Meta-analysis of the effectiveness of four adult learning methods and strategies

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Abstract

The effectiveness of four adult learning methods (accelerated learning, coaching, guided design, and just-in-time training) constituted the focus of a meta-analysis. Six operationally defined adult learning method characteristics were used to code and analyze the relationship between the characteristics and the study outcomes (learner knowledge, skills, attitudes, and self-efficacy beliefs). The six characteristics were instructor introduction and illustration of new knowledge or practice, and learner application, evaluation, reflection, and self-assessment of mastery of the knowledge or practice. The synthesis included 58 randomized controlled design studies (N = 2,095 experimental group participants and N = 2,213 control group participants). Results showed that all six adult learning method characteristics were associated with positive learner outcomes, but that methods and practices that actively involved learners in acquiring, using, evaluating, and reflecting on new knowledge or practice had the most positive consequences on learner outcomes. Results also showed that the adult learning methods were most effective when 5 or 6 of the adult learning characteristics were used as part of instruction or training, and the interventions were implemented with a small number of learners (< 30) for more than 10 hours on multiple occasions. Implications for research and professional development are described.

Keywords: Adult learning, Randomized design studies, Meta-analysis, Active learner participation.

Introduction

Adult learning is not a discretely separate field of enquiry but rather a collection of different but interrelated theories and methods (Brookfield, 1996). Different theories and models of adult learning are grounded in principles that emphasize a readiness to learn, autonomous learning, active participation in learning, critical thinking and reflection, and real-life relevance and application of learning content, material, or practice (Knowles, Holton, & Swanson, 1998; Merriam, 2001; Trotter, 2006). The principles of adult learning in turn have been used to propose professional development guidelines for both pre-service and in-service education (e.g., American Federation of Teachers, 2002; Imel, 1998).

The extent to which different adult learning models and approaches have common elements and are effective in terms of influencing learner outcomes has been the focus of a number of literature and research reviews (e.g., Callahan, Kiker, & Cross, 2003; Smith & DeFrates-Densch, 2008; Tusting & Barton, 2003). Although "meta-analytic studies are relatively rare in the field of adult [learning and] development" (Valentine & Cooper, 2009, p. 809), a few meta-analysis of adult learning methods have included attempts to identify which practices are related to learner outcomes (e.g., Torgerson, Porthouse, & Brooks, 2003; Wade, 1985; Zhao, Lei, Yan, Lai, & Tan, 2005). Although effect sizes were used in these syntheses to assess the impact of different kinds of practices (e.g., active learner participation, self-directed learning, computer-assisted instruction) on learner outcomes, none of the meta-analyses was guided by a conceptual or operational framework nor did any attempt to isolate the conditions under which the adult learning methods were most effective.

The manner in which the characteristics and associated practices of four adult learning methods were related to the acquisition and mastery of new knowledge or practice was the focus of the meta-analysis reported in this paper. The four methods are *accelerated learning* (e.g., Meier, 2000), *coaching* (e.g., Leat, Lofthouse, & Wilcock, 2006), *guided design* (e.g., Wales & Stager, 1978), and *just-in-time training* (e.g., Davis, 2005). Several of the four adult learning methods have been the focus of systematic review (Ackland, 1991; Dipamo & Job, 1991; Showers, Joyce, & Bennett, 1987), but the analyses have been primarily at a global or macro-level rather than in terms of the specific practice characteristics associated with learner outcomes. The one exception is the seminal research review of coaching by Showers et al. (1987), who identified a number of characteristics of learners and coaching opportunities that contributed to effective professional development. These included, but were not limited to, instructor presentation and discussion, learner practice and instructor feedback, and ongoing coaching in learners' everyday work settings (see especially Joyce & Showers, 2002).

The meta-analysis reported in this paper builds on previous syntheses but differs from most others by "digging deeper" to identify those practices that are most effective in explaining learner outcomes. The research synthesis also differs from previous reviews by using meta-analysis (Lipsey & Wilson, 2001) to identify which characteristics under which conditions best explain the effectiveness of the adult learning methods. The approach used to conduct the meta-analysis permitted us to *unbundle* (Lipsey, 1993) and *unpack* and *disentangle* (Dunst & Trivette, 2009) the characteristics of and conditions under which the adult learning methods were most effective. We begin by briefly describing each of the adult learning methods and then describe the operational framework that was used to assess the relationships between the presence or use of different adult learning characteristics and practices and learner outcomes.

Adult learning methods

Accelerated learning

First called suggestopedia (Lozanov, 1978), this adult learning method includes procedures for creating a relaxed emotional state, an orchestrated and multi-sensory learning environment, and active learner engagement in the learning process (Meier, 2000). A relaxed emotional state includes relaxation and breathing exercises, suggestion, and a positive learning atmosphere. An orchestrated environment includes imagery, dramatic readings, and the use of instructional videos and peripherals (posters and visual displays) for facilitating learning. Active learning includes plays or skits, role playing, practice exercises, and journal writing. Accelerated learning is considered a holistic adult learning method that is intended to promote creation (and not consumption), enhance retention, and quicken the learning process.

Coaching

"Coaching is a…method of transferring skills and expertise from more experienced and knowledgeable practitioners…to less experienced ones" (Hargreaves & Dawe, 1990, p. 230). This adult learning method includes procedures for joint planning and goal setting, coach information sharing and modeling, learner information gathering and practicing, joint analysis of and reflection on the learner's experiences, and coach feedback (Leat, Lofthouse, & Wilcock, 2006). Coaching is a learner driven process facilitated by a coach's encouragement and use of his or her knowledge and skills to promote learner understanding and use of newly acquired knowledge or practice (Gallacher, 1997). Coaching is conceptualized as a cyclic process that improves knowledge and skills, self-confidence, and collegial relationships as a result of ongoing coaching episodes.

Guided design

Guided design is used to promote critical thinking and self-directed learning (Hancock, Coscarelli, & White, 1983). The method is characterized by decision-making and problem solving processes that include procedures for using real world problems for mastering learning content, using small-group or team processing and facilitator guidance and feedback (Wales & Stager, 1978). The procedure was first used to teach decision making skills to engineering students (Colvin, Kilmer, & Smith, 1972) but is now widely used in a number of professions that involve

decision-making and problem solving (e.g., Turner & Bechtel, 1998). The benefits of this adult learning method include higher-order problem solving and meta-cognitive thinking abilities.

Just-in-time training

Just-in-time training includes a number of different methods and strategies used in the context of real-life challenges in response to learner requests for guidance or mentoring (Beckett, 2000). This adult learning method provides individualized, tailored training in response to a request specific to an immediate concern or need. According to Brandenburg and Ellinger (2003), just-in-time training is "often conceived as anywhere, anytime learning that is just enough, just for me, and just in time" (p. 309). The key characteristics of this adult learning method include access to or provision of information needed to improve performance or complete a task, on-the-job use of the information or guidance, and the availability of input and guidance from a mentor, supervisor, or coach on an as-needed basis. The primary outcomes of just-in-time training are context specific improvement of knowledge and performance.

Adult learning characteristics

Findings from a research review on the *science of learning* were used to develop criteria as standards against which the four adult learning methods were evaluated and judged (Donovan, Bransford, & Pellegrino, 1999). Donovan et al. (1999) identified three key elements of how people acquire and master new knowledge and skills. One focus of their analyses was the features and characteristics of learning environments and learner experiences that promote deep understanding of a content area or practice. These are: (1) New material and information is more easily learned when it is related to existing learner knowledge and is relevant to the learner, (2) mastery of new material and information requires application of the knowledge in the context of a conceptual, theoretical, or operational framework, and (3) ongoing monitoring and self-assessment of learner progress facilitates deeper understanding and continued application of new knowledge or practice. According to Bransford et al. (2000), instructors, trainers, teachers, and others (e.g., supervisors) play a "critical role in assisting learners to engage their understanding, building on learners' understanding, correcting misconceptions, and observing and engaging with learners during the process of learning" (p. 238).

The Donovan et al. (1999) findings were used to operationally define six adult learning method characteristics, two for each adult learning element, and

Table 1: Characteristics of the adult learning methods that were the focus of analysis

Features/Characteristics	Definition
Planning	
Introduce	Engage the learner in a preview of the material, knowledge or practice that is the focus of instruction or training.
Illustrate	Demonstrate or illustrate the use or applicability of the material, knowledge or practice for the learner
Application	
Practice	Engage the learner in the use of the material, knowledge or practice.
Evaluate	Engage the learner in a process of evaluating the consequence or outcome of the application of the material, knowledge or practice.
Deep Understanding	
Reflection	Engage the learner in self-assessment of his or her acquisition of knowledge and skills as a basis for identifying "next steps" in the learning process.
Mastery	Engage the learner in a process of assessing his or her experience in the context of some conceptual or practical model or framework, or some external set of standards or criteria.

to code the studies in the research synthesis in terms of the use or presence of the characteristics. Table 1 shows the characteristics. The three main features were *planning*, *application*, and *deep understanding*. Planning included the methods and procedures for both: (1) Introducing new knowledge, material or practices to learners and (2) illustrating and demonstrating the use of the knowledge, material or practices. Application included the methods and procedures for both: (1) Learner use of the knowledge, material or practices and (2) learner evaluation of the outcome or consequence of that experience. Deep understanding included methods and procedures for: (1) Engaging the learner in reflection on his or her learning experience and (2) learner self-assessment of knowledge or practice mastery as a foundation for identifying new learning opportunities.

The extent to which each of the characteristics were related to the study outcomes was the focus of analysis. Additionally, the relationships between different kinds of practices for each characteristic were examined to ascertain if certain practices were more effective than others in explaining study outcomes. Whether different combinations of characteristics were differentially related to the study outcomes was also assessed. Finally, we determined the extent to which claims about the relative importance of certain characteristics and practices were supported by the meta-analysis results, including, but not limited to, the importance of instructor guidance and feedback (Kirschner, Sweller, & Clark, 2006), learner reflection (Peterson, Taylor, Burnham, & Schock, 2009), real life relevance (Dickover, 2002),

the need to apply newly learned material or practices (Wade, 1985), and the use of performance standards for assessing learner progress (Otis-Wilborn, Winn, & Ford, 2000).

Method

Search strategy: Studies that investigated the effectiveness of the four adult learning methods were identified by four searches, one for each method. Both controlled vocabulary and natural language searches were conducted (Lucas & Cutspec, 2007). The terms used to identify studies of each adult learning method were ones that at different times have been used interchangeably to describe the learning methods. The search terms were used with *train* or *learn* or *educate* or *instruct* as Boolean AND conditions. In each of the searches, the term adult was also used as a Boolean AND condition to limit the studies to adult learners.

Several searches had additional delimiters. For example, the Boolean NOT operator was used with coaching to screen out studies involving sports, athletics, personal trainers, and similar practices that use a coach. Similarly, the NOT operator was used with just-in-time training to screen out studies that included inventory, management, and other terms that include the phrase *just-in-time* to describe procedures that are not adult learning methods.

Sources: ERIC (Educational Resources Information Center), Psychological Abstracts (PsychInfo), Academic Search Elite, Business Source Elite, World CAT, Social Sciences Citation Index, InfoTRAC Expanded Academic ASAP, Medline, OCLC PapersFirst, and Dissertation Abstracts were searched. These were supplemented by searches of Ingenta, Google Scholar, ABI/IFORM Global, the Cochrane Databases, and an extensive EndNote library maintained by our Institute.

Hand searches of the reference sections of retrieved journal articles, book chapters, and books were examined to identify additional studies. Journals dedicated to the adult learning methods were also examined to identify studies (e.g., Journal of Accelerated Learning and Teaching; Coaching: An International Journal of Theory, Research and Practice). Websites dedicated to the adult learning methods were searched to identify additional studies (e.g., *International Alliance for Learning*; *National Center for Guided Design*). We also conducted Social Science Citation Index searches of seminal papers and studies by individuals who either developed one of the adult learning methods or are leaders in the use of the methods. These individuals included, but were not limited to, Georgi Lozanov and David Meier (accelerated learning), Joyce Showers and Frank Kohler (coaching),

Samuel Colvin and Charles Wales (guided design), and DeLayne Hudspeth and Laura Dorsey (just-in-time training).

Inclusion criteria: Studies were included if the: (1) Participants were adult learners (defined as post high school age), (2) sufficient information was included in the research reports to code the use of the different adult learning method characteristics, (3) the adult learning method was compared to a control or "business as usual" condition, and (4) a randomized controlled design was used to evaluate the effectiveness of the adult learning methods.

Exclusion criteria: Studies were excluded if the participants were elementary or secondary school students, insufficient information was included about specific elements of the adult learning procedures, or pre-experimental, quasi-experimental, or single participant research designs were used. Single participant design studies were excluded because they were used for evaluating the effectiveness of only coaching and these types of studies often yield inflated effect sizes (e.g., Jenson, Clark, Kircher, & Kristjansson, 2007).

Search results

Fifty-eight studies were located in 49 reports. An investigation was considered a separate study in a single research report if the influence of two or more intervention groups were compared to a control group. Twenty-four studies investigated accelerated learning, 15 investigated coaching, 13 investigated guided design, and 6 investigated just-in-time training. The complete list of studies as well as selected characteristics of the learners and study outcomes can be obtained at http://www.puckett.org/docs/ijcelldocs.pdf.

Study participants: The 58 studies included 2,095 experimental group participants and 2,213 control group participants. The learners included classroom teachers, student teachers, undergraduate students, graduate students, medical personnel, counselors, English as second language learners, and business personnel (e.g., sales and customer service personnel). The settings in which the adult learning methods were implemented included college classrooms; elementary, junior and high schools; special education classrooms; hospitals and private physician practices; and various business and work settings. The learner outcomes in the studies included teaching practices, early childhood intervention practices, foreign language learning, nursing and medical procedures, science and engineering, mathematics and statistics, economics, and rare vocabulary.

Adult learning method characteristics: Coding of the adult learning method characteristics showed that 58 studies included instructor introduction of some

type of knowledge, material or practices, and 25 studies included instructor demonstration or illustration of the knowledge, material or practice. Forty-one studies included some type of learner application, and 23 studies included some type of learner evaluation of their use of the knowledge, material or practices. Twenty-two studies included some type of learner reflection, and 21 studies included some type of learner self-assessment of mastery.

Planning: The methods used to introduce new knowledge or practices to the study participants were grouped into six categories: (1) Class or workshop presentations, (2) warm-up exercises and pre-class quizzes, (3) self-instruction and out-of-class activities, (4) dramatic readings, (5) imagery, and (6) a combination of dramatic readings and imagery. The methods used to illustrate or demonstrate knowledge or practice were grouped into four categories: (1) Real life demonstrations, and real life demonstrations and role playing, (2) role playing (simulations, skits, plays), (3) instructional videos, and (4) learner informed lecture content. The latter included instructor incorporation of learner experiences into lectures or presentations, or the use of results from pre-class exercises, to illustrate the targeted content.

Application: The methods used to engage learners in the application of newly acquired information or material were grouped into five categories: (1) Real life use of the knowledge or practice, (2) role playing (simulations, skits, plays), (3) real life demonstrations and role playing, (4) problem solving activities, and (5) games/writing exercises. Two methods were used to have learners evaluate the consequences of application: (1) Instructor assessment, review, and feedback on the learners' experiences and (2) learner review and self-assessment of their use of information, material or practice. The latter included either individual or group reviews and assessment of learner use of the targeted information, material, or practice.

Understanding: The methods used to engage learners in reflection on knowledge acquisition and practice application were grouped into three categories: (1) Performance improvement reviews, (2) journaling and behavioral suggestions, and (3) group reflection on instructor feedback. Performance improvement reviews involved joint learner and instructor discussions of learner application. Journaling and behavioral suggestions involved strategies for engaging learners in self-reflection on their learning experiences. Group reflection involved learner processing of instructor feedback on application to promote deeper understanding of the learning topic.

Learner mastery was determined by: (1) self-assessment of personal strengths (and weaknesses) and (2) evaluation of learner performance against a set of standards or practice criteria. Self-assessment of learner strengths and weaknesses was done either individually or in a group in response to instructor feedback as

a basis for self-assessing learner mastery. Learner assessment of mastery used *a priori* identified standards or competencies (e.g., performance checklists) as criteria against which learner knowledge and performance were assessed.

Inter-judge agreement on the use or nonuse of the six adult learning characteristics, as well as the practices for each characteristic, was determined through an iterative process. One of the authors first coded all the studies. A second author then examined the codes to identify disagreements. A third author examined the characteristics and practices that were considered examples of each adult learning characteristic in terms of both agreements and disagreements. Disagreements were settled by further examination and analyses of the studies until there was 100% agreement on the codes.

Study outcomes: The outcomes were organized into four categories: Learner (1) knowledge, (2) skills, (3) attitudes, and (4) self-efficacy beliefs. Both standardized and investigator-developed measures were used to assess learner outcomes. Knowledge included mastery of course content, job requirements, medical procedures, memorization, and other content. Skills included teaching methods, practitioner intervention capabilities, computer use, medical procedures, interviewing skills, job performance, and second language learning. Learner attitudes included evaluation of the learning experience and satisfaction with the learning methods and procedures. Class attendance and completion of the study were used as proxy measures of learner attitudes. Self-efficacy included judgments of learner competence and confidence in their perceived ability to produce intended outcomes or consequences. The same iterative process used to reach 100% agreement on the codes for the adult learning method characteristics and practices was used to establish inter-judge agreement on the outcome measures.

Methods of analysis

Cohen's *d* effect sizes for the mean difference on the post-test study outcomes between the experimental and control groups were used to evaluate the effectiveness of the adult learning methods. Multiple effect sizes for the same outcome in any one study were averaged so that there was no more than one size of effect for each of the four outcomes (knowledge, skills, attitudes, and self efficiency beliefs). The weighted average Cohen's *d* was then computed for each of the six adult learning method characteristics as well as type of practice for each characteristic to ascertain which characteristics and practices accounted for the largest between group differences. The average sizes of effect and the 95% confidence intervals for the mean effect sizes were used for substantive interpretation. All analyses were performed using a fixed effects model (Hedges, 1994).

A number of analyses were performed to identify which adult learning characteristics and practices were associated with variations in learner outcomes. First, we assessed the extent to which each of the six different adult learning method characteristics were related to the study outcomes. Second, the particular types of practices for each adult learning method characteristic were examined to identify which kinds of practices for each characteristic had the largest sizes of effects on the study outcomes. Third, we examined the relationships between the adult learning characteristics and the four study outcomes to ascertain if certain characteristics were differentially related to the four outcomes. Fourth, we determined if different combinations of adult learning characteristics were differentially related to the study outcomes. Fifth, we determined whether the relationships between the adult learning methods and the study outcomes differed as a function of a number of moderator variables (e.g., number of learners, length of training).

We performed a number of statistical analyses to both aid in interpretation and to identify which characteristics and practices had the largest sizes of effects with the study outcomes. The *Z* statistic was used to assess whether an average weighted effect size differed significantly from zero. A 95% confidence interval not including zero indicates that the average effect size is significantly greater than zero at the .05 level (Hedges, 1994). The *Q* statistic was used for between group comparisons. The *Q* test is "analogous to the omnibus *F* test for variation in group means in a one-way ANOVA" (Hedges, 1994, p. 290). The analyses included preplanned comparisons or contrasts where indicated, which were tested by chi-square tests for between effect size differences (Hedges, 1994). Both of the primary methods were supplemental by secondary analysis when interesting patterns emerged and statistical analyses helped clarify the nature of the results.

Results

The average effect size and 95% confidence interval (CI) for all studies and outcomes combined was .42 (CI = .36-.47). The average effects sizes and CIs for the four adult learning methods were .91 (CI = .78-1.04) for coaching, .52 (CI = .37-.68) for just in-time training, .49 (CI = .39-.58) for guided design, and .05 (CI = -.04-.14) for accelerated learning.

Adult learning method characteristics: The sizes of effects and 95% confidence intervals for the six adult learning method characteristics are shown in Figure 1. Each of the six adult learning method characteristics was moderately to highly related to the study outcomes. Because the six characteristics represented a logical

Figure 1: Average effect sizes and 95% confidence intervals for the relationships between the six adult learning method characteristics and the study outcomes.
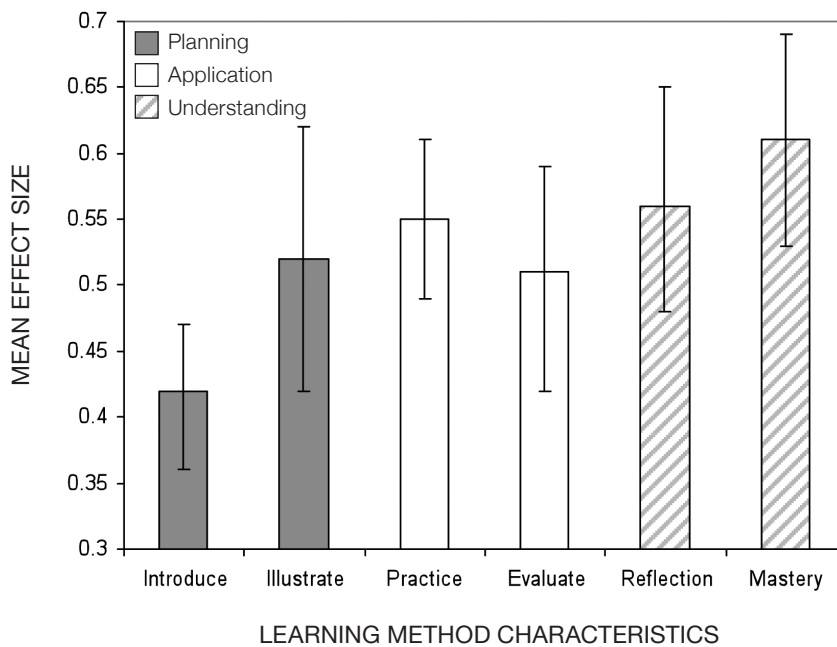
sequence of events, we determined the extent to which there was a discernable pattern in the sizes of effect by a test for a linear trend. The analysis produced a significant linear effect, $x^2 = 10.45$, $df = 1$, $p < .002$, indicating that greater learner effects were realized when events later in the learning process were used. We also determined if the two instructor-centered planning characteristics (introduction and illustration) differed from the four learner-centered application and understanding characteristics. The average effect sizes for the two sets of characteristics were $d = .45$ (CI = .38-.51) and $d = .55$ (CI = .48-.63) respectively. There was a significant between type of characteristics effect, $Q = 6.44$, $df = 1$, $p < .02$, indicating the relative importance of active learner participation in the acquisition and mastery of new knowledge or practice.

Table 2 shows the average effect sizes and 95% confidence intervals for the practices associated with each adult learning method characteristics. All of the practices, except the use of dramatic readings and imagery for introducing new information, and the use of instructional videos for illustrating learning content or practice, were significantly related to the study outcomes. Although the largest

**Table 2: Cohen's d Effect Sizes for the Different Adult Learning Method
Characteristics and Practices**

Characteristics / Practices	Number		Mean Effect Size	95% Confidence Interval	Z
	Studies	Effect Sizes			
Introduction					
Out of class activities/self instruction	9	11	.64	.52 - .77	10.43**
Classroom/workshop lectures	21	31	.63	.53 - .72	13.14**
Pre-class exercises	5	5	.54	.38 - .71	6.44**
Dramatic readings/imagery	4	8	.28	.07 - .49	2.57*
Dramatic readings	15	21	-.01	-.14 - .12	0.15
Imagery	4	6	-.02	-.19 - .15	0.25
Illustration/Demonstration					
Role playing/simulations	14	21	.55	.42 - .68	8.20**
Learner input	4	4	.53	.34 - .72	5.41**
Real life example/real life + roleplaying	3	4	.45	.14 - .76	2.85*
Instructional video	4	6	.34	.00 - .68	1.97
Practicing					
Real life application	9	13	.94	.79 - 1.09	12.15**
Real life application + role playing	5	7	.86	.61 - 1.03	6.75**
Problem solving tasks	13	19	.49	.39 - .58	10.10**
Learning games/written exercises	6	8	.38	.23 - .54	4.80**
Role playing (skits, plays)	8	14	.35	.19 - .51	4.21**
Evaluation					
Assess strengths/weaknesses	7	9	.94	.65 -1.22	6.49**
Review experience/make changes	16	24	.47	.38 - .56	10.19**
Reflection					
Performance improvement	4	6	1.27	.89 - 1.65	6.56*
Journaling/behavior suggestion	5	5	.82	.52 - 1.12	5.33**
Group discussion about feedback	13	19	.49	.39 - .58	10.10**
Mastery					
Standards-based assessment	8	11	.86	.72 - .99	12.47**
Self assessment	13	19	.49	.39 - .58	10.10**

* p. < 01. ** p <.0001.

majority of practices were related to the study outcomes, certain practices stood out as being more important. Out-of-class activities on the learning topic or practice (including self-instruction) and classroom or workshop presentations proved most effective in terms of introducing new knowledge or a practice. Instructor or trainer role plays or simulations, and the use of learner input and experiences for demonstrating a practice, were most effective in terms of illustrating a learning topic or practice.

Engaging learners is some type of real life or applied use of new knowledge or practice, either as a primary method or in combination with role plays, were far superior then the other practices for having learners apply and use new knowledge or practice. Learner assessment of his or her experiences proved most effective for having learners evaluate their experiences. Both practices were ones that more actively involved learners in applying and evaluating their experiences.

Two types of reflection were especially effective in terms of influencing learner outcomes: (1) Join instructor — learner discussions of learner performance with instructor facilitated learner identification of "next steps" in the learning process and (2) learner journaling and instructor-guided suggestions about a learner's experiences and which additional experiences would be most beneficial to a learner. The use of a standards-based assessment, performance checklist, or an *a priori* set of competencies that learners used to judge their progress in learning new material or practice was most effective practice for promoting learner mystery.

Learner outcomes: The influence of all the adult learning method characteristics taken together on the four outcome measures was $d = .69$ (CI = .56 - .82) for skill acquisition, $d = .49$ (CI = .32 - .65) for self-efficacy beliefs, $d = .41$ (CI = .27 - .54) for learner attitudes, and d = .33 (CI = .26 - .40) for knowledge acquisition, Zs = 5.71 to 10.16, ps < .0001. Analyses of the relationships between each of the six adult learning method characteristics and the four learner outcomes showed that in every analysis except one (instructor illustration and learner self-efficacy beliefs), the adult learning method characteristics were significantly related to each of the four outcomes. The findings showed, however, that the outcomes most strongly related to the adult learning method characteristics were learner skill acquisition and learner attitudes. This suggests that when learners had positive experiences with the practices used to promote their skill development, the more positive were their attitudes toward that learning.

Cluster analysis: The extent to which the simultaneous presence or use of different combinations of adult learning method characteristics was related to the study outcomes was determined by first performing a K-means cluster analysis (Dixon, 1992) of the six adult learning method characteristics and second by assessing the relationship between cluster membership and the sizes of effects for

Figure 2: Average Cohen's *d* effect sizes and 95% confidence intervals for the relationship between different combinations (clusters) of adult learning methods characteristics and the study outcomes.
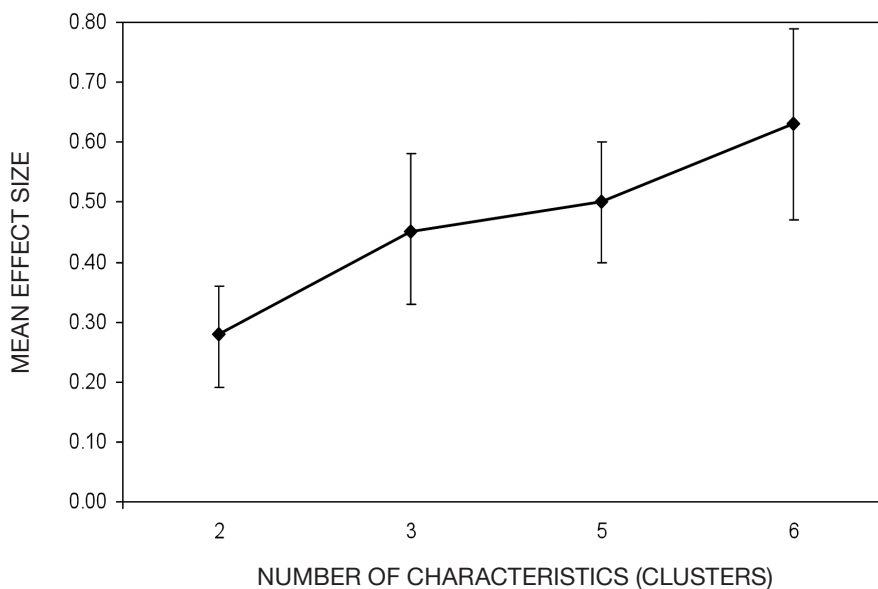
the study outcomes. A four cluster solution showed that a combination of 2, 3, 5 or 6 characteristics were used in the different studies. Studies in Cluster 1 introduced the learning topic to the learners and engaged them in the use of the material or practice. Studies in Cluster 2 used the same two characteristics and in addition instructor illustration of the material or practice. Studies in Cluster 3 used all the characteristics except instructor illustration. Studies in Cluster 4 used all six characteristics.

The relationship between cluster membership and the average size of effects is shown in Figure 2. A between cluster comparison was significant, Q = 19.67, df = 3, p < .0002, indicating that the average sizes of effects differed from one another. A test for a linear trend was also significant, x^2 = 14.38, df = 1, p < .0001, indicating that there was an incremental increase in the size of effects when more characteristics were used. The results clearly show that the more characteristics that were used by an instructor or trainer, the larger the average effect size for the influences of the adult learning methods on learner outcomes.

A between cluster analysis comparing the use of few (2 or 3) vs. many (5 or 6) characteristics was significant, Q = 10.57, df = 1, p < .001. The average effect size for Clusters 1 and 2 combined was d = 0.33 (CI = .26 - .41), Z = 9.23, p < .0001, and the average effect size for Clusters 3 and 4 combined was d = 0.54 (CI = .45 -

.62), $Z = 12.36$, $p < .0001$. Further analyses showed that neither Cluster 1 vs. 2 nor Cluster 3 vs. 4 differed significantly from one another.

Moderator effects: Whether the relationships between the adult learning methods and the study outcomes were moderated by study, setting, learner, or intervention variables was assessed by constituting moderator variable groups and examining the sizes of effects between the independent and dependent measures for each group. The study variables were type of study (published vs. unpublished), year of publication (1975–1989, 1990–1999, 2000–2001), and unit of randomization (individual vs. group). The learner variables examined were university students vs. non-college students (e.g., teachers, English language learners) and the number of learners (9–34, 35–75, 76–300+). The effect of setting was examined by comparing the use of the adult learning methods in college classrooms vs. work settings. The effects of length of the learning experience was assessed in terms of hours of instruction (1–10, 71–40, 41+).

The relationships between the adult learning methods and the study outcomes were all significantly related to learner benefits regardless of moderator variable. The strength of the relationships, however, was either similar or different depending on the moderator. There was no significant difference in the average effect sizes for published vs. unpublished studies, $Q = 1.71$, $df = 1$, $p > .15$. There were, however, significant between group differences for unit of randomization, $Q = 71.91$, $df = 1$, $p < .0001$, and year of publication, $Q = 66.52$, $df = 2$, $p < .0001$. Studies that assigned participants to experimental conditions at the individual rather than group (e.g., class) level and those studies that were more recently published had larger effect sizes.

The adult learning methods were more effective when used with practitioners, $Q = 47.75$, $df = 1$, $p < .00001$, and when implemented in applied settings and work environments, $Q = 25.55$, $df = 1$, $p < .00001$. Both findings suggest that the adult learning methods had more positive effects when used to influence changes in participants' jobs and professions that had immediate applied relevance.

There was a significant between group difference in the average effect sizes for the number of participants in each group, $Q = 31.45$, $df = 2$, $p < .00001$. The average effect sizes for small (9–34), medium (35–75), and large (76–300+) groups of learners were, respectively, .91 (CI = .71 – 1.11), .48 (CI = .38 – .58), and .33 (CI = .26 – .40). A test for a linear trend between the number of participants in each group and the sizes of effect was also significant, $Q = 29.32$, $df = 1$, $p = .00001$. The smaller the number of learners, the larger the average effect size. There was also a between length of training difference in the average effect sizes, $Q = 42.51$, $df = 2$, $p < .0001$. The average effect size for 1 to 10, 11-40, and more than 40 hours of training were respectively, .21 (CI = .13 – .30), .55 (CI = .44 – .67), and .60 (CI =

.51 – .70). A test for linear trend was also significant, x^2 = 37.16, *df* = 1, *p* <.0001, indicating that the more hours of training, the larger the average effect size.

Discussion

Findings showed that the six adult learning characteristics constituting the focus of analysis were all significantly related to the study outcome, but that particular practices for each characteristic stood out as more important determinants of learner benefits. The more actively involved learners were is mastering new knowledge or practice and the more instructors or trainers supported and facilitated the learning process, the better were the learner outcomes. The findings also demonstrate that how instructors engage learners, provide guidance, orchestrate learner self-evaluation and reflection, and encourage and support deeper learner understanding, matters in terms of affecting learner outcomes. Taken together, the findings highlight the importance of active learner participation in as many aspects of the learning process as are appropriate for the material or practice being taught, including opportunities to self-assess progress in learning and mastering new knowledge or practice. In addition, learner benefits were optimized when some type of *a priori* performance or standards-based assessment was used to have learners evaluate their progress in mastering new knowledge or practice, where the learning opportunities were used with a small number of participants for more than 10 hours on multiple occasions.

The fact that the cluster analysis results produced findings showing that the more adult learning characteristics that were incorporated into the learning opportunities, the better the outcomes, deserves special comment. This is the case because most adult learning theories postulate the importance of multiple kinds of learner involvement in mastering new knowledge or practice (e.g., Knowles, Holton, & Swanson, 1998; Merriam, 2001; Trotter, 2006). The results from the cluster analysis provide empirical support for those contentions.

The results, and particularly those related to the differential consequences of the adult learning characteristics and practices, provide support for as well as refute contentions by others about the relative importance of certain kinds of experiences and opportunities. The findings provide support for claims about the importance of instructor guidance and feedback (Kirschner, Sweller, & Clark, 2006), learner reflection and critical thinking (Peterson, Taylor, Burnham, & Schock, 2009), real world relevance and immediate applicability (Dickover, 2002), and the use of performance standards for having learners assess their progress (Henry, McTaggert, & McMillan, 1992). The findings do not support claims that learner self-directed learning and self-discovery in the absence of instructor guidance or feedback are

effective (Nah, 1999; Quay, 2003). The findings, contrary to claims by Wade (1985), showed that learner input is important in promoting understanding and mastery of new knowledge or practice. The results are also inconsistent with claims that type of instructional practice, number of learners, and length of training do not matter in terms of explaining learner outcomes (Wade, 1985).

The results have a number of implications for research and practice. One implication for research is further analysis of the conditions under which certain practices and combinations of practices optimally affect learner outcomes. This seems especially important given the findings from the moderator analyses. For example, as part of exploratory *post hoc* analyses of the relationship between number of adult learning characteristics and length of training, findings showed that when more characteristics were used, the less time it took to optimally affect learner outcomes.

Another implication for research has to do with the particular approach used to both code the adult learning methods and analyze the data to identify which characteristics and practices under which conditions emerged as most important. This type of meta-analysis permits one to move beyond analysis of either or both efficacy and effectiveness (Flay, Biglan, Boruch, Castro, Gottfredson, Kellam, Moscicki, Schinke, Valentine, & Ji, 2005) to analyses that yield information that has more direct implications for informing improvements in professional development.

The implications for professional development are straight forward in light of the findings in general and the cluster analysis results in particular. The more adult learning method characteristic that can be incorporated into instruction or training, the higher the likelihood that optimal learner benefits will be realized. Interestingly enough, a number of approaches to professional development include many of the characteristics and practices identified by the meta-analysis as effective in influencing learner outcomes (e.g., American Federation of Teachers, 2002; Imel, 1998). Imel (1998), for example, recommended (among other things) the incorporation of learners' experiences into the learning process. The American Federation for Teachers (2002) recommendations include, as part of 11 principles for professional development, learning methods that actively-involve learners in mastering new practices, where the learning occurs in real-life situations and is job embedded.

One goal in conducting the meta-analysis was sorting out what matters and does not matter in terms of explaining adult learner outcomes. Another was identifying the conditions under which what matters most accounts for optimal learner benefits. This was achieved to a large degree, but as is often case, new questions were raised that need to be answered by additional analyses of the studies in the meta-analysis

or studies that specifically investigate other relationships among variables that might explain learner outcomes (e.g., the influence of use of the majority of adult learning characteristics on rapidity of mastery). We therefore consider the meta-analysis not as an end point but rather a springboard for further research.

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