Predicting Training transfer of new computer software skills: A research study comparing e-learning and in-class delivery

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Abstract

E-learning is reported to provide trainees with flexible and individual learning opportunities as well as increased practice iterations that reduce time lag between new content and application attempts. This study was designed to study the impact e-learning has on training transfer, as future application of computer software skills. Training transfer, also called skill transfer, is determined by the degree to which trainees can effectively apply skills learned in a training session to the workplace. This study on e-learning emphasizes online training as a design factor that influences training transfer. The study examines the effectiveness of training transfer by comparing skill transfer from students enrolled in an online computer software class to students' skill transfer in a classroom/lab delivery. As explained by the Theory of Planned Behavior (TPB), attitudes, subjective norms, and perceived behavior control represents the direct antecedents and predictors of the intent to transfer training. The study has implications for understanding factors that contribute to training transfer and differences between e-learning and more traditional training deliveries. The findings report that e-learners are not statistically different from classroom learners in the intent to apply new software skills. However, learners with higher attitudes and higher perceived behavioral control were statistically stronger in the intent to apply new software skills. In addition, learners with higher goal setting structure, as a modifier for perceived behavioral control, had stronger intention to apply new software skills. The findings have implications for further research as well as workplace training applications.

Introduction

The role of e-learning in workplace training (as web-based training) and higher education (as online courses) is solidified by the continued growth in the utilization of technology by organizations and universities to disseminate knowledge and prepare learners for skill applications. Primary benefits of e-learning include access to learning content, flexibility in delivery of learning content, reduced cost of delivery, and design advantages as improved feedback and learner controlled pace (Park and Wentling, 2007; Zhang and Nunamaker, 2003). Industry reports on the state of training track growth trends in e-learning usage as % of all training delivery methods and % of type of e-learning delivery. The Association for Training and Development (ASTD)'s yearly training industry report has tracked continued growth in e-learning usage for organizations across all industry sectors. E-learning delivery has grown steadily from 15.4% of total training delivery in 2002 to more than 36% in 2009 (ASTD State of the Industry 2010 report). This growth rate is remarkable relative to the total expenditures on training of 52.6 Billion dollars in 2008 (Training Magazines 2008 annual report). This data reflects the commitment that U.S. organizations are making to embrace e-learning as an investment in technological solutions relative to workplace learning and performance issues. Within the e-learning delivery data ASTD found over 75% of e-learning is web-based and of those web-based deliveries over 80% are self-paced (ASTD State of the Industry 2007 report).

Industry feedback is overall positive relative to cost savings in delivering training content. Positive trends since 2006 include an industry standard measure of reuse ratio. This measure is calculated by dividing the learning hours used by hours made available to use in the workplace. In addition the ratio of employees to trainers (in-house) has increased (ASTD 2010 report). These are important measures for organizations that are concerned with the return on their training investment as e-learning continues to grow, determining whether certain projected benefits to e-learning are being realized. In 2009 the reuse ratio was 56.3 indicating that, on average, each hour of learning content was being used 56.3 times (ASTD 2010 State of the Industry Report). Many case studies and best practice reports have also presented positive results in the increased adoption of e-learning (web-based and self-paced) in their organizations. Manufacturing companies report improved flexibility, ease of access, minimal cost per employee, and adaptable content for customized training needs when using e-learning (O'Bryan et al., 2009; ACR News, 2010; Miller, 2010). Organizations in the service sector also report important advantages of e-learning deliveries including mandatory certification and organizational learning gains (Guthridge, 2008; Donald, 2007; Overton, 2004; Zelinski, 2001).

While the growth and expectations for e-learning are positive there still remain critical challenges to fully understand and utilize e-learning applications in training. A major barrier for many organizations to fully adopt e-learning is the significant development costs. Building an infrastructure that supports e-learning requires a substantial investment. Learning content should be adapted to more costly “plug and play” types of formats. Reports that costs in the delivery and consumption of learning hours are rising is reflected in these structural expenses (ASTD 2007 State of the Industry Report). In the middle of the last recession trends in organizational spending on training presented some interesting observations. Industry experts have suggested that perhaps the dip in training expenditures were more than a response to the poor economy and may reflect both saturation and a growing lag between rapid technological advances and organizations’ ability to integrate these new technologies. New courseware is available in off-the-shelf course catalogs and virtual classroom tools. Easy-to-use and rapid authoring tools enable developers and subject matter experts to produce growing amounts of online content. Learners are becoming overcome by the amount of online content available, and there clear limitations to how much they can absorb and apply. Companies are challenged when encouraging and motivating the usage of the courses, and realize that for many training problems, online courses by themselves are not effective. Companies are searching for the right blend of training methods to maximize their effectiveness. The situation, as reported during the 2008 recession is a bit confusing as budget and staffing cuts are directing shifts away from online learning. The observation that many companies originally turned to online learning to save money from their classroom programs is worth continued investigation (Training Magazine 2008 industry report).

Perhaps the biggest challenge, and focus of this research study, is the impact e-learning has on learners’ abilities to apply training content to actual workplace behavior as defined as training transfer for this study. Scholars observing this issue report barrier issues related to individual learner and access, learning styles, perception of usefulness on the job, and experience with e-learning platforms and technologies as presented Sun, et al.’s 2008 meta-analysis of e-learning effectiveness factors. Timing of training, management support, and training objectives were also research based barriers to transfer when using e-learning applications (Park and Wentling, 2007). Eddy and Tannenbaum’s 2003 study on barriers to e-learning organized the barriers into trainee attributes, training delivery, learner motivational factors, and the post training environment. Practitioners presenting company best practices report barriers to skill application when using e-learning the availability of learning modules in very specific content areas (DeCarvalho, 2003); useful connections to corporate returns on training investments (Crush, 2009); and linkage with mandatory or required certification training (McColloch, 2009; Donald, 2007). International companies such as PepsiCo have identified 10 barrier areas that must be addressed for e-learning efforts to positively impact skill application including: 1. reducing content creation time; 2. Finding subject matter experts to develop training modules; 3. Identifying the right software tools; 4. Project management for e-learning program implementation; 5. Review and approval of modules in rapid content development context; 6. Collaboration across the organization in platform utilization; 7. Reuse and repurpose content with adjustments to existing content; 8. Mandatory assessment; 9. IT integration with other online systems; 10. Integration of relevant and current media (Unneberg, 2007).

It is interesting to note that while both researchers and practitioners recognize the importance of e-learning as it relates to applied skill transfer in the workplace there is a noticeable gap in both the research body of knowledge and industry reports. Hutchins and Burke's 2007 study found a statistical research to practice gap among training professionals. Their findings presented general agreement by training professionals in factors that influenced training transfer (organizational, individual, and design) but professionals differed in their agreement of how differences impact transfer success. This paper reports on a study investigating the relationship between e-learning and training transfer and examining factors that contribute to predicting training transfer. The study specifically adds to the examination of how learners are influenced relative to training transfer and how training methods can be predicted to impact skill transfer.

Review of Literature

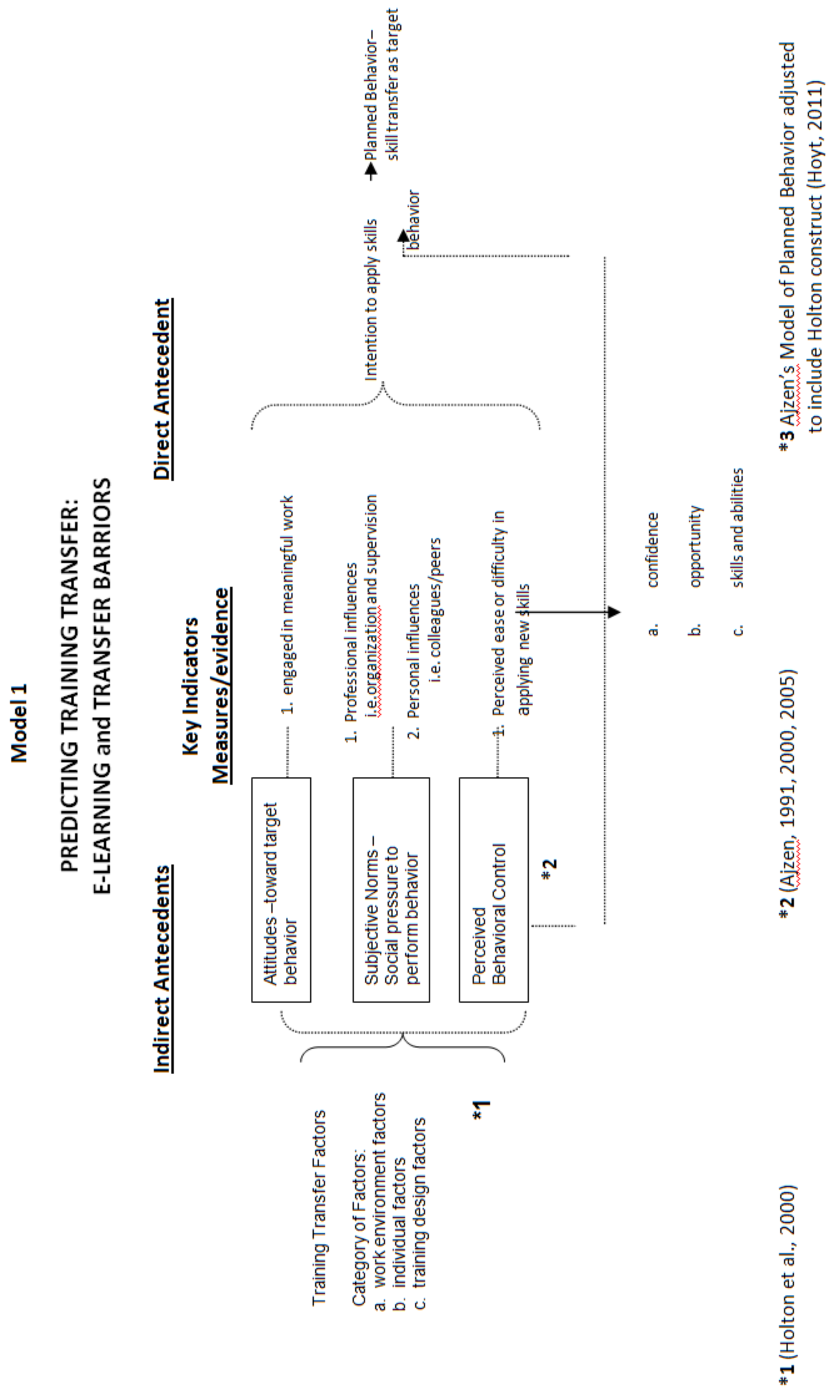
Training transfer, also known as skill transfer, is directly associated with the behavioral or application in training effectiveness evaluation. Skill transfer has been generally defined as the extent to which trainees can effectively apply skills learned/gained in a training session to actual job context (Baldwin & Ford, 1988). The definition has changed little as researchers have examined transfer since the earlier studies with only minor refinements that imply different levels of learning such as sustained learning, permanent change in behavior, or retention (Velada & Caetano, 2007). Additional refinements emphasize the transfer as resulting in improved performance (Goldstein & Ford, 2002, Noe et al., 2006). Distinctions between skills learned and practiced in training with retention and generalizing across work contexts (Holton & Baldwin, 2003; Scaduto, et al., 2008) has also added to but not changed the generally agreed upon definition of training transfer. A meta-analysis in 2003 by Eddy & Tannenbaum settled on a definition that articulated the degree to which employees use new knowledge and skills to perform their jobs and contribute to organizational success. This definition adds an important dimension to the study of training transfer…the degree of transfer rather than an absolute transfer or no transfer. A more rigorous review and testing of the influences on training transfer have been conducted over the years. A theoretical framework has evolved and generally agreed upon by those researching training transfer that categorizes the influences into 3 main influence areas/determinants of transfer: Training Design, Individual characteristics, and Work Environment (Blume, et al., 2010; Tracy et al., 2001; Holton, 1996; Kavanaugh, 1998; Holton et al., 2000, Chen et al., 2005, Velada et al., 2007). This theoretical framework is important as it provides direction for researchers and practitioners when examining training transfer. Studies on training transfer have moved forward by examining the specific factors within these categories of determinants. Factors such as self-efficacy (Velada et al., 2007), goal orientation (Chiaburu & Marinova, 2005), individual literacy skills (Bates and Holton, 2004), and motivation (Seyler et al., 1998; Scaduto et al. 2008) address individual determinants of training transfer research. Factors such as feedback, supervisory support, and corporate culture (Clarke, 2002; Subedi, 2006; Falconer, 2006) address the work environment determinants of training transfer research. Factors such as the content relevance (Liebermann & Hoffmann, 2008), trainer aptitude and characteristics (Kopp, 2006; Holladay and Quinones, 2008) and pre-training scripts (Santhanam, 2002) address design determinants of training transfer research. Recent studies on training transfer have also included research on the impact of e-learning and training transfer**.** Though e-learning studies have been increasing steadily from at least 2003 (Zhang, 2003) works examining e-learning and training transfer is a less developed analysis area. Initial work on e-learning concentrated on the role that e-learning could play in training for organizations. Widely described as the benefits of e-learning, Zhang's 2008 meta-analysis outlined 6 basic added value categories for organizations using e-learning including: time and location flexibility; cost and time savings (Khirallah, 2000; Moe and Blodget, 2000); self-paced and just-for-me learning (Beam and Cameron, 1998; Burgstahler, 1997); collaborative learning environment (Hiltz and Benbunan-Fich, 1997); better access to the trainers (Hiltz and Wellman, 1997;

McClosky et. al, 1998); unlimited use of learning materials. The earlier research studies examining the impact of e-learning and trainees focused on learner satisfaction (Sun et. al, 2008; Wang, 2003; Arbaugh, 2000, 2002). Subsequent studies transitioned to research on studies that emphasize e-learning and training transfer. Recent research on e-learning have been integrating Holton's three categories of transfer factors (design, organizational, and individual) as a guideline for more focused studies on the modifying factors when using e-learning to improve training transfer (Holton et. al, 2000). Specific design studies focus on pre-training activities and in training practice opportunities (Leone et. al, 2004; Hong, 2002), organizational focus on supervisor support and learning culture (Lim et. al, 2006; Lewis, 2002), and individual factors attitudes (Park and Wentling, 2007; Katz 202); learner control (Granger and Levine, 2010); self- efficacy (Shih, 2008; Tai, 2006; Thompson et. al, 2002); personality type (Kanuka and Cocente, 2003). This study examines individual, design, and organizational factors and will add to this important body of knowledge on e-learning and training transfer.

An additional construct and theoretical framework, the Theory of Planned Behavior (TPB), will be used to measure skill transfer as the intent to apply training content. The theoretical framework for connecting external events such as training delivery type (e-learning) to the predicting of workplace performance is based on the theory of planned behavior (Ajzen, 1987). The theory of planned behavior theorizes that antecedents of behavioral intent such as applying training content include attitudes, subjective norms, and perceived behavioral control. Behavioral intent can then be used to predict future behavior in the workplace. The theory of planned behavior (TPB) is a theoretical construct resulting from the earlier theory of Reasoned Action. Reasoned action poses that intentions to behavior can be predicted from measuring attitudes toward the target behavior and subjective norms related to the target behavior (Ajzen & Fishbein, 1975, 1980). Central to TPB is that a person's intentions to behave are anticipated to include motivational aspects that influence behavior and indicate how much effort individuals are willing to exert. The first independent determinant, attitude, refers to the degree to which a person has a favorable or unfavorable evaluation of the target behavior. The second determinant, subjective norm refers to the perceived social pressure to perform or not perform the target behavior. The theory of planned behavior extends the scheme of antecedent to action by adding a third independent determinant of intent to behave, perceived behavioral control, a factor referring to the perceived ease or difficulty of performing a behavior. This third determinant also assumes that past experiences, anticipated impediments and obstacles are considered when assessing control. Implied in this factor is the general acceptance that the more favorable the attitude and subjective norm relative to the target behavior and the greater the perceived behavioral control the stronger should be an individual's intention to perform the behavior under consideration will be (Ajzen, 1987). Ajzen's work on the theory of planned behavior focuses on intention, regarded as one immediate antecedent of actual behavior. The stronger an individual's intentions to achieve a behavior target the more successful they are predicted to be in actually reaching the target behavior. Ajzen offered two foundations for the hypothesis that perceived behavioral control together with intention (as influenced by attitude and subjective norms) can directly predict behavior. The first foundation is that while holding intent constant the effort expended to reach a target behavior will increase with perceived behavioral control. The higher level confidence (perceived control) that an individual has will strengthen their perseverance to achieve the target behavior as compared with an individual who doubts their ability to reach a goal. This foundation also assumes that intentions can be separately influenced by attitudes and subjective norms thus allowing for individuals with different perceived control able to have equally strong intentions to act. The second foundation addresses the direct link between perceived behavioral control and actual behavior by positing that perceived behavior control can be used as a substitute for a measure of actual control. The extent to which perceived control is accurate determines the extent it can be used to predict the probability of reaching a behavior target. To predict behavior may sometimes be sufficient to consider intentions (attitude and subjective norm) alone while other situations may require both intentions and behavioral control (Ajzen, 1985, 2005). One strength of the Ajzen framework is based on studies suggesting that intentions are good predictors of behavior in high involvement situations such as consumer behaviors (Canniere et. al, 2009; Shih and Fang, 2005; Bansal and Taylor, 2002; occupational intentions (Arnold et. al 2006; Krueger et. al, 2000); mindfulness and habituation (Chatzisarantis and Hagger, 2007; Ajzen 2002); and training and training transfer (Hoyt, 2011; Burns, 2009; Johnson and Hall, 2005; Bledsoe, 2005).

Using the Theory of Planned Behavior (TPB) as a construct to predict training transfer is a developing body of knowledge as studies have probed interventions that influence transfer effectiveness. As previous studies have made connections between intentions (motivations) and target behaviors (transfer of training) methods, such as the theory of planned behavior, have been identified as a viable method to measure intention to apply skills developed in training. Santhanam's 2002 study established the strength of TPB as it examined the impact of manipulating a pre-training script with messages intended to enhance behavioral, normative and control beliefs had on the intention to transfer training. Research studies using TPB as the framework to measure training transfer have been conducted in Human Resource areas such as diversity training (Wiethoff, 2004), safety training (Johnson and Hall, 2005) and new policy implementation (Breslin et. al, 2001). Studies using TPB that examined transfer of technology skills include general usage of technology after training (Smarkola, 2008) and specific statistical software (Leone et. al, 2004). Studies using TPB to measure training transfer involving web-based or online learning include predicting continued adoption of web-based learning (Shih, 2008) and effectiveness of online delivery (Lim et. al, 2007). This study will add value to the body of knowledge of e-learning effectiveness as a training delivery as well as provide additional insights into the use of TPB as a framework to predict future transfer behavior post training interventions.

Model 1 represents a view of this study's use of e-learning, Holton's influence factors on training transfer, and Ajzen's theory of planned behavior constructs.


Model 1
PREDICTING TRAINING TRANSFER:
E-LEARNING and TRANSFER BARRIORS
Indirect Antecedents
Key Indicators
Measures/evidence
Direct Antecedent
Training Transfer Factors
Category of Factors:
a. work environment factors
b. individual factors
c. training design factors
*1
Attitudes –toward target behavior
Subjective Norms – Social pressure to perform behavior
Perceived Behavioral Control
*2
1. engaged in meaningful work
1. Professional influences i.e.organization and supervision
2. Personal influences i.e. colleagues/peers
1. Perceived ease or difficulty in applying new skills
Intention to apply skills
behavior
Planned Behavior– skill transfer as target
a. confidence
b. opportunity
c. skills and abilities
*1 (Holton et al., 2000)
*2 (Ajzen, 1991, 2000, 2005)
*3 Ajzen's Model of Planned Behavior adjusted to include Holton construct (Hoyt, 2011)

Objectives and Hypothesis of this Study

This project used data from quantitative design study to examine the impact e-learning has on predicting training transfer. The independent variable e-learning is examined using modifiers attitude, subjective norms, and perceived behavioral control as framed in Ajzen's theory of planned behavior. These modifiers represent antecedents to the intention to apply new software skills. The dependent variable, intent to apply new software skills, is also framed using Ajzen's theory of planned behavior. Findings may lead to a better understanding of the impact e-learning has training transfer. The findings may also provide insights into modifying factors that optimize e-learning as it relates to training transfer of new software skills.

H1 – E-learners will have stronger intent to apply new software skills than in-class learners.
H2 – Learners with higher intention antecedents will have stronger intent to apply new software skills.
H2a – Learners with higher attitude scores will have stronger intent to apply new software skills.
H2b – Learners with higher subjective norm scores will have stronger intent to apply new software skills
H2c1 – Learners with higher perceived behavioral control scores will have stronger intent to apply new software skills.
H2c2 – Learners with higher goal setting structure scores will have stronger intent to apply new software skills

Methods

Sample, Data Collection, and Analysis Plan

The subjects in this study included 31 undergraduate students enrolled in a software application class. Fifty one % of the students enrolled in these courses were in an online section, 58% female and 73% working either part time or full time. Potential participants were identified by their enrollment in software application courses and contacted in week 9 of a 10 week quarter term. Students were invited to participate through the e-mail function of their course website (Blackboard) linked to a web-based survey on SurveyMonkey software . The analysis design was a post training survey. The survey design included sections for: 1) respondent profile, 2) attitude toward target behavior of skill transfer in the workplace, 3) subjective norms relative to target behavior, 4) perceived behavior control relative to target behavior, and 5) the intention to apply transfer skills from training into the workplace. The analysis plan included descriptive statistics for respondent profile (frequencies) and respondent profile for independent and dependent variables (central tendencies). Inferential and differences analysis were planned to express generalizations about learners (e-learning and in class learners) from the study sample. Statistical differences analysis was planned for hypothesis testing measuring differences between e-learners' and in class learners' training transfer. Means differences between groups tests were conducted to display statistical differences between e-learners' and in class learners' training transfer intention when certain dependent variable factors were present (attitudes, subjective norms, perceived behavioral control). The Independent T-test, recommended for small sample size ($n \leq 30$), was used to report mean differences between groups (e-learners and in class learners) and their intention to apply new software skills. Impact of dependent variables on the independent variable intention to transfer skills (hypothesis and means testing) were defined as "higher" or "lower" when calculated score (in attitude, subjective norms, perceived behavioral control, and goal setting structure) were above or below the calculated average for each dependent variable.

Survey Measures

The survey instrument used for this study was adapted from Ajzen's guidelines for measuring attitudes, subjective norm, perceived behavioral control, and intention to behave (Ajzen, 2002). Each of the subscales used a 7 point Likert type scale. Attitudes were measured using five items such as "applying new software skills for other classes/in workplace in the next 3 months will be…scale from most enjoyable to least enjoyable." Cronbach alpha test for reliability on the attitude construct was .94. Subjective norm was measured using three items such as "most people who are important to me would approve of me applying new computer software skills…scale from strongly approve to strongly disapprove". Cronbach alpha test for reliability on the subjective norm construct was .81. Perceived behavioral control was measured using 3 items such as "how much personal control will you have in applying new software skills in the next 3 months. . .scale from complete control to no control at all." Cronbach alpha test for reliability for the perceived behavioral control construct was .80. The goal setting construct was measured with 3 items such as "I have identified a specific activity where I can use new software skills…scale from strongly agree to strongly disagree". Chronbach alpha test for reliability for the goal setting construct was .69. The intent to apply software skills after training construct was measured with 5 items such as "I am determined to use new software skills in the next 3 months…scale from strongly agree to strongly disagree". The Cronbach alpha test measuring reliability for the intent to apply new software skills was .83.

Results

The findings suggest that e-learning does not have a statistical impact on training transfer of new computer software skills as compared to in-class experience (H1). However, findings of the study did present factors that contribute to predicting future training transfer, as defined by the intention to transfer new software skills (H2 and H3). The Independent T-test results in table 1 display a greater mean for students experiencing in-class relative to intentions to apply new software skills (M=12.69) than students experiencing e-learning (M=10.5). The mean difference was not statistically significant for hypothesis 1.

Table 1 – Independent T-test analysis to determine mean differences in the intention to apply new software skills when comparing e-learners to in-class learners.

Mean differences in intention between e-learners and in-class learners	Mean difference description	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Intention to apply software skills	Greater mean for in-class	-1.241	25	.226	-2.19231	1.76718

Note: $^{*}p \leq .05$, $^{**}p \leq .01$, $^{***}p \leq .001$

Table 2 presents the independent T-test that was calculated to determine if there were statistical differences in mean scores for three individual antecedent factors that influence the intention to apply new software skills. Table 2 also presents the independent T-test calculation to determine statistical differences in mean scores for aggregate antecedent factors that influence the intention to apply new software skills. The findings express that learners with stronger individual antecedent factors scored higher in the intention to apply new software skills in the future with 2 antecedents statistically significant. Learners with a stronger aggregate antecedent factor also scored higher in the intention to apply new software skills in the future and were statistically significant. Learners with stronger (higher than average mean) attitudes toward applying new software skills in the future had higher scores in the intent to apply new skills and was statistically significant at t=3.372 (24), p<u><</u>.01. Learners with stronger subjective norms toward applying new software skills in the future had higher scores in the intent to apply new skills and was not statistically significant at t=1.648 (25), .112. Learners with stronger perceived behavioral control toward applying new software skills in the future had higher scores in the intent to apply new skills and was statistically significant at t= 4.961 (25), p≤.001. Learners with stronger total antecedents (attitude, subjective norm, and perceived behavioral control) toward applying new software skills in the future had higher scores in the intent to apply new skills and was statistically significant at t= 4.78 (25), p≤.001.

Table 2 – Independent T-test analysis to determine mean differences in intention to apply new software skills when comparing all learners with higher intention antecedent scores to those learners with lower intention scores.

Mean differences in antecedents to the intention to apply new software skills	Mean difference descriptio n	t	df	Sig. (2-tailed)	Mean difference	Std. error differenc e
Attitude antecedent-intent to apply skills	Greater mean for higher attitude	3.372	24	.003**	5.26190	1.56041
Subjective Norm antecedent-intent to apply skills	Greater mean for higher SN	1.648	25	.112	2.89773	1.75850
Perceived Behavioral Control antecedent –	Greater mean for higher PBC	4.961	25	.000***	6.41209	1.29251

intent to apply skills						
Aggregate total antecedents-intent to apply skills	Greater mean for higher total Antecedents	4.780	24	.000***	6.53939	1.36820

Note: *p≤.05, **p≤.01, ***p≤.001

Table 3 presents the independent T-test that was calculated to determine if there were statistical differences in mean scores for learners with strong goal setting structure factors that influence perceived behavioral control. Table 3 also presents the independent T-test calculation to determine statistical differences in mean scores for goal setting structure factors that influence the intention to apply new software skills. The findings express that learners with stronger goal setting structure factors scored higher in the antecedent perceived behavioral control and the intention to apply new software skills in the future. Learners with stronger (higher than average mean) goal setting structure had higher scores in the antecedent perceived behavioral control and was statistically significant at $t = 5.087$ (25), $p \leq .001$. Learners with stronger (higher than average mean) goal setting structure had higher scores in the intent to apply new skills and was statistically significant at $t=7.002$ (25), $p \leq .001$.

Table 3 – Independent T-test analysis to determine mean differences in intention to apply new software skills when comparing learners with higher goal setting scores to learners with lower goal setting scores.

Mean differences in goal setting structure to the intention to apply new software skills	Mean difference description	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Goal setting and Perceived Behavioral Control	Greater mean for higher Goal Setting Structure	5.087	25	.000***	3.45	.67816
Goal Setting	Greater	7.002	25	.000***	7.45	1.06391

structure and total intention	mean for higher Goal Setting Structure					

Note: *p<.05, **p<.01, ***p<.001

Table 4 presents the independent T-test that was calculated to determine if there were statistical differences in mean scores for three individual antecedent factors that influence the intention to apply new software skills for just e-learning subjects. Table 3 also presents the independent T-test calculation to determine statistical differences in mean scores for aggregate antecedent factors that influence the intention to apply new software skills for e-learners. The findings express that e-learners with stronger individual antecedent factors scored higher in the intention to apply new software skills in the future with 2 antecedents statistically significant. E-learners with a stronger aggregate antecedent factor also scored higher in the intention to apply new software skills in the future and were statistically significant. Learners with stronger (higher than average mean) attitudes toward applying new software skills in the future had higher scores in the intent to apply new skills and was statistically significant at t=3.184 (11), $p \leq .01$. E-learners with stronger subjective norms toward applying new software skills in the future had higher scores in the intent to apply new skills and was not statistically significant at t=1.982 (12), .071. E-learners with stronger perceived behavioral control toward applying new software skills in the future had higher scores in the intent to apply new skills and was statistically significant at t= 4.556 (12), $p \leq .01$. E-learners with stronger total antecedents (attitude, subjective norm, and perceived behavioral control) toward applying new software skills in the future had higher scores in the intent to apply new skills and was not statistically significant at t= 2.042 (11), .066.

Table 4 – Independent T-test to determine differences in E-learning students intention to apply new software skills between students with above average scores in intention antecedents and students with below average scores in intention antecedents.

Mean differences in antecedents to the intention to	Mean difference description	t	df	Sig. (2-tailed)	Mean difference	Std. error difference

apply new software skills for e-learning students only						
Attitude antecedent-intent to apply skills	Greater mean for higher attitude	3.184	11	.009**	5.92857	1.86201
Greater mean for higher Subjective Norm (SN)	Greater mean for higher SN	1.982	12	.071	4.14286	2.08982
Greater mean for higher Perceived Behavioral Control	Greater mean for higher PBC	4.556	12	.001**	6.70833	1.47250
Greater mean for higher total Antecedents	Greater mean for higher total Antecedent s	2.042	11	.066	4.907476	2.40203

Note: *p<.05, **p<.01, ***p<.001

Discussion

Overall, findings of the study revealed that trainees/students with stronger intention antecedents in attitude and perceived behavioral control had stronger intentions to apply new software skills in the future (H2a and H2c). While the analysis results suggest statistical connections between intention antecedents and behavioral intentions relative to training transfer, there was one antecedent not found to be statistically connected to stronger intention to apply training skills(H2b). However, ~~In addition~~, online delivery of training content was not found to be statistically significant as compared to the control group of in-class subjects (H1). The findings did not fully support Hypothesis 1, that e-learning delivery of training content would more strongly impact the intent to apply training than in-class delivery. While the mean for intention to apply new software skills was higher for online classes the difference between e-learning classes and in-class was not statistically significant. Findings specific to e-learners did reveal that when examining only e-learning subjects there was a statistical difference between learners with high intention to apply new software skills and learners with low intention when antecedent scores (attitude, subjective norm, perceived behavioral control) were high. Also, when examining only e-learning subjects there was a statistical difference comparing learners with strong antecedent scores with those with weaker antecedent scores in the intention to apply new software skills. Subjects of this study who had higher scores in the antecedent measures (Hypothesis 2) had stronger intentions to apply new software skills. All three antecedents of attitude, subjective norm, and perceived behavioral control had higher mean scores in intention. Attitude and perceived behavioral control, including goal setting structure as a modifier, were statistically significant as stronger influences on the intention to apply new software skills. One possible explanation of why the subjective norm antecedent was not statistically significant as a factor in intention to apply new software skills is based on students less experience in forming expectations of how potential supervisors in an organization might support their new skills after training. Petty et. al's 2004, while not using the TPB construct, found no differences between online (CD-based) learners and in-class learners in training transfer as measured by a standardized training performance self-assessment tool (Training Performance Transfer / TPT scale). Other reported studies on e-learning transfer using models similar to the theory of planned behavior and those using the TPB construct do not use an in-class control group so direct comparisons of this study's results are tangential. However, the findings using just e-learning subjects are supported by other studies that have examined e-learning and training transfer. Lim et. al's 2006 study reported a positive relationship between attitude (as motivation), subjective norm (as senior/supervisor support), and perceived behavioral control (as self-efficacy) with stronger training transfer as measured by an adapted self-report scale. As reported in Granger and Levine's 2010 meta-analysis learning perceived behavioral control (as learner control) is associated with skill based learning outcomes. Shih's 2008 study reported findings supporting the hypothesis that perceived behavioral control positively impacted training transfer for e-learners. More generalized studies examining studies on training transfer of new software skills include Leone et. al's 2004 study that reported findings indicating a positive relationship between stronger and intention to apply new software skills and when target behavior of skill transfer is relevant to learners both perceived behavioral control and subjective norms positively impact the intention to apply new software skills. The results reporting on the main hypothesis (H1) that e-learners did not have stronger intentions to apply software skills while antecedents (attitude, perceived behavioral control, and goal structure) did have an impact on intention to apply software skills (H2a and H2c) may still be revealing the extent to which delivery platform (online vs. in class) is influential in skill transfer. The delivery platform could be more likely to influence transfer when it is a framework that facilitates the autonomy of e-learning (Park and Wentling, 2007; Zhang and Nunamaker, 2003) but not be a barrier to perceived behavioral control and goal structure. A study in 2010 reported stronger performance (applied skills) when learners (interns) were in learning environments where autonomy and goal clarity were present. They define goal clarity as the extent to which a learner has defined task goals (work products to be completed) and task activities (specific task strategies used to accomplish task goals). Goal clarity is more intense and influential (performance as skill transfer) when learners understand what work products are expected and have standards which work products can be evaluated. When task goals are understood learners' attend and effort can be focused on relevant activities and skills are developed that work products require. In contrast, when task goals are unclear uncertainty and stress impair the ability to learn by making it difficult to identify, acquire, and perform appropriate activities to accomplish the task. The connection to autonomy (discretion to carry out assigned task goals and select task activities on own) is present when unclear task goals with high autonomy lead to ambiguity in task goals and activities to accomplish goals. Lower autonomy (more structure in assigned task goals and work activities) can focus learners' attention and effort on prescribed activities and procedures that allow learning to take place while effectively completing work products, demonstrating skill transfer (Beenen and Mrousseau, 2010). Interpretations of if and how delivery platforms (e-learning vs. in class) impact skill transfer are multivariate perspectives that require examining interaction between platform and mitigating factors.

Implications

The implications are numerous for trainers and educators committed to understanding factors that influence training transfer. With increasing pressures to reduce costs and improve organizational competitive advantage the contribution of training will remain an important factor. Though this study's findings did not find unequivocal evidence of e-learning advantages relative to training transfer the findings do provide clear guidelines for trainers and educators in general. One important implication is extended to the growing technological interventions in training and education. Anticipated benefits costs and access of e-learning applications (i.e. smart phones, pads, etc.) and delivery methods in e-learning should be tempered by the acknowledgement that e-learning benefits in performance improvement as training transfer are dependent on the modifying factors of attitude and perceived behavioral control of trainees. The second implication implies that trainers/educators should emphasize organizational support, training design features, and individual trainee experiences that facilitate strengthening the attitudes of learners toward the target behavior of applying training content and developing individual's perceived behavioral control relative to the target behavior of applying new training content. The body of knowledge on the factor categories of training transfer can be designed and evaluated for specific learning environments based on projected impact on attitude and behavior control. When addressing training design trainers should consider options in instructional design techniques that strengthen the perception trainees have relative to their abilities and opportunities to apply new skills. Trainee characteristics such as achievement motivation, strength of rewards, improved self-efficacy, and job satisfaction should be important measures added to the pre-training, training, and post training evaluation of training content and methods chosen. The extent to which training design and delivery interventions targeting trainee characteristics impact trainee attitude and perceived behavioral control will determine the degree of training transfer post training. Implications for understanding organizational work environment influences such as supervisory support, peer support, and performance feedback were not advanced in this study's examination of the strength of subjective norms on intention to apply new trainee skills. While most studies examining supervisory support indicate a positive relationship with transfer Velada et. al's 2007 study also did not find a statistical relationship between supervisory support and training transfer. However, abandoning the consideration of an organization's influence on training transfer is not prudent when other research has reported influence but implied in this study is that modifiers or mitigating factors to subjective norms should be identified.

Recommendations for Future Research

The findings of this study provides suggestions for future research directed at examining connections between specific training interventions and improved attitude, perceived behavioral control, and intentions to apply new training skills. Previous studies that examined training transfer using Holton et. al's 2000 3 factor construct for impacting skill transfer can now strengthen the understanding of training interventions beyond the category by connecting it with its relationship with developed attitude, subjective norm, and perceived behavioral control. As an example the findings of Chen et al.'s 2005 study that examined how design factors contributed to transfer could be extended by examining how specific design features and instructional e-learning techniques impacted attitudes, subjective norms, and perceived behavioral control. Evaluating specific training interventions using this framework would strengthen organization's decision making when deciding on delivery and various organizational returns on training investment. Additional contributions to these future studies as adding value to the training transfer construct could be projected in the depth of our understanding of transfer factors as well as a model that aids in predicting successful training transfer behavior based on stronger intentions. Additional research directions suggested by this study include longitudinal research on training transfer and exploring how well research constructs in goal setting theory (Locke and Latham, 1984) might explain both strength of perceived behavioral control and subjective norms. While the TPB construct's solid research base on predicting future behavior based on influencing behavior intention is the foundation of this study longitudinal research will be needed to address any continuity with retention studies such as Wexley and Latham's 2002 study that found 40% of transfer occurring immediately following training drops to 25 % in 6 months and 15% is one year. Leone et al.'s 2004 study examined how goal setting behavior and TPB compared when used to predict training transfer. Brown's 2005 research examined effective goal setting and training transfer. I propose that research extending their work that examines how GST as a subset of TPB could best predict training transfer.

Limitations of this Study

As in many studies in the field of training transfer there are important generalization issues that must be considered. First, studies generalizing the impact on training transfer are generalized to workplace training from subjects that were university students. The validity in using students as surrogates for workplace predictions is equivocal in the literature. Important in considering this issue relative to training transfer is Locke's 1986 study that reported college students and employees respond similarly to goals, feedback, incentives, and participation…all components of training transfer factors. Other studies using business students have concluded that generalizing to employees is strengthened with students when measuring behaviors that are as meaningful to students as they are to employees. The construct of intent in this study included future predictions on application in workplace situations. Training transfer research has reported strong relationships between trainee's perception of content relevance and transfer effectiveness (Falconer, 2006;Santhanam, 2002) and a case could be made even when considering Locke's 1986 study that students can't fully perceive relevance until they are actually in the workplace. Another limitation of this study important in the interpretation of results includes the experience of subjects relative to e-learning. Smarkola's 2008 study found differences between experienced and inexperienced technology users when examining transfer behavior of teachers. This study did use profile questions that attempted to measure e-learning experience (i.e. # of times engaged in e-learning and frequency) but those single measure items may not be adequate to gauge or interpret that factor as it relates to intent to apply new software skills. This is especially important as one interprets the results of this study as it found that there were no statistical differences between e-learning and in-class learners relative to intent to apply new skills. The comfort level of the e-learning environment could certainly be a possible mitigating factor for learners.

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