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An empirical examination of e-learning design: The role of trainee socialization and complexity in short term training

Regina Yanson [a, *], Richard D. Johnson [b]

[a] School of Business, Francis Marion University, Florence, SC 29501, USA
[b] University at Albany, SUNY, USA

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ABSTRACT

Using data from 143 individuals, this study examined how pre-training socialization and task complexity affected learning in an online environment. A controlled laboratory experiment, using a 3 (socialization) × 2 (complexity) between subjects design was conducted. Participants were assigned to either more or less complex training and received either face-to-face, online, or no socialization before beginning the training. Results indicated that those who received face-to-face socialization performed better than those who received either online socialization or no socialization. There was no learning difference between the online and no socialization condition. Those who received simpler training performed better than those who received more complex training. Socialization and complexity were not interactively related. Implications for research and practice are discussed.

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1. Introduction

Organizations continue to invest billions of dollars annually into the training and development of their employees with the goals of producing positive changes to their workforce, maximizing employee potential, and improving organizational performance. In 2011 alone, U.S. organizations spent $156.2 billion (or $1,182 per employee) on learning and development (Miller, 2012). Of this training, over 25% of the hours were spent online and nearly 40% were technology supported (Miller, 2012). Organizational commitment to these e-learning initiatives is high, with some estimating that the global e-learning market will be nearly $50 billion by 2015 (Adkins, 2011). E-learning is argued to provide efficiency and cost savings (DeRouin, Fritzsche, & Salas, 2004; Welsh, Wanberg, Brown, & Simmering, 2003), greater flexibility and learner customization (Cascio & Aguinis, 2005; Kraiger, 2003; Long & Smith, 2004), and reduction of training time (Salas, DeRouin, & Littrell, 2005; Welsh et al., 2003). For example, companies have found cost reductions of over 40% compared to traditional training (Gill, 2000) and IBM was able to provide five hundred percent more training at one third the cost by switching to e-learning (Hall & LeCavalier, 2000).

However, the implementation of e-learning has not automatically resulted in increased training efficacy (Goldstein & Ford, 2002). There are potential drawbacks that can limit the effectiveness of e-learning. These include an added level of complexity resulting from the technology mediation of course interactions (Hillman, Willis, & Gunawardena, 1994), a sense of isolation

* Corresponding author.
E-mail address: ryanson@fmarion.edu (R. Yanson).

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felt by learners (Garrison & Arbaugh, 2007; Welsh et al., 2003), and lower learner engagement (Salas et al., 2005). Thus, it should not be surprising that many students, faculty, and professionals have indicated that they prefer face-to-face (FtF) courses over online courses (Means, Toyama, Murphy, Bakia, & Jones, 2010). Some scholars have therefore argued that e-learning is less effective than FtF training because it is simply an adaptation of other training tools and inferior to the original delivery method (Barton & Delbridge, 2001). But, research has shown that performance deficits in e-learning are often less due to technology and more due to training design (Sitzmann, Kraiger, Stewart, & Wisher, 2006).

Ultimately maximizing the advantages of e-learning while mitigating its drawbacks is less about technology, and more about applying sound training principles and using technology in a manner that best supports these design principles. For example, a key recommendation made by Salas et al. (2005) was to "allow for interaction between trainees and for communication between trainees and facilitators" (p. 117). Research has shown that purposeful interaction between trainees improves e-learning outcomes (e.g., Arbaugh & Benbunan-Fich, 2006; Johnson, Gueutal, & Falbe, 2009; Johnson, Hornik, & Salas, 2008). But a remaining question is what can be done to increase the frequency of purposeful interactions when e-learning occurs in a compressed timeframe, rather than in an ongoing setting?

Facilitating purposeful interactions in shorter courses will likely grow in importance because the length of a course has become one of the most important considerations by CEOs as they evaluate training investments (Skillsoft, 2012). Research has shown that even for short-term teams, having members develop stronger interpersonal relationships is important (Druskat & Kayes, 2000). Therefore, it is important to investigate mechanisms for designing e-learning that enhances the likelihood that members gain stronger interpersonal relationships and a shared learning environment. Thus, one purpose of this research is to focus on the use of pre-training socialization to build peer connections early in the training. Pre-training socialization occurs when learners are provided with an introductory socialization period where they have the opportunity to get to know each other, develop relationships, and develop a sense of trust with their peers. For example, in pre-training socialization, trainees could engage in activities where they could share information about themselves such as their job titles, location, hobbies, and interesting facts about themselves.

To this research question, we add a second one, how does learning complexity can affect performance in e-learning? Learning complexity is a reflection of the information load, information diversity, and rate of information change involved in training (Sweller, 1988). Salas et al. (2005) recommended that organizations "provide distance learning for hard-skill training but supplemented with other forms of instruction for training on such abstract topics as workplace ethics" (p.120). It has been argued that some material may be too complex to effectively communicate in an online environment (Salas et al., 2005; Welsh et al., 2003). But only limited empirical work on the role of complexity exists. Therefore a second goal of this study is to investigate the role of learning complexity.

Despite the concerns about using e-learning for more complex tasks, it has been argued that the more that trainees are connected and part of a shared learning environment, the more effective learning should be (Johnson et al., 2008). In addition, research has also argued that the more individuals have a shared understanding and communication environment, the greater the complexity of tasks that they can complete electronically (Markus, 1994; Zack & McKenney, 1995). Even though complexity can make learning more challenging, these previous studies suggest that peer connections and a shared learning environment may be even more important when the training tasks are more complex. Therefore, the final focus of this study was to investigate whether learning complexity and trainee socialization were interactively related to learning.

2. Theoretical overview

2.1. E-learning

E-learning has been defined as a form of training where "learning material [is provided] in online repositories, where course interaction and communication and course delivery are technology mediated" (Johnson et al., 2008: 357). Research on e-learning can be broadly categorized into three main areas: course/training design factors, technology factors, and student/trainee factors. For example, research on e-learning design has compared the effectiveness of online versus FtF instruction (Campbell & Swift, 2006; Sitzmann et al., 2006). It has also focused on the role of peer and instructor interactions (Arbaugh & Benbunan-Fich, 2006; Arbaugh, 2000, 2001; Russell, Kleiman, Carey, & Douglas, 2009) and the use of learner control (Akyol & Garrison, 2008; Orvis, Fisher, & Wasserman, 2009). Still other research has focused on how using techniques such as metacognitive instruction (Schmidt & Ford, 2003) or adaptive guidance (Bell & Kozlowski, 2002) can improve outcomes.

E-learning research has also focused on how technology can enhance e-learning. For example, studies have focused on the use of WebCT/Blackboard, mobile phones, group support systems, and online video tutorials (Alavi, Marakas, & Yoo, 2002; Chao & Chen, 2009; Lu, Yu, & Liu, 2003; Zhang, Zhao, Zhou, & Nunamaker, 2004). Research has also focused on the adoption and use of e-learning technology and how these adoption factors affect e-learning effectiveness (Carswell & Venkatesh, 2002; Ong, Lai, & Wang, 2004). Finally, research has focused on student/trainee characteristics such as computer experience, conscientiousness, goal orientation, self-efficacy, and metacognitive activity (Brown, 2001; Johnson et al., 2009; Schmidt & Ford, 2003; Schniederjans & Kim, 2005). The current study best fits within the design factors research stream and extends research on two design considerations: trainee socialization and training complexity.

2.2. Trainee socialization

The importance of collaboration and interaction between students and their peers in e-learning has been well established (e.g., Arbaugh & Benbunan-Fich, 2006; Johnson et al., 2008). "Through communication, members learn to adapt to one another as they create and recreate a unique culture and group structures, engage in relevant process and activities, and pursue individual and group goals" (Anderson, Riddle, & Martin, 1999: 142). Learners are able to share tasks, exchange ideas, course information and feedback, all of which may help to improve learner engagement (Arbaugh & Benbunan-Fich, 2006; Piccoli, Ahmad, & Ives, 2001). Peer interaction and collaboration also provides trainees with opportunities to influence each other and create unique training cultures and learning communities.

Creating these online communities of learning has long been of interest to researchers (e.g., Alavi et al., 2002; Gunawardena & Zittle, 1997), but much of this research has focused on longer-term classroom learning groups, which are often semester or year long. What is less well known is how to develop and encourage deeper interactions in short term-training courses such as certification courses in team building, negotiations, leadership, project management, health and safety, and other focused skills courses. These courses are typically shorter in nature and frequently range in length from a few hours to a few weeks. Given the importance that CEOs are putting on training length (Skillsoft, 2012), the importance of short-term, focused training courses will likely increase.

One potential way to increase purposeful trainee interactions is by providing pre-training peer and group socialization opportunities. In this initial socialization period, trainees have the opportunity to get to know each other and become comfortable communicating with one another. This initial socialization period can have many benefits. First, socialization may foster tighter group or learner cohesion. Group dynamics researchers frequently reference cohesion as an essential element for team performance (Crouch, Bloch, & Wanlass, 1994; Yalom, 1995). Second, as group members get to know each other they can develop a sense of trust with their fellow members (Suchan & Hayzak, 2001). Trust is essential in building successful learning communities because it can result in increased interaction, cooperation, peer feedback, enthusiasm, and support for group members (Giddens, 1991; Jarvenpaa & Leidner, 1999).

A common finding from the group support system literature is that although technology can increase the amount of information available, and it can increase the amount of information shared, they often do not lead to improved knowledge gain or performance (Dennis, 1996). Within an e-learning setting, socialization can help learners overcome this issue by providing them with an early opportunity to establish stronger relationships and increase peer connectedness. These relationships should help learners establish learning communities earlier in training. Development of a shared community can affect knowledge acquisition in several ways. First, when individuals feel that they are in a shared environment, they can exchange richer and more complex information (McGrath, Arrow, Gruenfeld, Hollingshead, & O'Connor, 1993). Second, individuals can place a higher value on peer communication (Sahay, 2004) and attend to this communication more deeply (Mackie, Worth, & Asuncion, 1990) when they know and can trust the information from those in their group. Third, members in shared communities may be more willing to reach out to each other when they need support and to help others when asked. In turn, the increased communication and improved peer connections can lead to more in-depth learning and increased learning (Alavi et al., 2002; Johnson et al., 2008, 2009).

The flexibility of e-learning provides organizations multiple ways to deliver an initial socialization and orientation period. Pre-training socialization can provide trainees with the opportunity to share information, get to know each other, and develop initial relationships. This social exchange may help foster the development of a shared learning environment, with greater levels of trust, stronger social and emotional relationships, and share richer information relative to providing no socialization.

One approach to implementing a socialization activity would be to do it online, through tools such as email, chat, or instant messaging. Another would be to provide the socialization in person before the course begins. Providing socialization in a FtF setting may be more effective in expediting the development of a shared learning environment because of its richer communication environment. Research, specifically Media Richness Theory (Daft & Lengel, 1986), argues that FtF communication is the richest form of communication because it provides a stronger capacity for immediate feedback, multiple cues (ex. body language and voice inflection), language variety for a deeper expression of meaning, and the ability of to adapt to the needs of the individual. With FtF socialization, trainees will not only be able to hear what their peers say, but they will also be able to perceive the tone of voice, body language, gestures, or other visual cues that are more limited online.

These arguments about the relative effectiveness of online and FtF socialization are also consistent with findings from research on virtual teams, which has found that group members often find it difficult to develop fundamental team processes that improve relationship building, cohesion, and trust online (Lipnack & Stamps, 2008; Solomon, 2001). Virtual team members often report weaker relationships with fellow teammates than their traditional team counterparts (McDonough, Kahnb, & Barczaka (2001)). However, research has found that the early inclusion of FtF communication that emphasizes social interaction can greatly improve interpersonal relationship building (Maznevski & Chudoba, 2000), learning, and group performance (Kaiser, Tullar, & McKowen, 2000). For this reason, we believe that individuals who receive online socialization will demonstrate higher learning than those who receive no socialization, and those who receive face-to-face socialization will demonstrate higher learning than those who received online or no socialization.

H1. *Pre-training socialization will be positively related to learning such that individuals who receive face-to-face pre-training socialization will have the highest learning, followed by those who receive online pre-training socialization and then by those who received no pre-training socialization.*

2.3. Training complexity

The second factor of interest to this study is training complexity. According to cognitive load theory (CLT) (Sweller, 1988), a task that contains greater information load, information diversity, or rate of information change has greater complexity than a task that is lower in these characteristics. This perspective is also consistent with the work of Wood (1986) who argues that the complexity of a task increases as more information cues and the relations between these cues increase. According to van Merrienboer and Sweller (2005), working memory is limited to about seven elements at a time, although it usually operates with only two to four elements. Once trainees' working memories have reached capacity, the trainees are unable to process additional information.

As learning tasks become more complex, the number of elements that must be processed in working memory increases (van Merrienboer, Kester, & Paas, 2006) and the likelihood that trainees will be faced with increased interconnectivity of these elements also increases. When training is more complex, trainees are forced to process more information concurrently, and there is an increased risk that trainees will be unable to process all the information. Another way of viewing complexity is through Bloom's Taxonomy (Anderson & Krathwohl, 2001; Bloom & Krathwohl, 1956). In this taxonomy, tasks can be classified on a continuum ranging from more simple, lower order, cognitive processes such as knowledge recall and comprehension to more complex, higher order, cognitive processes such as analyzing or differentiating and evaluating or explaining. In the context of employment law, an example of a more "simple" learning objective would be for the learner to recall facts related to employment laws and statues. In more simple training, learners could be expected to recall that all private sector employers with 50 or more employees must comply with the Family and Medical Leave Act. But for training that is more complex, learners would be expected to not only remember the salient employment laws, but to also be able to evaluate a particular employment situation, and analyze what type of discrimination, if any, occurred. Thus as learning material becomes more complex the focus shifts from the recall of factual information to the evaluation, application, and integration of knowledge to new contexts. Thus it should not be surprising that both actual and perceived complexity have shown a negative relation with both task and learning (Argote, Insko, Yovetich, & Romero, 1995; Fisher & Ford, 1998; Warr, Allan, & Birdi, 1999).

For this reason, both researchers and professionals have argued that e-learning may be less appropriate for complex, and abstract topics than for simpler and more factual-based topics (Salas et al., 2005; Welsh et al., 2003). Concerns about using e-learning for more complex training are twofold. First, the technology itself creates additional complexity for trainees because, in addition to learning the course material, trainees also need to know how to interact, communicate, and navigate within the technology mediated environment, etc. (Hillman et al., 1994). Second, there are fewer cues available to the trainee during interactions because the electronic communications channel can remove cues such as emotion, gestures, facial expressions, and immediate feedback available to the trainee (Daft & Lengel, 1986).

For trainees this means that a portion of their cognitive resources will be required to navigate the "e-learning" environment, leaving fewer cognitive resources for focusing on the training itself. For simple training, this may not be an issue as they may have the cognitive resources available to process both the training material and navigate the electronic environment. But when the material becomes more complex, the cognitive effort may be too large to focus on both the material and environment, reducing learning. In support of these arguments, research has found that paradigm development can affect learning outcomes. Higher paradigm courses have more algorithmic solutions, greater structure, higher consensus on how work is conducted, and lower ambiguity. Essentially with higher paradigm courses, the complexity of how to approach and work in the course is lower than for lower paradigm courses. Specifically, this research found that student grades were higher in the courses with higher paradigm development than in courses with lower paradigm development (Hornik, Saunders, Li, Moskal, & Dzuiban, 2008). Thus, the following hypothesis was investigated:

H2. *Training complexity will be negatively related to learning such that more complex training will be associated with lower learning.*

2.4. Interaction effect

Although an initial socialization period can provide trainees with the opportunity to connect with peers and to develop needed relationships, its importance may be magnified when training is more complex. When the training is simpler, the trainees may feel that the cognitive load associated with learning the material is light enough that they do not need to interact with peers, to share information, ask questions, or rely on the knowledge of others to learn. But, when the training becomes more complex, the cognitive load associated with learning the material may be high enough that they have to rely more on their peers. Relationships developed during an initial socialization period can help trainees feel that they can trust their peers to share valuable information and they can then attend to it more fully (Mackie et al., 1990). This can reduce the cognitive load on a trainee because they can rely on peers to fill gaps in their knowledge. Those who were socialized more richly should be

more likely to develop stronger relationships and a shared learning environment, which should also improve outcomes relative to those who are less well connected. For this reason, we argue that socialization and complexity will be interactively related to learning.

H3. *Pre-training socialization and complexity will be interactively related to learning such that performance differences in the socialization groups will be larger in the complex training condition than for the simple training condition.*

3. Method

3.1. Participants

The sample for this study consisted of 143 individuals (78 males, 63 females, 2 participants did not indicate gender), drawn from a required core undergraduate business course. The mean age of the sample was 19.8 years (range = 18–52). Most of the participants used computers on a daily basis (96%), had over 4 years of experience with computers (95%), and had completed at least three courses that used the Blackboard Learning System (91%). Conversely, the majority of the participants had not completed an online course prior to the experiment (72%).

Participants received nominal course credit for participating in the study. In addition, to encourage participants to put forth sincere effort, participants were given the opportunity to receive an Amazon.com gift card based upon their performance. For each experimental condition, the person with the highest score received a $50 gift card and the person with the second highest score received a $25 gift card.

3.2. Manipulation

A controlled laboratory study using a 3 × 2 (Socialization: Face-to-Face, Online, and None × Complexity: high/low) between-subjects experimental design was conducted to examine the hypotheses. Both the FtF and online socialization groups completed a twenty minute long group exercise called "Two Truths and a Lie" as part of the socialization manipulation to encourage interaction between participants before training. This is a variation on a group exercise recommended as a good icebreaker in online settings (York, Yang, & Dark, 2007). The activity involves participants taking turns introducing themselves to one another and sharing three statements about themselves, two statements should be truthful and one should be a lie. The other group members are to then take turns guessing which statement was the lie. The only difference between these two conditions was that in the online condition, all communication was mediated through Blackboard and occurred online, whereas in the FtF condition, participants completed the task in the same room. In the no socialization group, participants did not have any group socialization before the training started, but instead worked on a task unrelated to the study (an online jigsaw puzzle). This was done to ensure that all participants would spend the same amount of time in the experiment.

The simple and complex training conditions both focused on employment law and major equal employment opportunity legislation in the United States. Consistent with Bloom's taxonomy (e.g. Anderson & Krathwohl, 2001; Bloom & Krathwohl, 1956), the simple training focused on two lower order cognitive processes (remembering and understanding), and factual knowledge. The complex training additionally focused on two forms of discrimination (e.g. disparate treatment and adverse impact), how to assess, and how organizations can avoid discriminatory practices. The complex training thus includes both lower (e.g. remembering and understanding), but it also incorporated higher order processes such as (understanding, applying, analyzing, and evaluating), and both factual and conceptual knowledge. A pilot study was conducted to test the complexity manipulation. The results indicated that participants in the simple condition found it to be simpler and performed better than those in the complex condition. Based on the results of the pilot study, a few minor logistical adjustments were made to ensure the success of the main study.

3.3. Procedure

The full experiment took approximately 90 min to complete and utilized Blackboard for the delivery of course materials and for peer communication. The experiment was managed by three proctors, each of whom managed a single room. To ensure consistency across all sessions each proctor followed the same protocol, utilized a prepared script, and synchronized the timing of each section of the experiment. All participants in the experiment were randomly assigned to groups of three based on the computer stations at which they sat upon arrival. In the no socialization and online socialization condition, each team member was placed in a separate room before the experiment began, whereas in the FtF socialization, participants were initially placed in the same room and then moved to separate rooms for the duration of the experiment.

Upon arriving at the training session, each participant signed in, completed an informed consent form, and a pre-test questionnaire that assessed participants' motivation to learn. The twenty minute socialization manipulation then occurred, as described above. Next, participants in the FtF socialization condition moved to adjacent rooms to ensure that all group members were in separate rooms to ensure than all training interactions would occur online (those in the online or no socialization were already in separate rooms). Next, to assess baseline employment law knowledge, participants completed a ten minute pre-training employment law quiz. Finally, the participants received either simple or complex training.

The training itself also consisted of multiple stages. First, participants completed a self-paced learning module on employment law. Participants could use the chat function in Blackboard to discuss anything they wished with their group members. Second, participants completed a short hands-on learning module where they acted as a judge in an employment discrimination lawsuit and to make a ruling about discrimination. Participants who received simple training were asked whether or not someone had been wrongfully terminated and, if so, which law(s) had been violated. Participants in the complex condition were also to determine the type of discrimination (i.e., disparate impact or disparate treatment) that occurred. As in the first phase, participants in each condition were able to work with their group members via chat to identify the correct solution. Communication among group members was not required, however, the nature of the hands-on learning module encouraged participants to chat. Finally, participants were asked close out the training module in Blackboard and to complete a 15-question multiple choice post-training quiz and a questionnaire regarding their training experiences.

3.4. Measures

3.4.1. Pre- and post-experiment knowledge

Pre- and post-experiment employment law knowledge was measured with a 15-item multiple choice quiz, and scores on quiz could range from 0 to 150 points. The pre-experiment employment quiz was used as a measure of baseline employment law knowledge. Although the tests were similar for the simple and complex learning tasks, each reflected the material covered during the training. A sample item from the pre-training quiz was "The Age Discrimination in Employment Act prohibits discrimination in pay, benefits, or continued employment for employees at what age? A sample item from the complex post-training quiz was "In which type of case is most of the debate focusing on the discriminatory consequences rather than the intent to discriminate?"

3.4.2. Motivation to learn

Motivation to learn (MTL) was used as a covariate in this study. MTL reflects a desire to learn the content of the training program (Noe & Schmitt, 1986), and has been shown to relate to the choices an individual makes in regards to direction, intensity, and persistence in learning activities (Colquitt, LePine, & Noe, 2000; Klein, Noe, & Wang, 2006; Tannenbaum & Yukl, 1992). A meta-analysis of training research has found that MTL was correlated with knowledge acquisition. MTL was measured with a seven-item subset of Noe and Schmitt's (1986) scale. Items from this scale have been used in previous research and have been shown to be related to learning outcomes (Noe & Wilk, 1993; Quiñones, 1995; Tharenou, 2001), . The scale utilized a 7-point, Likert-type scale with anchors ranging from 1 (Strongly Disagree) to 7 (Strongly Agree) and was scored so that higher scores reflected higher motivation to learn. A sample item was, "I like to have opportunities to improve my skills." The coefficient alpha reliability estimate for this scale was 0.86.

4. Results

4.1. Preliminary analysis

Table 1 shows the correlations between all variables included in study, while Tables 2 and 3 show the pre- and post-experiment performance score means and standard deviations for each experimental condition. Preliminary analysis showed that none of the groups differed on mean pre-test scores, suggesting that each group had similar pre-experiment knowledge of the legal environment in which HR operates. Previous training research has found that existing knowledge and motivation to learn can affect training outcomes (e.g., Bandura, 1997; Colquitt et al., 2000), In addition, e-learning research suggests that the more experience that an individual has in an online environment, the better they can leverage the resources available and to navigate the environment (Kock, Verville, & Garza, 2007). Therefore, each of these were used as a covariate in the analysis. The hypotheses were tested using ANCOVA.

Table 1
Correlations among variables.

Variable	1	2	3	4	5	6	7	8
1. Pre test								
2. Post test	0.207**							
3. Complexity	0.097	−0.182**						
4. Socialization	0.115	0.079	−0.095					
5. Age	0.019	0.086	−0.061	−0.104				
6. Gender	−0.006	0.014	−0.045	0.007	0.046			
7. Online course experience	−0.131*	−0.167**	−0.082	0.034	0.136*	0.108		
8. Motivation to learn	−0.024	0.246**	0.016	0.116*	−0.006	−0.096	−0.019	0.75

Note: Reliabilities appear on the diagonal. Complexity: 1 = Low, 2 = High. Socialization: 1 = No Socialization, 2 = Online Socialization, 3 = Face to Face Socialization. Motivation to learn was coded such that higher scores reflected higher motivation. *$p < 0.05$. **$p < 0.01$.

Table 2
Cell means for pre-training performance.

		Complexity								
		Simple			Complex			Total		
		n	M	SD	n	M	SD	n	M	SD
Socialization	Face-to-face	24	55.4	16.9	32	58.4	18.2	56	57.1	17.6
	Online	24	50.4	19.7	21	51.9	19.9	45	51.1	19.6
	None	18	53.3	17.8	24	60.0	16.9	42	57.1	17.4
	Total	66	53.0	18.1	77	57.1	18.3	143	55.2	18.3

Table 3
Cell means for post-training performance.

		Complexity								
		Simple			Complex			Total		
		n	M	SD	n	M	SD	n	M	SD
Socialization	Face-to-face	24	105.8	24.5	32	98.8	22.7	56	102.4	23.5
	Online	24	97.1	22.4	21	83.8	25.0	45	90.1	24.3
	None	18	89.0	37.2	24	93.8	23.0	42	91.7	29.6
	Total	66	98.0	28.2	77	93.1	23.9	143	95.4	26.0

4.2. Tests of hypotheses

The results of the ANCOVA analysis are presented in Table 4. Tests of specific hypotheses are presented below. First, the results show that both pre-training employment law knowledge ($F(1,132) = 6.50$, $p < 0.05$) and motivation to learn ($F(1,132) = 14.00$, $p < 0.001$) were statistically significantly related to post-training knowledge. But, online course experience was not statistically significantly related to post-training knowledge ($F(1,132) = 1.07$, $p > 0.05$). Hypothesis 1 proposed that pre-training socialization would be positively related to learning. The initial results support this hypotheses ($F(2, 138) = 3.15$, $p < 0.05$). Given the significant F, a post-hoc Scheffe Test (1953) was conducted, with means adjusted for unequal sample sizes. The results of this analysis indicated that the group that received face-to-face socialization outperformed ($M = 102.4$) those who received either online socialization ($F(1,132) = 6.08$, $p < 0.05$) or no socialization ($F(1,132) = 3.38$, $p < 0.05$). But the results did not support a statistically significant difference between the online socialization and no socialization groups ($F(1,132) = 0.34$, $p =$ n.s.). Thus, H1 was partially supported. In support of H2, individuals with more complex training ($M = 93.1$) performed less well than those who received less complex training ($M = 98.03$) ($F(1, 132) = 4.85$, $p < 0.05$). Finally, the results did not find support for an interaction between training complexity and socialization ($F(2, 132) = 0.32$, $p > 0.05$).

5. Discussion

The primary goal of this study was to use a controlled laboratory experiment to investigate trainee socialization and training complexity, and their impact on e-learning. Although not all hypotheses were supported, the research does provide evidence that pre-training socialization can positively impact learning. Specifically, the study found that those who received face-to-face socialization outperformed those who received either online socialization or no socialization. No performance differences were found between those who were socialized online and those who received no socialization. These findings further support previous research in the areas of e-learning and virtual teams, which suggests that group members often find it difficult to develop fundamental team processes that improve relationship building, cohesion, and trust in the online environment (Lipnack & Stamps, 2008; Solomon, 2001). Such team processes are extremely valuable because they can lead to more in-depth learning and increased learning (Alavi et al., 2002; Johnson et al., 2008, 2009). In addition, the study found that those who received more challenging training performed less well than those who received simpler training. This finding is consistent with cognitive load theory and Bloom's taxonomy, which each suggest that the more that an individual's working memory is taxed and the more that individuals are required to analyze and integrate ideas, the more complex the training (Bloom & Krathwohl, 1956; Sweller, 1988). Finally, the results did not support an interaction between socialization and complexity.

5.1. Theoretical contributions

This study makes several contributions to our knowledge of e-learning. First, it extends our understanding of the role socialization plays in e-learning. Previous research has highlighted the importance of building connections and creating a shared learning space in e-learning. This study builds on earlier research by comparing the use of three forms of pre-training socialization: no socialization, online socialization, and FtF socialization. The inclusion of three forms of socialization allowed

Table 4
Analysis of variance results.

Source of Variance	SS	df	MS	F	Sig.
Covariates					
Pre-experiment performance	3585.80	1	3585.80	6.502*	0.012
Motivation to learn	7719.54	1	7719.54	14.00***	0.000
Online course experiment	591.22	1	591.22	1.07	0.302
Main effects					
Socialization	3476.40	2	1738.20	3.15*	0.046
Complexity	2676.34	1	2676.34	4.85*	0.029
Interaction					
Socialization × complexity	351.71	2	175.85	0.32	0.728
Explained variance	18401.01				
Error	72799.07	132	551.51		
Total	90175.88	140			

* $p < .05$; *** $p < .001$. R Squared = 0.193 (Adjusted R Squared = 0.144).

for a richer understanding of the relationship between socialization and learning. Specifically, the results indicate that merely providing opportunities for socialization is not enough to build connections. Media Synchronicity Theory (MST) suggests that the nature or context in which the communication is occurring can shape the media capabilities needed (Dennis, Fuller, & Valacich, 2008). Thus, the FtF socialization may have supported richer communication by allowing participants to more quickly share greater amounts of information, and by including physical cues during peer interactions (such as facial expressions). As a result of the richer communication channel, individuals in the FtF groups could be better positioned to create deeper relationships than the online socialization groups during training.

Second, the study also contributed to our understanding of the role of training content complexity in an e-learning environment. Previous research has suggested that e-learning may be more appropriate for the acquisition of certain types of knowledge than others (e.g. procedural vs. declarative, or hard-skills vs. soft-skills) (Salas et al., 2005). It can be harder to learn more cognitively challenging tasks in an online environment due to the lack of communication cues available to those in the learning environment (Daft & Lengel, 1986; Dennis et al., 2008) as well as the increased cognitive load associated with trying to communicate and navigate in the online space. This suggests that when planning for more cognitively challenging learning tasks, trainers may need to incorporate additional technological support to help trainees overcome the difficulties associated with communicating and sharing information online.

5.2. Practical implications

Several practical implications for e-learning design were also revealed through this study. First, the findings suggest that trainees should be given the opportunity to get to know their fellow trainees in person prior to training when possible. One way to do this would be to have geographically-based pre-training socialization, or networking opportunities (to minimize travel time and organizational expenses) where trainees could briefly get to know each other. During socialization sessions, trainers could focus on sharing information such as skills, interests, or any other factors that may help trainees to establish relationships prior to training. This should not only benefit training outcomes, but it can also provide the networking opportunities for trainees to broaden their personal networks, that are often lost when companies move to e-learning (Johnson & Gueutal, 2011).

In addition, trainers, teachers, and professors should consider the level of difficulty of learning content. One way to address this is by dividing challenging material into smaller, simpler modules (Sweller, 1988). This “chunking” of material has been suggested as way of preventing trainees from experiencing cognitive overload and from overwhelming their short term memories (van Merrienboer & Sweller, 2005). Modularizing training allows trainees to concentrate on mastering smaller sets of information before moving on to the next module. Modules can be followed by quizzes that assess trainees’ learning, and trainees could then progress to the next level after meeting the requisite competency level.

Another mechanism that could assist trainers is through the use of virtual mentors and interactive videos (Zhang, Zhou, Briggs, & Nunamaker, 2006; Zhang et al., 2004). On-demand videos can be made available that provide trainees with additional information or supplemental illustrations on specific topics. These tools can provide trainees with the ability go back and review more difficult or detailed information at their convenience, reducing the pressure to retain everything at once during training. In addition, technology can be used to capture and scan keywords from these videos so that trainees can search and review videos on a specific topic.

5.3. Limitations

Although we believe that our findings are interesting, there are a number of potential limitations associated with the study that should be mentioned. A major strength of this study was its internal validity through the use of a controlled laboratory

experiment, but this also may limit its generalizability to other settings. The experimental design resulted in a very specific, controlled, training situation to establish causality, but because this controlled environment is not likely to occur naturally, this research should be replicated in field and organizational settings. A second factor that may limit the generalizability of the findings is that the sample consisted of undergraduate students in a northeastern university with little to no online course experience. Therefore, caution should be used in generalizing the findings to different settings and samples. It should also be noted that the length of the training was limited to approximately 90 min, in contrast to many training programs that are either one full day or several days in length. The length of time could have limited the effects of socialization. Thus, the replication of this study over a longer timeframe should result in strengthening the findings. Replicating this study with different samples, different levels of online course experience, different settings, and over different lengths should be done before generalizations are made from the data.

5.4. Future research

Given the importance of socialization in e-learning, future research should delve more deeply into socialization to better understand what aspects of FtF socialization contribute to improved e-learning outcomes? Once identified, research could investigate how to replicate these factors in online socialization. Because previous research has found that online groups can engage in rich and complex electronic communication when they have a shared context (Markus, 1994; Zack & McKenney, 1995), understanding how to use socialization to develop this shared context can help improve e-learning outcomes. For example, how might organization use social networking tools and technologies to help socialize employees or students before training?

Additionally, research is needed to better understand the role of course content on e-learning success. Although researchers are aware that the relationship between instructional design and successful learning outcomes is influenced by both course level and the subject matter taught (Burke & Moore, 2003; Charlier, Brown, & Rynes, 2011), there has been limited research that focuses on the appropriateness e-learning for certain types of courses (Salas et al., 2005; Welsh et al., 2003). Further research is needed that focuses on not only why certain types of knowledge (e.g., hard vs. soft, declarative vs. procedural) are more difficult to learn in an online environment, but also how to better design e-learning to support training for all types of learning objectives. For example researchers could address which characteristics of soft skills makes it more challenging and how technology can be utilized to overcome any e-learning shortcomings. As the findings from this study suggest, socialization may be one way of helping connect learners and improve outcomes for courses that focus on soft skills or more complex learning.

Additional research should also investigate other factors contributing to e-learning success. For example, trainee characteristics such as personality, motivation, self-efficacy, or job involvement have been shown to affect training outcomes (Colquitt et al., 2000). Would factors such as self-efficacy or job involvement moderate the effects of socialization and complexity, or would their relation add additional explained variance? Future research could address the incremental validity of socialization opportunities versus other course interventions to better understand how and where socialization improves e-learning outcomes relative to these other interventions. Research is also needed that focuses on how technology characteristics such as the reliability of technology (Johnson et al., 2009; Perreault, Waldman, Alexander, & Zhao, 2002), the use of video (Zhang et al., 2006), technology vividness (Nicholson, Nicholson, & Valacich, 2008), and group support systems (Alavi et al., 2002) can interact with socialization and complexity. For example, if the vividness and interactivity of a video or virtual mentor were low, it may not be effective in helping overcome the complexity of the training.

Research should also focus on additional training outcomes such as training utility and affective reactions to training (e.g. satisfaction). With research suggesting that different e-learning outcomes are affected by different trainee and course design characteristics (Johnson et al., 2008), it is important for researchers to begin to systematically investigate which characteristics are most likely to affect different e-learning outcomes. It is likely that different factors should play different roles depending upon the outcome variable of choice. For example, social presence is often argued to be of critical importance in e-learning (e.g. Gunawardena & Zittle, 1997), and research has often found that it is related to both training satisfaction and utility judgments (Tu & McIsaac, 2002). But, recent research has found that social presence was not related to learning (Johnson et al., 2009). These differences in antecedent factors could mean complex tradeoffs for designers of e-learning.

In addition, to better understand how interaction patterns emerge over time, researchers should take a longitudinal approach to investigating how training socialization and training communication benefit trainees. Researchers can also focus on how different types of interactions are more or less important at different points in the training. For example, TIP Theory (McGrath, 1991) discusses how different types of communication, such as those focused on member support, group maintenance, or task completion, are necessary for successful team functioning. But, the type of communication needed at different points during the group's lifecycle can affect e-learning outcomes. For example before training begins, member support and group maintenance may be more important than in latter stages of training. By longitudinally investigating training, researchers will be able to gain a much richer and more nuanced understanding of socialization and communication in e-learning.

Finally, research can investigate how the length of socialization and length of training affect learning. It is possible that the importance of socialization may be magnified as training length grows, because groups that are able to socialize prior to training may use those initial connections to develop stronger, more cohesive groups. Such cohesion could, in turn, result in

improved training outcomes. Conversely, it is possible that for longer term groups, as interaction increases, the initial impact of socialization may be reduced. But, more research is needed to better understand these relations.

6. Conclusion

This study was motivated by the desire to better understand how three types of pre-training socialization (e.g. face-to-face, online, or none), training complexity, and their interactive relation affected learning in an e-learning setting. A secondary purpose was to more closely examine the research guidelines made by Salas et al. (2005) in regards to making e-learning more effective. Using a controlled laboratory experiment, the results indicated that both training complexity and socialization affected learning. Specifically, the results indicated that providing trainees with face-to-face socialization led to better learning than either online socialization or no socialization. This suggests that the ability to get to know other trainees in a richer environment can provide benefits for trainees, and that there is value in bringing trainees together physically to help them connect with each other. In addition, the results provide support for the contention that more complex training can lead to lower learning. Taken together, the results of this study illustrate the importance of understanding the complex set of relationships between design, trainees and training outcomes. Only by understanding these complex relationships, will we be able to more effectively design e-learning to meet the needs of all trainees.

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