij}^-} \text{ (When } f_{ij}^- \text{ is best)} \quad (2)$$

FCP is based on a Fuzzy Composite Index (FCI). The equation for the Fuzzy Composite Index is:

$$L_j = \{\sum_{i=1}^{n_j} w_{ij} \beta_{ij}^{p_j}\}^{1/p_j} \quad (3)$$

Where, Lj is Fuzzy Composite Index for the B+1 level group j of B level indicators;

- w_{ij} is weight of B level indicators in group j;
- p_j is balancing factors among indicators for group j;
- f_{ij}^+ is the best value of i^{th} fuzzy indicators for group j;
- f_{ij}^- is the worst value of i^{th} fuzzy indicators for group j;
- f_{ij} is the value of i^{th} fuzzy indicators for group j.

The final fuzzy composite index, which is used for ranking, is obtained by calculating the FCI from basic level to top level.

The weight parameters for indicators at different levels (w_{ij}) are established based on the degree of importance that decision makers feel each indicator has relative to other indicators of the same group (Bardossy and Duckstein, 1992).

The balancing factors (p_j) reflect the importance of maximal deviations between indicators in the same group, and determine the degree of substitution between indicators of the same group. Low balancing factors (equal to 1) are used for a high level of allowable substitution. High balancing factors (equal to 3) are used for minimal substitution (Bardossy and Duckstein, 1992). The best value (f_{ij}^{+}) stands for the maximum possible value of the indicator, and the worst value (f_{ij}^{-}) stands for the minimum possible value of indicator.

5.2 FuzzyDeciMaker

The FuzzyDeciMaker tool was developed by the Civil Engineering Department of the University of Nebraska at Lincoln. It is a software tool to implement FCP functions, which supports building tree data structure, inputting data, calculating the Fuzzy Composite Index for different levels and ranking different scenarios. The indicators in the measurement of outcomes were based on using data from the SAP ERPSim training session and collected using the participant survey.

6 ANALYSIS AND RESULTS

6.1 Fuzzy Classification using FuzzyDeciMaker Tool

Since substitution is allowed for all indicators therefore, the balancing factors for all indicators are set to 1.

Table 2: Fuzzy model values.

Indicators	TC	CTC	TS	IC
Weight	0.25	0.25	0.25	0.25
Balancing factor	1	1	1	1
Best Value	5	5	5	5
Worst Value	1	1	1	1

6.2 Assessment Results

The ranking of the eight teams and the final FCI values are shown at Table 3. The teams ranking based on net profits is also shown in Table 3.

From Table 3, we can see the comprehensive assessment results of the training outcomes for the eight teams. Among these eight teams, H has the best performance, while E has the worst performance based on the net profit from the business simulation game. The fuzzy Indicator of each team is also shown in Table 3 and team H has the highest FCP index value and team E has the lowest FCP index value. Table 3 shows that the rankings from the fuzzy analysis corresponds closely with the rankings using net profit with only one positional error (rank of teams F and G are interchanged).

Table 3: FuzzyDeciMaker assessment results.

TEAM	**A**	**B**	**C**
FCP Index	0.667	0.83	0.78825
Cognitive Outcome Rank (Net Profit)	7 ($8K)	2 ($58K)	3 ($52K)
TEAM	**D**	**E**	**F**
FCP Index	0.75425	0.6085	0.70025
Cognitive Outcome Rank (Net Profit)	4 ($42K)	8 ($3K)	6 ($23K)
TEAM	**G**	**H**	
FCP Index	0.7	0.8835	
Cognitive Outcome Rank (Net Profit)	5 ($27K)	1 ($64K)	

6.3 Analysis of Second and Third Level Indicators

To investigate what indicators contributed most to the rankings, the FCI and ranking of different levels of indicators in the hierarchical model were analyzed.

Table 4: Second level indicators.

	TC		**CTC**		**TS**		**IC**	
	FCI	**#**	**FCI**	**#**	**FCI**	**#**	**FCI**	**#**
H	1.0	**1**	1.0	**1**	0.75	**5**	0.835	**3**
B	0.937	**2**	0.585	**8**	0.835	**2**	0.917	**1**
C	0.812	**3**	0.667	**4**	0.835	**3**	0.876	**2**
D	0.812	**4**	0.752	**3**	0.832	**4**	0.791	**5**
G	0.375	**8**	0.665	**5**	0.417	**8**	0.835	**4**
F	0.75	**5**	0.917	**2**	0.915	**1**	0.626	**8**
A	0.75	**6**	0.585	**6**	0.75	**6**	0.75	**6**
E	0.625	**7**	0.585	**7**	0.585	**7**	0.747	**7**

Tables 4 and 5 show the second indicator rankings and the third level indicator rankings for the team characteristics factor compared with the final fuzzy composite ranking (FCP Final Rank from Table 3).

From Table 4, we can see that the final ranking of cognitive training outcome based on Fuzzy Analysis is closest to that based on Team characteristics. The ranking based on this factor, shows that only team G is out of place in the ranking order. For example, for teams H and B are ranked as first and second, respectively by both the overall FCI score and the TCC score. The overall FCI score and the TCC score also correspond on the least effective teams, F, A and E. The above congruence in the scores for the top two and bottom three performing teams indicate that team characteristics plays the most important role on assessing cognitive outcomes with ERP Simulation training with the fuzzy model.

Other second level indicators (Collaborative training content, Training Structures and Individual characteristics) have less impact on measuring the cognitive outcomes in the fuzzy model. For each of those dimensions, there were at least 5 mismatches with the overall ranking (Table 4).

Table 5: Third level indicators for team characteristics.

	Heterogeneity	Cooperation	Team Dialog
H	1	1	1
B	2	2	2
C	3	3	3
D	4	4	4
G	5	5	7
F	8	8	8
A	6	6	5
E	7	7	6

Under team characteristics factor, the ranking based on heterogeneity and cooperation are the closest to that based on the TC indicator and the final ranking (Table 5). So, team heterogeneity and cooperation plays the most important role among third order factors inside team characteristics in assessing cognitive outcome in the fuzzy model.

7 CONCLUSIONS

We have developed and validated a model to assess the effectiveness of post-implementation training programs in building cognitive skills and business procedural knowledge. The model uses survey items from four constructs – team characteristics, individual characteristics, collaborative training content and training structures and was successful in ranking teams on outcomes, which was validated against the net profit values from the simulator. It is seen that to avoid personal differences amongst departments and employees, a collaborative training program that brings together personnel from diverse functions and business areas needs to be used to install the foundation needed for long term success. As a result of team work addressing cross functional duties during training, gaps in understanding are filled to bridge the operating silos that still exist even after ERP implementation. The close cooperation during such training programs also facilitates mass cooperation and allows greater information flow. Within teams, heterogeneity and their cooperation made substantial differences in the level of cognitive outcomes of the training program. Whereas, participation in team based training, builds understanding of the organizational culture and allows managers to address cross functionalities which enable heterogeneity of existing systems (Scott and Vessey, 2002). This allows all business duties to function and synchronize in real-time. When operating at the mature phase of an ERP system implementation, a seamless workflow of data is realized (Stephenson and Sage, 2007). In addition, Stephenson and Sage (2007) point out the importance of organizations and the need of supporting the ever changing evolution of ERP systems, and knowledge resides in all members of an organization hence the term “Organizational Capacity.” Realizing the importance of individual characteristics and the ability to measure what supports team members to collaborate in general ensures customer satisfaction, and profit sustainability. Benefits of ERP system are profits but proper oversight is duly important. Other research indicates that firms with ERP systems are less likely to experience Internal Control Weakness (ICW), (Morris, 2011). The proper training program is a critical factor when considering the individual, team, and organization that deals with consumers. Training is the way to set the tone from the top down for any ERP system implementation and post implementation management.

7.1 Contributions to Research and Practice

The major contribution of this research is to develop and validate a fuzzy logic based multi criteria measurement model to assess the factors present in a ERP post-implementation training program to develop cognitive outcomes. The level of cognitive outcomes of ERP post implementation training programs predicted from the fuzzy logic model was validated against business profitability results from the ERPSim simulator. The team composition of the participants in the training program was seen to be the most important to achieve increased outcomes from the training. To build more cross functional knowledge, the team of training participants needs to have heterogeneity and have strong cooperation among themselves. The results support a repeat study with a larger number of teams and each team having more members. The model can be used to guide future research and applied to measure other training programs. The results of the study can be used in IS practice to implement and support ERP systems more effectively. It is clear that better group composition and dynamics must be orchestrated during ERP post implementation training programs so as to boost training outcomes. Cognitive outcomes require the end users to build a strong understanding of the scope of the ERP system and understand how their function touches other functions and by designing better group interactions, the broader business procedural knowledge can be enhanced among ERP system users.

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APPENDIX

Survey Items by each study construct:

Collaborative Training Content (CTC):

1. The training required joint work within my team.
2. The training required problem solving using the SAP system.
3. The training required reflection and sharing my insights with my team members.

Training Structures (TS):

1. The training materials provided me with detailed instructions on what to do.
2. I am satisfied with the guidance provided by the facilitator during the training
3. The facilities and equipment used in the training session were excellent

Team Characteristics (TC):

1. My team member(s) came from different functional areas than me.
2. My team member(s) engaged in lots of dialog at each step of the simulation exercise
3. There was a lot of cooperation and teamwork among my team member(s)

Individual Characteristics (IC):

1. I was motivated to learn as much as I can from this training class
2. I was very interested to take this training class
3. When I learn ….
   - I like to deal with my feelings
   - I like to think about ideas
   - I like doing things
   - I like to listen and watch