

## Powerful E-Learning: A Preliminary Study of Learner Experiences

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### Abstract

This study continues a program of research into the nature of powerful learning experiences, with a focus this time on e-learning contexts. It was conducted using structured phone interviews with adult learners pursuing undergraduate degrees through e-learning coursework. Among other things, data suggest that meaningful social interaction and emotions may be important components in powerful learning experiences. In addition, the data suggest that powerful learning can indeed occur in e-learning environments. Results of this study combine with those from three previous studies to point toward practices of instructional designers and educators that may contribute to powerful learning in e-learning environments. Further examination of powerful learning in such environments holds promise.

**Keywords:** meaningful learning, powerful learning, e-learning, adult learning, instructional design

### Introduction

What makes a learning experience powerful? For instance, what makes one experience especially memorable while another is easily forgotten? If we knew, could we take specific actions that might make learning experiences more powerful? The present study is the fourth in a series, and the first in the series to extend from traditional learning environments to the area of e-learning. E-learning is defined here as encompassing "a wide set of applications and processes such as Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio- and videotape, satellite broadcast, interactive TV, CD-ROM, and more" (Kaplan-Lieserson, n.d.).

### Background

This series of studies evolved out of the concern that traditional approaches to instructional design tended to focus on the attainment of only low-level learning goals (e.g., several authors in Seels, 1995). Through these studies, the authors endeavor to add to work that addresses more meaningful, higher-level goals such as "understanding" (e.g., Kember, 1991; Wilson et al., 1995; Gardner, 1999; Perkins & Unger, 1999; Reigeluth & Squire, 1998) and to serve educators, researchers, and policymakers who are looking for updated learning and schooling models that can better address the increasing use of e-learning technologies (McCombs & Vakili, 2005).

While the term "powerful" can be applied to the process of learning, for instance, to a learning experience that has special qualities that make it especially effective and/or efficient (Brandt, 1998; McPhee, 1996), it often refers to the outcomes of learning. For instance, learning that is powerful results in new knowledge and skills that change how one thinks and acts in some substantial way and often

transfers to a wide range of circumstances. In the present study, *powerful learning experience* was defined as one that stands out in memory because of its high quality, its impact on one's thoughts and actions over time, and its application in a wide range of circumstances.

The specific aim of the series of studies is to learn more about the nature of powerful learning experiences and the conditions or factors that might be involved in making them special. This descriptive work is intended to eventually lead to insights that designers and educators might consider as they develop courses. The approach for this study was similar to the approaches used by Visser and Visser (2000) and Perry (2002), who asked people to reflect on particularly meaningful learning experiences in their pasts.

As in the previous three studies (Rowland & DiVasto, 2001; Rowland, Hetherington, & Raasch, , 2002; Rowland, Lederhouse, & Satterfield, 2004), two assumptions impacted the approach. First, learners were assumed capable of recognizing when an experience was powerful. Secondly, although some of the factors might be internal (i.e., characteristics of the learner) and may not be readily exposed by the learner himself or herself, the learner was assumed capable of communicating at least some of the factors involved in his or her experience.

The three previous studies of powerful learning by adult learners provided a foundation for this fourth study. In the first study (2001), Rowland and DiVasto conducted extensive multi-stage interviews and surveys (see Appendix for similar survey) and made comparisons between a small, highly diverse group of learners and a group of instructional design experts regarding what each group believed were factors and key elements of powerful learning experiences. Factors that emerged included active engagement in authentic settings (i.e., in settings that either represent or approximate environments where knowledge and skill is typically applied), personal interaction with mentor/expert teacher (i.e. with someone who serves as a mentor and who is also an expert teacher), and opportunity for reflection in and on action. Much uniqueness was noted among individual participants' responses, and it was hypothesized that powerful learning may be an individual experience that designers can do little to affect.

In the second study (2002), Rowland, Hetherington, and Raasch sought to determine if clearer themes would emerge from more similar groups. Adult professionals with considerable work experience in four fields were surveyed. Themes that emerged as factors in their powerful learning experiences included active learning, personal growth/development, relationship between instructor and learner, relevance to one's work and/or life, and personalization (i.e., adaptation of instruction for the individual learner). However, no single factor was identified by more than one third of the participants, so just as in the first study, most support was given to the conclusion that powerful learning experiences are unique to the individual.

The third study (Rowland, Lederhouse, & Satterfield, 2004) involved surveys of undergraduate students in three professional fields and explored the question of whether an even greater coherence in participant groups would lead to identifiable themes relating to powerful learning. Across the responses, several themes emerged including hands-on activity; practical application in real or authentic environments; and supportive interactions with others. However, no themes represented the responses of a majority of participants. Therefore, the evidence continued to suggest that learning experiences and the factors that make them powerful are unique to individuals and/or specific circumstances.

Participants in all three previous studies rarely viewed 'instructional technology' as a contributing factor to powerful learning. Yet, e-learning opportunities continue to grow. For example, in their most recent report regarding the status of online higher education, the Sloan Consortium stated that "higher education institutions taught nearly 3.2 million online students during the fall term of 2005, an increase of about 850,000 students and a growth rate of 35 percent" since their previous 2005 report (Allen & Seaman, 2006, p. 5). Therefore, in response to the increasing use of e-learning technologies, the present study began to explore powerful learning in e-learning contexts.

## Method

The names and e-mail addresses of approximately 180 potential student participants were supplied to us by a New York State college in early 2006. A target of twelve participants was set, and participants were recruited through an e-mail invitation. Those who responded were sent an electronic consent form

to complete. Interview appointments were set up with the nine students who completed consent forms. Prior to their interviews, participants were e-mailed topics to reflect upon, including their memorable learning experiences, their past e-learning experiences, and any circumstances that might enhance their learning. Structured phone interviews were then conducted with nine adult students who were seeking bachelor's degrees primarily through e-learning classes.

Interview questions were tested with four Ithaca College graduate students who would not be part of the study. Based on the flow of those interviews and the students' feedback, the questions were refined (see Appendix). Interviews began with several questions about participants' professional backgrounds and their use of computers. Participants were also asked to identify their ages in terms of ranges that were offered by the interviewer. The gender of each participant was inferred by the interviewer. The interviewer then defined a powerful learning experience and asked participants to describe a learning experience that had been very powerful for them. In order to uncover significant factors in their experiences, participants were asked to expand upon their descriptions by naming components or aspects of the experiences that might have contributed to those experiences being powerful for them. Similar questions then examined e-learning experiences. Participants were then asked to compare their two types of experiences and describe any similarities or differences between their powerful e-learning experiences and other types of learning experiences.

The next questions involved future possibilities for powerful learning with the intention of constructing theoretical and/or practical paths from current approaches toward ideal states. Participants were asked to imagine and describe what could be a powerful learning experience in an ideal world and, then, in an ideal *e-learning* context. These descriptions led naturally to a comparison and a question of barriers or constraints that currently prevent e-learning experiences from being more powerful. Lastly, participants were asked for recommendations to e-learning instructors or designers that might improve e-learning experiences, then for any additional comments or insights about e-learning and/or powerful learning. After responses were accumulated, identifying information was removed.

Beyond the simple tabulation of demographic data, data were analyzed in an inductive manner, moving from data in individual responses, to categories and cross-case comparisons, essentially following steps proposed by Tesch (1990). The authors started with an independent examination of each participant's response to each question, then compared interpretations and allowed categories to begin to emerge. Next, again working independently, the authors coded all responses by category, allowing the coding to further refine the category. Codings were compared, and the few differences that were found were easily resolved (i.e., discussion revealed either a miscoding by one author or one alternative coding that both authors agreed was more reasonable). The authors then created a large question X participant table with coded responses in the cells. Some detail beyond the codes was maintained in the cells in order to stay closer to the data. Once again working independently, the authors searched for meaningful relationships across responses and participants, for example, the emergence of subgroups. As before, few inconsistencies were found between interpretations, and these were easily resolved. Finally, results were compared with those from the previous three studies following the same analytic process (i.e., first by each author individually, then comparing interpretations).

## Results

### *Demographics*

Participants included seven females and two males. One person was 18–25 years old, one person was 26–35, and all others were over 36. Two participants described themselves as being in the accounting field, one was a school bus driver, one worked in education, and one worked in the high-tech field. Years of experience in their fields covered a range from less than five years to over twenty years. Four participants did not currently perceive themselves to be members of a professional field and thus chose to self-identify as students.

### *Computer Experience*

All participants described themselves as being comfortable using a computer, two being moderately comfortable, five very comfortable, and two extremely comfortable. When asked how often they use a computer each day, one person said 1–2 hours, four said 3–6 hours, and four said 7–12 hours.

### *E-Learning Experience*

When asked about their experience with e-learning, two participants said that they had a little experience, four said a good amount of experience, and three said an extensive amount of experience. (Participants were all enrolled in programs that are delivered primarily via e-learning, but they were not asked how far along they were in those programs.)

### *Powerful Learning Experiences*

Participants shared a wide range of what they considered to be powerful learning experiences—from a high school field trip to the loss of a family member. The authors found no patterns among these experiences, for example, with regard to context, type of activity, or specific outcome. As far as conditions or factors that contributed to these experiences being powerful, a few patterns did emerge. All nine participants described experiences that involved active engagement in authentic (real or realistic) settings, settings such as community meetings, family environments, and business conferences. All nine participants also described experiences that included meaningful interactions with other people. These other people were not described as simply being bystanders to experiences; instead, certain people—often teachers, community members, peers, professional colleagues, and family members—seemed to play integral roles in participants' processes of personal meaning making.

Five participants indicated that a high emotional state or emotional bond was involved. Four participants said that their personal response to pain, fear, and/or loss was a contributing factor. Two participants stated that their experiences were powerful because the experiences were new or out of the norm.

Only six of the nine participants said that they could recall any e-learning experiences that were "good" and were thus able to provide answers to questions in this area. Three participants indicated that flexibility contributed positively to their experiences—flexibility in time and course interactions, in sources of learning materials, and in learning activities.

Three participants said the instructor and/or delivery method was important. Two participants described the use of resources beyond the text as having contributed to their positive experiences. Four participants expressed that their e-learning experiences were beyond "good" and could be described as "powerful." No patterns were found across responses when participants compared their powerful learning experiences and e-learning experiences.

### *Powerful Learning in an Ideal World*

Descriptions of powerful learning in an ideal world produced several patterns. Participants cited the desirability of hands-on/experiential aspects (three participants), flexibility and/or control (three), virtual classroom experiences (two), a combination of e-learning and classroom learning (two), and real-time interaction with others (two).

When considering an ideal world, and comparing similarities and differences between imagined powerful learning and imagined powerful e-learning, two participants felt that both types of experiences could be similar because they both involved interaction with others. Two participants saw similarities in the component of real-time interaction. Two participants expressed that the two types of ideal experiences would be different because e-learning is not experiential for them.

### *Barriers to E-Learning Experiences*

When asked about what barriers prevent e-learning from being more powerful, three participants described computer and/or technology difficulties. Three participants described inadequate contact/involvement by professors. Two participants felt that mistrust of students on the part of some professors (i.e., treating responsible adult students as irresponsible children) created a barrier. Two participants cited other students' poor commitment as being a barrier.

### *Recommendations to Designers*

Three participants suggested that more professor interaction might make e-learning experiences more powerful. Three participants suggested more real-time, synchronous interaction. Two participants suggested more assistance in using the computer. Two participants suggested providing course content

that was more than just text.

### *Other Topics*

Two topics of interest emerged from a comparison of responses across interview questions. First, several participants brought up the topic of online discussions. One offered a positive view, another offered a negative view, and five others described both positive and negative aspects. Second, the role of the professor in online courses surfaced across participant responses to several different questions. Two participants made positive comments about their professors' impact on their learning while five participants shared stories about difficulties they experienced as a result of the practices of their professors. Two participants did not mention professors' impacts on their learning.

### *Summary*

Two themes emerged from responses by all participants. All nine described powerful learning experiences that demonstrated active engagement in authentic settings, and all of the powerful learning experiences cited involved meaningful interactions with other people.

For learning experiences in general, and for a majority of participants, emotion surfaced as an aspect of powerful learning. Several participants stated having a preference for hands-on or experiential learning. Also, the uniqueness of a learning experience contributed to its being powerful for several participants.

In the area of e-learning, participants identified flexibility as a feature of positive learning experiences, and they expressed a desire for more real-time interaction, more contact with their professors, and more computer assistance. Finally, participants expressed mixed views about online discussions and they noted the significance—both positive and negative—of their interactions with professors in e-learning courses.

### **Discussion and Implications**

The intent of the study was to begin to focus exploration of the phenomenon of powerful learning on the context of e-learning. The authors conducted interviews with a small number of college students pursuing undergraduate degrees through e-learning coursework. From this small set of interviews it would not be appropriate to make broad generalizations. However, some notable patterns of interest could be seen across the responses, particularly when considered in combination with results from the previous three studies.

Before discussing those patterns, however, several other limitations should be acknowledged. First, interviews were fairly structured and lasted only about 20 minutes for each participant. Second, interviews were conducted over the telephone and, therefore, missed nuances that might come from face-to-face interaction. And third, interviews were all conducted by one female researcher (first author). Her manner of questioning and the fact that she was female may have had an influence on participant responses.

In terms of interpreting results, several participant examples of powerful learning experiences surprised the authors, and this revealed an initial bias. A powerful learning experience was defined as being one that stands out in memory because of its high quality, its impact on one's thoughts and actions over time, and its application in a wide range of circumstances. How could a simple Web conference or a high school field trip be *powerful* in this sense? It became clear that what participants considered to be powerful learning was highly personal and complex, and that the authors were unconsciously imposing an inappropriate external standard. This did not affect data gathering in any way the authors are aware of, nor did it affect interpretation once it was exposed.

Similarly, the authors came to realize that they had begun the study with a bit of skepticism regarding the ability of e-learning environments to support powerful learning. In contrast, four participants described online classes as having been powerful learning experiences for them. For instance, one participant said that an online class had "opened up many new avenues" for her. Another said her learning was powerful because of the many "expressions of personal experience" that took place during the class. Another said that her e-learning course provided her with "deeper insights into how people think." In fact, some participants perceived the mere existence of e-learning and its associated

opportunities as having made their learning powerful. As one participant expressed, “had it not been for e-learning, I would not be finishing my degree.” Results reveal that, at least for some people, powerful learning can occur in e-learning environments.

In terms of patterns that emerged, active engagement in authentic settings was an important aspect of powerful learning described in this study as well as in the previous three studies. For example, participants in this study shared stories such as speaking to a group at an Alcoholics Anonymous meeting, connecting with peers at a symposium, and interacting with children at home. Additionally, in descriptions of ideal learning situations, participants expressed things such as “virtual reality,” a “live participatory component,” and learning “in real life” situations as being preferable components of their ideal learning experiences. Authenticity of setting was defined in terms of realism or fidelity, that is, how realistic the environment in which the learning occurred was perceived to be in comparison to the context where tasks would normally occur or in which knowledge and/or skills would typically be applied. This did not necessarily imply physical fidelity, but rather, it referred to learners’ perceptions.

Authenticity of setting appears possible in e-learning, but due to the different challenges involved in the e-learning context, this definition may need to be broadened. For example, Barab, Squire, and Dueber (2000) propose that authenticity occurs “not in the learner, the task, or the environment, but in the dynamic interactions among these various components...authenticity is manifest in the flow itself, and is not an objective feature of any one component in isolation” (p. 38). Data from the present study suggest that authenticity in this sense may be important in powerful learning experiences, including those involving e-learning.

Another pattern that emerged was that all nine participants described powerful learning experiences where another person or other people played active roles in their individual meaning-making processes. These included people such as teachers, children, group members, and peers, in contexts such as meetings, classes, and parent-child interactions. For example, one participant described an e-learning class that she felt was powerful because, “the instructor made it fun.” Another participant talked about his powerful learning including “input from other peers in your field that have had similar experiences.” And another participant who does home schooling said her learning was powerful because it included “learning with my children.” Even when describing good or powerful e-learning situations, information about active, meaningful interactions with teachers or peers was included in all participant accounts of their experiences.

This finding was consistent with a large majority of the 271 experiences described by 82 participants in the three previous studies. In those studies interaction with others, such as relationships with instructors and collaborations with peers, was frequently cited as a factor in descriptions of powerful learning experiences. Analyses from all four studies do not reveal *how* interaction with other people affects powerful learning experiences, but the fact that it does seems likely. That is, it seems that some form of meaningful social interaction may be a significant ingredient in powerful learning experiences.

In e-learning environments particularly, emphasizing the presence of others, through discussions, communication with instructors, and other social interactions may be especially significant. When that social interaction was lacking or poorly facilitated by instructors, participants in this study expressed dissatisfaction. For example, one participant shared that she had “no real interaction with professors” and “felt like I was talking to myself.” Another participant expressed the need for more “professor interaction to keep things on track.” And another said that at times “teachers seemed to disappear” and this was a barrier to making her learning experience a powerful one. Further research should be conducted into other peoples’ role(s) in individuals’ powerful learning experiences.

Dirkx (2001) suggests that “personally significant and meaningful learning is fundamentally grounded in and is derived from the adult’s emotional, imaginative connection with the self and with the broader social world” (p. 64). Five participants in the present study described a high emotional state or emotional bond. For example, one participant talked about the emotion of seeing her community’s negative reaction to a mixed-race couple. As a result she developed life-long empathy for those who are persecuted. Another participant described her emotional bond with her daughter as being an important component in the powerful learning she has recently experienced as a new mother. It is interesting that the seven study participants who were women included emotional aspects of their powerful learning experiences in their descriptions. The two male participants gave accounts of

experiences that did not include descriptions of emotions at all. This may suggest that women find emotion to be an important factor in powerful learning. On the other hand, it may also be the result of the female participants feeling more comfortable describing emotions to a female interviewer or simply the inclination of the two males not to provide emotional descriptions. Nonetheless, future research into connections between emotion and powerful learning seem warranted.

Also in the realm of emotion, four participants said that their personal response to pain, fear, and/or loss was a contributing factor to their powerful learning experiences. One participant “learned how much we can overcome” through the experience of losing her son. Another participant described a powerful experience involving a poorly-skilled teacher. She talked about her painful loss of confidence and her wish that she could change teachers halfway through a course. “I say that—but I learned how to deal. How can you say eliminating the bad stuff is good? Maybe it’s the best.” These responses suggested that powerful learning can occur in contexts that are both pleasant and unpleasant, another finding consistent with previous studies.

Descriptions of contexts of active, experiential learning came up in all participant stories about powerful learning. Previous studies (Rowland & DiVasto, 2001; Rowland, Hetherington, & Raasch, 2002; Rowland, Lederhouse, & Satterfield, 2004), also support this theme. One participant described how she would like to interview and interact directly with an expert in her field. Another spoke about the desirability of experiences where she could “actually see why you’re learning what you’re learning... and how it can be applied in real life.”

Flexibility and control were themes that emerged in three responses to questions about good e-learning experiences and in three responses about powerful learning in an ideal world. For example, one participant offered a Web conference as an example of a good e-learning experience. He indicated that he liked the flexibility of Web-based conferences. He explained that they are easy to schedule and that there is no need to make travel plans. Because of this flexibility, he said that more people can attend Web-based conferences, and he felt that there tends to be better input from diverse backgrounds than the input from one group meeting in a room somewhere. Another participant said that because she has health issues, the flexibility to do class work only on her “good days” makes online courses ideal for her. One participant spoke in terms of control, saying that being able to make changes “if things weren’t going well” would enhance her learning in an ideal world. Another participant described flexibility relating to the instructor’s manner or delivery method and said she appreciated an instructor who created assignments that “allowed her to do her own thing.” As Garrison and Anderson (2003) suggest, “control in content and process is a catalyst for spontaneous and creative learning experiences and outcomes” (p. 18). Results from this study support this notion.

Technological aspects of e-learning were mentioned as factors impacting e-learning experiences. Two participants said that real-time interaction was a component of good e-learning experiences, and three others cited this as a recommendation to e-learning designers. One participant stated that “today’s environment lacks real-time power.” Another said that the lack of real-time interaction made her feel as if she were talking to herself at times. Several participants mentioned the importance of a well-functioning computer system and/or of lessons for which navigation functions have been thoroughly tested. For example, when asked about recommendations for instructional designers that might make e-learning experiences more powerful, one participant blurted out, “make sure the links work!” These responses suggested that the technologies used in e-learning settings influence learning experiences, at least for some people.

Participants provided mixed views about e-learning experiences involving asynchronous online discussions. Six participants mentioned enjoying them or finding them helpful. However, five of those participants also expressed that they found online discussions problematic due to factors such as other students’ poor communication skills and attitudes, poor discussion facilitation by professors, and difficulty communicating due to lack of real-time, synchronous options. For example, two participants suggested that because people can be somewhat anonymous in online discussions, fellow students do not always give enough thought to what they are writing and to who might be in the discussion. As one participant put it, “language can be dangerous...it’s not a chat room.” Increased involvement of professors in guiding asynchronous discussions was suggested by four participants as a way to improve discussions in e-learning situations.

Additionally, several participants mentioned the role of professors in e-learning experiences. They expressed a desire for their professors to be more available and, as one participant put it, “more involved and on top of things.” Others felt that professors need to make personal connections with students. The importance of the instructor-learner relationship was a factor in previous studies (Rowland & DiVasto, 2001; Rowland, Hetherington, & Raasch, 2002; Rowland, Lederhouse, & Satterfield, 2004) and, when combined with this study, suggests that instructors do play a role in determining the quality of learning experiences in formal settings.

Only four participants felt they could describe their e-learning experiences as being *powerful*. However, it seemed that what made learning powerful for these participants was the content and/or activity, not the e-learning medium *per se*. For instance, a participant spoke about an online history course that she “didn’t want to take in the first place,” explaining that it turned out to be extremely powerful for her because the content opened up new ideas and broadened her interests. Still, the results support the notion that powerful learning is possible in e-learning environments for at least some people.

The study’s overall results appear to reflect two theoretical perspectives. First, results were consistent in several ways with the perspective of *constructivism*, which suggests that knowledge is actively constructed and reconstructed by individuals through reflection upon past and present experiences (Piaget, 1957; Bruner, 1960). All descriptions of powerful learning experiences involved active engagement in events by the participants, not just in terms of doing things but actively making meaning through the doing. And participants frequently cited that, through reflection during and after their experiences, they achieved deeper and highly personal understandings, not just, for example, reinforcement via rehearsal.

More specifically, results seem to point toward a *collaborative constructivist* perspective of learning, which has its roots in the works of Lev Vygotsky and John Dewey. This perspective stresses the “inseparable relationship between personal meaning making and the social influence in shaping the educational transaction” (Garrison & Anderson, 2003, p. 12). For instance, all participant descriptions of powerful learning involved meaningful interactions with other people, not just in terms of an exchange of information but in what appeared to be a negotiation of meaning as both parties came to new and personal understandings. No study participant described a powerful learning experience where he or she simply observed an event in solitary and reacted to it, in other words, vicarious learning which may have been accounted for by an objectivist learning theory.

A second perspective that was especially interesting, and which is just beginning to be applied in the areas of human learning and performance, was complex systems theory (see Rowland, 2007). Results from the four studies suggest that powerful learning may be an emergent phenomenon—a unique result of non-linear interactions among components (e.g., Gleick, 1987). A non-linear interaction is one in which effects are not proportional to causes and, therefore, one whose effects cannot be predicted by the examination of simple causal relationship among separate parts. Specifically, three related results include: (1) power has not been described as the result of single causal factors or any consistent group of factors, (2) the effect obtained appears significant beyond what one might expect from a simple causal (i.e., linear) interaction of factors, and (3) there appears to be little consistency across experiences in the factors cited and how they interact. These approximate the characteristics of emergent phenomenon described by Morowitz (2002) and others. If powerful learning is emergent, then it is largely unpredictable and, therefore, a search for typical prescriptive design principles (i.e., if learning goal X, then apply method Y) would be futile (e.g., Brown, 2002; McDaniel, 2007). Rather, the designer seeking to facilitate powerful learning would likely find it more effective to focus on creating conditions in which powerful learning would be more probable.

## Conclusion

The descriptions provided by the participants of this study appear to reinforce findings from previous studies that powerful learning experiences are likely to be individual and to result from many factors coming together in a unique way. Consequently, it would appear difficult if not impossible to engineer them through applying simple prescriptive principles. On the other hand, results indicate a strong tendency for social interactions and active engagement in authentic settings to play a role.

Results also suggest that powerful learning experiences are possible in e-learning environments. While



instructional designers and educators may not be able to control or prescribe individual experiences of powerful learning, the inclusion of meaningful social interaction and active engagement in authentic settings in courses may increase the likelihood that individuals will find their learning experiences to be more powerful.

These results are preliminary. Larger numbers of participants and more in-depth methods should reveal how far results from previous studies extend to e-learning, and provide greater insight into powerful learning in e-learning contexts.

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