Excerpt: Lauren Cochran

Literature Review

Research concerning brain aging and adult education is plentiful, but research which studies the relationship or implementation between the two is currently lacking. Because of this, the preliminary research can be divided into direct and indirect implications for the proposed project.

A particularly apt source of research for direct implications is music education. Music learning, especially in the initial stages, is a process typically associated with youth and rigorous practice. Virtuosos are in equal parts born as they are forged in the early fires of adolescence—like mathematics, it's often assumed that the older one gets the less capacity they possess for gaining new or expert level skills in music. Reifinger (2016) offers an excellent meta-analysis on the topic, addressing current and prevalent research into age-related changes on the capacity and growth of older-adults when learning music or tasks directly applicable to playing a musical instrument. Music is an exceptionally pertinent choice for research into age-related learning conditions for corporate environments because it is a process which involves multiple learning domains and the shared territories between them. In order to execute a musical performance different skills and abilities must be utilized, including but not limited to: cognitive, psychomotor, multimodal sensory input and image, working memory, and selective inhibition. Specifically, the meta-analysis addresses research on the development of musical performance skills, characteristics of adult learners, differences between younger and older adults in beat, tempo, and rhythm, differences between the same group when reading music during a performance, the effects of practice, motor memory, and auditory memory capacities. Although some aspects of the review—like beat, tempo, and rhythm—are not directly applicable to adult training in other fields at first glance, the findings can provide guidance for the limitations and

accommodations that must be made for physical and/or practical skill-sets in an instructional environment.

Lenehan et. al (2015) also conducted an applicable meta-analysis, albeit their focus was on the relationship between education level and cognitive decline rates. Lenehan and colleagues focused on research published after the year 2000, picking up where the last published literature review on the topic left off. Utilizing specific selection criteria (age of participants, minimum examination periods, and more), the researchers examined ten different studies on the effect of education on cognitive performance in the aging, healthy brain. Although several studies contradicted each other on specifics, most if not all studies found that a higher level of education was consistent with better performance across most cognitive domains. The reasons for this higher performance was a matter of contention: some studies cited a stronger baseline in education leading to a slower rate of decline later (cognitive buffer), while others proposed that it was the continued use of that education in daily work as opposed to the mere acquisition of it that led to stronger mental performance. The summation of the review was as follows: although there appears to be some link between education level and cognitive decline, there was not enough research to provide evidence for a statistically significant deviation between higher ($x \geq$ 9 years) and lower ($x \leq 8$ years) levels of education in cognitive decline. Additionally, due to the increased level of education in industrialized countries like the United States, the population may already be operating at maximum cognitive reserve, limiting the ability of researchers to isolate the rate of change between cognitive decline and education level.

Moving from the direct to indirect consequences, Clemmit (2008) examined methodologies of preventing memory loss and thereby retaining learning capacity in old age. Specifically, Clemmit focused on addressing concerns expressed by the baby boomer generation over age-related cognitive decline. Although a great deal of the surveyed research is geared

toward or about Alzheimer's disease, its implications are relevant in all facets of memory research. Much of our basic understanding and major breakthroughs in the science of memory have been born out of research on neurodegenerative diseases like AD. Coupled with a discussion of the known biological processes of diseased memory, Clemmit also provided an overview of normal age related cognitive changes as well as discussed some useful techniques for delaying the onset of forgetfulness. He noted that although many people worry about their memory in later age, it's largely the ability to recall recent episodic events that is impacted in our advanced years. Chiefly valuable for my research is the discussion of the ethics and viability of different techniques, pharmaceuticals, and technologies to enhance memory retention and eliminate age-related difficulties.

Wingfield and Kahana (2002) also sought to address some of the baby boomer's concerns by carrying out experimental research in an attempt to quantify the differences noticed across age group in memory retrieval. Memory retrieval refers to the specific act of recall: between categories, within categories, and within or outside of structured order. Tests were conducted with two groups of 15 matched in terms of vocabulary and education, in which half the participants were adults in their 20s and the other half were adults in their 60s and 70s. The participants were tested on their ability to recall a list of twenty five words within five categories (animals, gemstones, etc) distributed in random order. As was expected, older adults took longer to recall all of the words. In an effort to avoid the confounding variable of learning degree between participants, the researchers examined the interresponse times (i.e., time between each response) to study the growth rates in between (animal -> gemstone) and within (animal -> animal) categories. Across all age groups, 'within category' responses were rapid in retrieval by comparison to 'between' category responses and no significant latency was observed between the older and younger participants. However, the older participants showed a significant reduction in

response time when transitioning between categories. This result was noteworthy because it supported the theory that the older brain has a harder time forming new episodic memories--as in the case of remembering the different categories presented to them--while the semantic memory remains relatively intact through the years.

Since the proposed research aims not just to examine adult education but to also survey its implementation, evaluation methods for said programs must also be considered. What are the program's intended goals, is it reaching those goals, are the goals feasible and sustainable, is the program operating with greater benefit than cost—etc. Li-Hui Lin's research (2015) was devised for doing just that: establishing evaluation domains for the social outcomes of learning (SOL) in the older adult population of Taiwan. While Taiwan may be some distance and has, of course, significant cultural deviations from North America, the concerns surrounding an aging population are an international dilemma, and thus the proposed evaluation systems can easily be translated to different countries. In order to determine what domains, subdivisions, and indicators should be addressed during SOL evaluation, the researcher assembled a focus group and utilized the Delphi technique with three rounds of questionnaires (in which each successive questionnaire was modified based on previous round results). The results included three domains under health

(knowledge, attitude towards, and behavior), and four dimensions of civic and social engagement (individual, family, communal, and society) that 80% or more of the assembled experts rated as important indicators. Interestingly, none of the indicators within the social and civic dimensions exceeded a rating of 80%, while several of the subdivisions of health behaviors exceeded it by as much as 8%. The potential reasons for this difference may lie in the current state of curriculum design and, according to the researcher, point toward a burgeoning need for older adult educators to incorporate more civic and society-based outcome objectives in future curricula.

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Finally, du Plessis et al (2011) provided both a literature review of adult education research and a facilitator's guide for future implementation. Specifically, du Plessis and colleagues examined research done in which the researchers compensated or tried to adapt for normal age-related decline factors in their educational programs. The factors included both cognitive and physical age-related deficits such as vision loss and change, hearing loss and change, inhibitory deficits in attention spans, and cognitive processing speed. The current theoretical landscape of adult education was also examined wherein some theories of aging garnered support (scaffolding theory of cognition, for example), and other longstanding paradigms were countered by new evidence (such as the correlation between sensory changes and cognitive decline). The facilitator aspect of the research offered suggestions for designing coursework for older populations, some of which seemed obvious (such as offering adaptable text-size), while others were less immediately clear but apt nonetheless for instructional designers to consider.

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