Ill vs. Well-Structured Learning: Instruction for Expert Learners

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Two approaches educators can take when teaching content to their students are Ill-structured and well-structured instruction. Ill-structured instruction can take the form of discovery learning. Through discovery learning, students participate in unguided educational activities in which students must determine the expected outcomes of learning, independently, without instruction from a teacher (Alfieri, Brooks, Aldrich, & Tenenbaum, 2010). Well-structured instruction, on the other hand, is student learning that is, in some form, guided by a teacher (Mayer, 2004).A debate continues among researchers as to which type of instruction, ill-structured or well-structured instruction, is more effective and efficient for learning. Equally important, is which students benefit from ill-structured or well-structured instruction. *The purpose of this paper is compare ill-structured and well-structured instruction, and to discuss the role of deliberate practice for expert performance and how it relates to Cognitive Load Theory when designing instruction for expert learners.*

Ill-structured vs. Well-structured Instruction

Proponents of guided learning report negative outcomes for unguided learning. Clark, Kirschner and Sweller (2012) stated unguided learning required more time to learn than guided learning, making unguided learning less efficient. Other reasons Clark et al. (2012) gave for abandoning unguided learning were that only a handful of students, usually the top performers, benefitted from unguided learning, incorrect information could be learned which has a negative impact on future learning, and students who learn at a slower pace become frustrated with unguided learning. Conversely, researchers also argue for using unguided instruction as it allows for explorations and discovery of concepts not directly taught by teachers (Bonawitz et al., 2011). In addition, researchers also point out unguided instruction allows students to take on an active role in the learning process.

Novice learners. Novice learners comprise the largest population of learners that educators instruct (Clark et al., 2012). Information learning is still developing for novice learners. They lack highly developed schemas needed to process, store, and use previously learned information common to expert learners (Kalyuga, Ayres, Chandler, & Sweller, 2003).

Expert learners. These are learners who have spent years studying or learning about a specific topic or subject area (Ormrod, 2012). Expert learners process the knowledge they learn in a different manner than novice learners. Information inside the brain of an expert learner is stored categorically and systematically to aid in quick retrieval and allows expert learners to make connections between newly learned and previously learned information, unlike novice learners (Ormrod, 2012).

Theoretical Framework for Deliberate Practice

One type of guided learning, *deliberate practice*, has been cited as a beneficial instructional method for use with expert learners. Ericsson, Krampe, and Tesch-Romer (1993) defined deliberate practice as purposefully engaging in activities that improve task performance. Keith and Ericsson (2007) discussed the importance of setting goals for deliberate practice. Instructors, teachers, coaches, or individuals engaging learners in deliberate practice for expert performance set goals for performance improvement (Keith & Ericsson, 2007). Another aspect of deliberate practice is feedback, for learners to assess their task performance (Keith & Ericsson, 2007). A need for feedback originated with Thorndike's Law of Effect (Narciss, 2008). Thorndike stated individuals either repeated a behavior or extinguished a behavior depending upon the positive or negative consequences they encountered directly after engaging in the behavior (Saettler, 2004).

Research findings indicate effort not experience dictates expert performance (van Gog, Ericsson, Rikers, & Paas, 2005). This effort is observed through deliberate practice. Individuals also need to have conscious thought during deliberate practice in order for performance to improve (van Gog et al., 2005). Expert performers constantly process and evaluate their performance in order to gauge the course of action they take next. Similarly, Ericsson, Nandagopal, and Roring (2005) discussed the inconclusive evidence of the role genetics play in an individual's ability to develop expertise in a specific area. Motivation, an intense desire to increase task performance, and deliberate practice supersede genetic influence on expert performance (Ericsson, Roring, & Nandagopal, 2007).

Findings of Expert Performance

Ericsson and Williams (2007) stressed the importance of researchers connecting theoretical frameworks to practical application. Laboratory findings should transfer to practical interventions in society in order to substantiate the claims of researchers. Ericsson and Williams (2007) reported expert performance has been studies in various fields such as medicine; performing, visual or language arts; math; and mainly in sports related fields. Findings from several studies of expert performance are presented in the following section.

Plant, Ericsson, Hill, and Asberg (2005) replicated findings from previous studies conducted on relationships between study time and academic performance in college. Deliberate practice and self-regulated learning were the theoretical frameworks used in the Plant et al. study (2005). Results from the Plant et al. (2005) study indicated students' performance in college was not related to the amount of study time. Student performance in high school was found to be related to college GPA and study time by itself was not predictive of college GPA. Conversely, study time only had a positive significance when researchers included the quality of study time (ie. alone or in a group) with GPA and students' SAT scores. Plant et al. (2005) found students who studied in solitude in a quiet environment performed at a higher level than students who reported studying in groups. Additionally, students who had higher attendance rates and used long-term planning to monitor their progress were found to have higher GPAs (Plant et al., 2005). These findings support the theory of deliberate practice as individuals who focus and use conscious thought increase their performance levels (van Gog et al., 2005). Similarly, Keith and Ericsson (2007) found a relationship between SAT scores and typing proficiency. Students' SAT scores predicted performance on typing proficiency when using meaningful text but not when typing nonsensical text.

Tuffiash, Roring, and Ericsson (2007) investigated individual expert-performance in the word game of SCRABBLE. Players who participate in SCRABBLE competitions are ranked based on their play. Participants of the study were divided into two groups. One group was representative of the average player found in the National SCRABBLE Association (NSA) and the other group was representative of an expert level player of the NSA. Tuffiash et al. (2007) hoped to find a connection between players SCRABBLE rating and their verbal ability as measured on standardized assessments similar to what other researchers have found between expert chess players and their spatial ability. Tuffiash et al. (2007) found that expert SCRABBLE players created longer and higher numbers of words in laboratory trials than average SCRABBLE players. Self-reports were used to determine the hours of practice each group dedicated to improving SCRABBLE performance. Expert SCRABBLE players reported significantly longer amounts of time dedicated to practicing SCRABBLE skills than average SCRABBLE players (Tuffiash et al., 2007). This finding supports the theory of deliberate practice since players investing more time practicing were identified as the expert level SCRABBLE players (Ericsson et al., 2005).

Raab and Johnson (2007) studied eye tracking of expert, near expert and non-expert handball players in Germany as it related to tactical knowledge and perceptional cognition. This was a longitudinal study conducted over 2 years. Raab and Johnson (2007) found all levels of handball players chose their first generated option for the situations they were presented during the optical tracking assessment more than their second or third stated options. Expert handball players responded faster than near expert and non-expert players; however, they did not produce more responses (Raab & Johnson, 2007). All levels of players produced, on average, three responses as options for the optical situations they were presented. A connection between the type of gaze used in the optical assessment and the response quality was indicated by the results. Expert players engaged in spatial gazing at higher rates than near expert and non-expert players. Raab and Johnson suggested a possibility that expert players required less gazing time than near expert or non-expert players to generate responses due to prior experiences.

Cooke, Gorman, Duran, and Taylor (2007) conducted a study comparing experienced and inexperienced teams to determine differences in performance and learning. Experienced teams performed better than inexperienced teams, although experienced teams did not perform at a faster rate than the inexperienced group. One specific area that the experienced team excelled on was a coordination task (Cooke et al., 2007). This finding demonstrated that prior knowledge or experience was beneficial during the learning process. Cooke et al. (2007) also reported experienced teams outperformed inexperienced teams in the areas of communication processes and communication speed. The findings of Cooke et al. (2007) may explain the successful non-communication skills athletic teammates use during intense competitions such as the Olympics. Volleyball teammates often practice for many years, watching their partners every move and acquiring the ability to anticipate what they will do next. Extended periods of deliberate practice is what allows athletes to perform at the expert level in their chosen sport.

Cognitive Load Theory and Expert Performance

Cognitive Load Theory (CLT) presented by Sweller (1988) underscores the importance of selecting the right amount of information presented during instruction in order for learning to occur. During the learning process, individuals must absorb new information and file it with previously learned information for retrieval later (Sweller, 1988). Additional studies in the area of CLT have indicated an important principle to consider when designing instruction for expert learners. Kalyuga et al. (2003) found instruction used for novice or lower level learners may not be appropriate for expert learners. Instruction containing redundant information has been shown to be beneficial for low level or novice learners but cause cognitive overload for expert learners (Kalyuga et al., 2003). Therefore, instruction designed for expert learners needs to use a format that eliminates redundant information, which impedes learning.

One suggestion proposed by van Gog et al. (2005) is to use verbal analysis techniques during transfer assessments to learn more about the thought processes expert learners use to develop schema. During the instructional design process, expert learners need to be assessed to determine their current level of performance before an appropriate performance task can be developed. Other variables such as "mental effort, time on task, and strategies should be considered in the selection of practice tasks" (van Gog et al., 2005, p. 77) for expert learners. In addition, instruction for expert learners should be adaptive to the individual. Finally, van Gog et al. (2005) state learners need to engage in training that will help them develop self-learning traits in order to add to their knowledge base and performance ability after formal education ends.

Fadde (2009) suggests expert learners receive targeted training to develop recognition skills for increasing speed for decision making. A four-step approach to recognition training proposed by Fadde included (a) "locating the recognition aspect of a reaction performance skill", (b) "devising tasks to test and/or train the recognition sub-skill", (c) "conducting a systematic recognition training program", and (d) "enhancing and evaluating transfer of training using performance-based tasks" (2009, pp. 369-370). Providing targeted training on recognition to individuals in domains such as healthcare, education, aviation, and armed forces increases the expertise level of these individuals over less time.

Conclusion

Ill-structured and well-structured instruction were discussed as they relate to student performance. A division among researchers has some setting up camp with ill-structured or unguided instruction because it provides opportunities for learners to investigate content teachers fail to present. On the other side of the argument, researchers believe well-structured or guided instruction provides the best circumstances for learners to acquire new knowledge. When it comes to learning, the level of the learner needs to be considered when selecting the instructional method. Ericsson et al. (1993) proposed a theoretical framework known as deliberate practice specifically for use with expert learners. During deliberate practice, expert learners repeatedly complete tasks to improve their level of performance. In order to attain superior levels of performance, extensive practice or training is necessary in excess of 10 years (Ericsson et al., 2005; Ericsson et al., 2007).

Findings from expert performance studies demonstrated a connection between study habits of expert learners and GPA (Plant et al., 2005). Practice time for SCRABBLE players was shown to have a relation with the level of expertise supporting the theory of deliberate practice (Ericsson et al., 2007; Tuffiash et al., 2007). Raab and Johnson (2007) found eye gaze played a role in response generation for expert handball players. In a study looking at team performance, Cooke et al. (2007) reported experienced teams had more effective communication processes and speed than the inexperienced teams. This implies the longer the same members of a team practice and compete together they should increase their level of expertise.

Since expert learners are impacted by cognitive load differently than novice learners, instructional design needs to be tailored specifically for the type of learner it is intended. Fadde's

(2009) four-step approach to recognition training is one method that can be used to design instruction to improve performance levels of learners. Additional studies should be conducted to analyze thought processes of expert learners in order to determine effective training tasks to improve their performance levels (van Gog et al., 2005). Finally, learner level is an important consideration when designing instruction. Instruction designed for novice learners is not appropriate for expert learners and vice versa (Ericsson et al., 2005; Ericsson et al., 2007)

References

Alfieri, L., Brooks, P. J., Alrich, N. J., & Tenenbaum, H. R. (2011). Does discovery-based instruction enhance learning? *Journal of Educational Psychology, 103*(1), 1-18. doi:10.1037/a0021017

Bonawitz, E., Shafto, P., Gweon, H., Goodman, N.D., Spelke, E., & Schulz, L. (2011). The double-edged sword of pedagogy: Instruction limits spontaneous exploration and discovery. *Cognition, 120*(3), 322-330. Doi:10.1016/j.cognition.2010.10.001

Clark, R. E., Kirschner, P. A., & Sweller, J. (2012). Putting students on the path to learning: The case for fully guided instruction. *American Educator, 36*(1), 6-11. Retrieved from http://www.aft.org/pdfs/americaneducator/spring2012/Clark.pdf

Cooke, N. J., Gorman, J. C., Duran, J. L., & Taylor, A. R. (2007). Team cognition in experienced command-and-control teams. *Journal of Experimental Psychology: Applied, 13*(3), 146-157. doi:10.1037/1076-898X.13.3.146

Ericsson, K. A., Krampe, R. T., & Tesch-Romer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*(3), 363-406.

Ericsson, K. A., Nandagopal, K., & Roring, R. W. (2005). Giftedness viewed from the expert-performance perspective. *Journal for the Education of the Gifted, 28*(3/4), 287-391.

Ericsson, K. A., Roring, R. W., & Nandagopal, K. (2007). Misunderstandings, agreements, and disagreements: Toward a cumulative science of reproducibly superior aspects of giftedness. *High Ability Studies, 18*(1), 97-115. doi:10.1080/13598130701351088

Ericsson, K. A., & Williams, A. M. (2007). Capturing naturally occurring superior performance in the laboratory: Translational research on expert performance. *Journal of Experimental Psychology: Applied, 13*(3), 115-123. doi:10.1037/1076-898X.13.3.115

Fadde, P. J. (2009). Instructional design for advanced learners: Training recognition skills to hasten experience. Educational Technology, Research, and Development, 57(3), 359-376. doi:10.1007/s11423-007-9046-5

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist, 42*(2), 99-107. doi: 10.1080/00461520701263368

Kalyuga, S., Ayres, P., Chandler, P., & Sweller, J. (2003). The expertise reversal effect. *Educational Psychologist, 38*, 23-31.

Keith, N., & Ericsson, K.A. A deliberate practice account of typing proficiency in everyday typists. *Journal of Experimental Psychology: Applied, 13*(3), 135-145. Doi:10.1037/1076-898X.13.3.135

Mayer, R. E. (2004). Should there be a three strikes rule against pure discovery learning? The case for guided methods of instruction. *American Psychologist, 59*(1), 14-19. doi:10.1037/0003-066X.59.1.14

Narciss, S. (2008). Feedback strategies for interactive learning tasks. In J. M. Spector, M. D. Merrill, J. Van Merriënboer, & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 125-143). New York, NY: Taylor and Francis.

Ormrod, J. E. (2012). *Human Learning*. (6th ed). Allyn & Bacon: Upper Saddle River, NJ

Plant, E. A., Ericsson, K.A., Hill, L., & Asberg, K. (2005). Why study time does not predict grade point average across college students: Implications of deliberate practice for academic performance. *Contemporary Educational Psychology, 30*(1), 96-116. doi:10.1016/j.cedpsych.2004.06.001

Raab, M., & Johnson, J. G. (2007). Expertise-based differences in search and option-generation strategies. *Journal of Experimental Psychology: Applied, 13*(3), 158-170. Doi:10.1037/1076-898X.13.3.158

Saettler, P. (2004). *The evolution of American educational technology*. Greenwich, CT: Information Age.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*, 257-285.

Tuffiash, M., Roring, R. W., & Ericsson, K. A. (2007). Expert performance in SCRABBLE: Implications for the study of the structure and acquisition of complex skills. *Journal of Experimental Psychology: Applied, 13*(3), 124-143. doi:10.1037/1076-898X.13.3124

van Gog, T., Ericsson, K. A., Rikers, R. M. J. P., & Paas, F. (2005). Instructional design for advanced learners: Establishing connections between the theoretical frameworks of cognitive load and deliberate practice. *Educational Technology, Research, and Development, 53*(3), 73-81.