Journal of Education and Social Development, 2019, 3–1
July. 2019, pages 9-14
doi: 10.5281/zenodo.3264015
http://ibii-us.org/Journals/JESD
ISBN 2572-9829 (Online), 2572-9810 (Print)

The Experience of Training Pilots Over the Age of 40 Transitioning to Technologically Advanced Aircraft: A Grounded Theory

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Received on 05/22/2019; revised on 06/15/2019; published on 06/30/2019

Abstract

Older adults face many challenges in the workplace, one being the advancement of technologies both in hardware and software development. The purpose of the study was to understand the learned experiences of older adults integrating advanced technologies into their critical decision-making work experience because of training. Literature claimed a degradation of cognate abilities as a person ages. However, literature also showed that older adults can learn like their younger counterparts. The answer then for older adults and their ability to learn advanced and changing technologies must lie deeper than just the loss of cognitive abilities as one ages. The research question for the study was, "What is the experience of older pilots in training who are transitioning to technically advanced aircraft?" The study employed grounded theory using seven participants answering guided interview questions. The population was pilots who fly for a volunteer organization within the state of New York. Out of a population of 52 pilots, seven participated whose ages were between 40-80 years and went through transition training from basic aircraft cockpits to computerized G1000 models. Data analysis began with guided interview questions along with coding and memoing. The first stage of analysis was the initial coding process, then focus coding, axial coding, and finally theoretical coding. Theoretical coding generated a theory, which pointed to self-efficacy. Self-efficacy along with self-regulated personal learning were motivators for the optimum outcome of reaching goals regardless of age.

Keywords: Andragogy; Computer simulator/simulation; Older adults; Pedagogy; Technically advanced aircraft (TAA)

1 Introduction

The development of advanced cognitive processes is needed if older Americans are to be successful in the rapidly evolving technological era. Each year, the U.S. Authority of Labor Statistics reviews the age structure of the country's workforce (Bureau of Labor Statistics, 2008). The organization cannot discharge information distinguishing singular businesses or work environments but reports data on the age structure of the workforce by industry and occupation (Bureau of Labor Statistics, 2008). Largely, a 101% increase in older Americans exist in the work force (Bureau of Labor Statistics, 2008). About 5% were no less than 65 years of age, which included approximately one-fifth of skilled specialists no less than 55 years of age (Bureau of Labor Statistics, 2008). The purpose of the current study was to understand experiences of older Americans, specifically pilots transitioning to digital from analog technologies. The research question was, “What is the experience of older pilots in training who are transitioning to technically advanced aircraft (TAA)?” The researcher investigated the experiences of older adults who had graduated from a G1000 training program concerning two types of aircraft. The issues inherent in the research study were the increasing need to transition an older work force to a more advanced educational learning environment.

Since the United States has turned into a data responsive society, the evolution is a typical aspect in all working environments. More occupations use data and advanced software applications, which, in turn, present greater opportunities for more Americans. A review by the Department of Commerce and the National Telecommunications Information Agency demonstrated that more than 57% of the U.S. workforce utilized personal computers (PCs; Department of Commerce, 2016). The statistic included 80% use for administrative positions, 70% use for specialized occupations, and 20% use in assembly work (Bureau of Labor Statistics, 2008). The maturing workforce of data specialists incorporates more than 54 million laborers 40 years old or older or almost 33% of the entire U.S. workforce (Bureau of Labor Statistics, 2008). Unless businesses and industries are proactive, they will miss the chance to employ this significant base of maturing laborers, bringing about a decay of working environment profitability and a negative effect on U.S. businesses and the country's general monetary development (Bureau of Labor Statistics, 2008).

Reflecting on the statistics, evidence abounds on how the United States, as well as the world, is moving to an all-digital society. Computers and advanced software run almost every aspect of our lives, from watches to cars and even homes. Young adults growing up in today’s environment are much more technologically savvy than their predecessors born just a

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generation before. Understanding the causal factors of helping older workers keep pace or advance in the technology era is paramount. The current study focused on an area of change in aviation were the digital environment is becoming commonplace even in small general aviation aircraft.

2 Methods

The researcher used grounded theory for the study. The grounded theory research approach attempts to develop theories of understanding based on data from the real-world (Charmaz, 2006). In this context, theory means to make a statement or a model based on evidence (Strauss & Corbin, 1990, 1998). The outstanding feature of grounded theory is that the researcher uses data to develop a theory (Charmaz, 2006). The emergent theory originates from data analysis (Heath & Cowley, 2004).

3 Literature Review

The literature review of pilots transitioning to TAA revealed difficulty for pilots to achieve the goal of moving from manual performed tasks to automated tasks in advanced aircraft (Broady, Chan, & Caputi, 2010; Hamblin, Gilmore, & Chaparro, 2006; Harada, Mori, & Taniue, 2010; Homko, 2011). The goal of training pilots to fly TAA is to aid the formation of proper habit patterns to mitigate human error (Homko, 2011). Older adults, 40-80 years of age, experience difficulty with today's training methods. Older pilots acquired habits from previous training that are inadequate to learn and transfer to the new computer technology found on today's modern aircraft (Broady et al., 2010; Hamblin et al., 2006). However, research showed that the capacity and craving to learn in regards to older individuals are fundamentally quite the same as younger adults when educators change the learning environment to address a slower learning rate and requirements for encouraging feedback (Broady et al., 2010). Difficulties of subjective learning because of age can be successfully neutralized by design and integration of positive encounters (Broady et al., 2010). Broady et al. (2010) as well as Homko (2011) expressed that educators can enhance older adults' disposition toward technology.

Homko (2011) found that older pilots transitioning to TAA need more time to learn required TAA tasks. Older adults are slower to accomplish tasks possibly due to cognitive memory loss (Broady et al., 2010). The scaffolding method allows more time for older adults to absorb information required to pilot TAA thus making the experience less intimidating. Broady et al. (2010) supported scaffolding and determined that educators could counteract loss of cognitive skills due to age by allowing older students greater time for processing and making the experience more likely to produce successful outcomes. "This may suggest that a weekend course in TAA not be an advisable option for an older student. Older students should allow themselves sufficient time to become thoroughly familiar with all aspects of the operation of TAA" (Homko, 2011, p. 18).

What future educators and instructors can take from the literature is an understanding that older adults can be taught to utilize innovation similar to younger adults if developers design training to support older adults. Homko (2011) recommended that design guidelines are vital in outlining technology-based and innovative instruction for more established learners. To start with, instructors must allot adequate time for established individuals to develop new abilities. Secondly, the instructor should interact with the learner positively and consider that achievement is the normal result. While instructors should consider these two focuses for all learners, they especially relate to older adult learners (Homko, 2011).

Studies about age and learning demonstrated that even though some subjective debasement occurs with age, older individuals' capacity and longing to learn were not different from young individuals when instructors changed the learning environment to address slower learning rates and requirements for encouraging feedback (Broady et al., 2010). Broady et al. (2010) demonstrated that proper preparing and positive encounters could viably balance difficulties of learning related to age. A pilot with various years of flying possessing a solid foundation in aeronautics, through guided constructivist-based feedback given by the facilitator to the transitioning pilot, could achieve beneficial outcomes in their learning and adaption to the new flying stages (Loyens, Magda, & Rikers, 2008). Learning requires controlled direction and guidance with positive feedback (H. D. Brown, 1987; Loyens et al., 2008). Homko (2011) found that more established individuals could be taught to utilize innovation similarly as more youthful individuals are taught. Instructors must permit abundant time for more established individuals to learn new abilities (Homko, 2011). Instructors must treat all individual learning employing innovation in a positive way to elicit feelings of progressing achieving normal results, especially related to experienced, more adult learners.

Constructivist learning theory proposes that instruction must take students' experiences and knowledge into account while providing opportunities for students to construct new understanding from the current environment (Bednar et al., 1995). Building or scaffolding can enhance and reinforce previous learning. Learning is a procedure of one piece expanding on another (Bednar et al., 1995). Scaffolding takes the learner from the known to the what needs to be known (Bednar et al., 1995; Vygotsky, 1978). Scaffolding supports the learned behavior or change in the learner by offering clarification and drawing in the learner, confirming that the learner comprehends the displayed data. In response to the two recommendations that Homko (2011) made, constructivism guided by a positive method for scaffolding under a legitimately prepared facilitator utilizing reenactment or simulation, would fulfill this need.

In constructivism, the learner and facilitator arrange and analyze the learner's needs and goals they appropriately planned. Utilizing scaffolding together with the constructivist design, the facilitator can build the best possible methods to achieve the development of HOTS needed for maturing pilots. Simulation takes real-time performance and experiential learning into a safe environment. Research demonstrated that seasoned pilots can more effortlessly move to an altogether different and productive growth in understanding and learning necessary to progress through flight stages more effectively.

4 Discussion of the Results

The purpose of the study was to investigate older pilots' ability to transition to TAA from standard cockpit style gauge setups to computer screens and software. The significance of the study was that it focused on how older adults learned and adjusted to technology in workplace settings with the purpose of developing a theory that described or explained the process of the transition from their learned experiences to actual performance in the work (cockpit of the aircraft) setting.

The researcher's goal was to interpret and understand the participant's perspective of the transitioning process as well as what the participant learned in one context to the application of that learning to a new context and situation. The researcher's interpretation was accomplished in a reflexive manner cognizant of researcher bias, assumptions, and experiences (Charmaz, 2006). The researcher's interpretation was also grounded in the knowledge that educational, behavioral, and social psychologists involved in the scientific study of the mental functions of humans and their behavior were interested how humans learn and how they transfer knowledge to new situations (Charmaz, 2006).

The basis of the study reflected the voices of the participants; the analysis of the raw data from the interviews was critical for

the theory to emerge. The researcher identified the resulting codes from each stage. As the data was analyzed across participant interviews, themes became apparent. Commonalities in the participants' experiences emerged as did differences in their experiences, but both fit into broader themes related to individual experiences. The 14 parent codes evolved into six broader categories or themes including

1. Zond of proximal development
2. Attribution theory
3. Comfort level with technology
4. Learning concepts
5. Training
6. Bandura's theory of self-confidence and efficacy

As the researcher analyzed the codes against the data, codes, and categories five central themes emerged.

1. Zone of proximal development
2. Attribution theory
3. Bandura's self-confidence and efficacy
4. Training

The final level of the coding process centered on comparing the four themes to existing codes and categories. Three overarching themes emerged from the process.

1. Zone of proximal development
2. Attribution theory
3. Bandura's self-confidence and efficacy

Each level of analysis after the initial coding process revealed broader and stronger categories, and as these links between codes and categories gained relevance, themes began to emerge. The process of reevaluating and repeated analysis resulted in the evolution of 14 parent codes and 34 child codes to three final overarching themes leading to the emergent theory to address the research question--the theory of the importance of self-efficacy of learning for older adults in an advanced technological training program.

The research question investigated the ability of older pilots transferring to more advanced cockpits with computerized technology, looking specifically at training and perceptions of their ability to make the transfer safely and effectively. The main issue was whether older adult's perceptions of their ability to acquire new and more advanced knowledge of new and improved technology in the working environment depended on the training design itself and the performance of the instructors or was it more the individual and their own personal perceptions of either the technology or themselves. The researcher was interested in the process of older adult's ability to learn new technologies because of his recently lived experiences both in the classroom and in the aircraft.

The NTSB pointed out that new avionics platforms should, in theory, provide a safer mode of situational awareness, yet it has proven especially among older pilots to be just the opposite (Broach et al., 2003). Authentic voices provided data needed to answer the research question. Narratives of participants provided data for a theory about what older adult education programs need to convey to instructors to teach older students. Improved teaching would enable older pilots to transition safely and expeditiously to higher levels of technological innovations becoming highly qualified, competent employees who not only can do the job but want to remain in their chosen career.

5 Interpretation of the Findings

Educational psychologists look for ways of persuading older students to start and succeed in their activities and goals. Instructors may have to develop specific tasks and formulate outlines such as reading or studying a problem and working through to a clear end. Instructors need to be shown how to help older students succeed in today's environment. Instructors should develop and tap into the area of self-efficacy for older students to act for themselves as well as for them to assume a personal commitment to see the task through.

Bandura (1994) pointed to four sources in developing a person's belief in themselves. The four areas for self-efficacy are modeling, mastery of the experiences, persuasion, and physiological arousal (Bandura, 1994). Self-efficacy is the best model for education because it affects an older person's personal actions by considering what their goals are, their own efforts, and ultimately developing their own strategy for success. An older student is a person of varied experiences unlike his or her younger counterpart. Older students gain experiences over time from life lessons and exposure to literature, news events, art, and sports. All familiarities can be tapped into and brought forward to help the older student perform and succeed. (Redmon, 2010).

The resulting data from the study provided opportunities for decision makers to reflect on what the transition from one technology to another will mean for an older workforce. The goal was to "promote continuous development of human competencies" (Säljö, 2003, p. 311). The research supported professional educators and practitioners, such as instructors and facilitators looking for ways to improve the practice of developing learning structures within work environments especially for the older student (Tuomi-Gröhn & Engeström, 2003).

5.1 Previous Literature

Studies looked at previously in the literature review showed that although some cognitive loss of learning happens with age, the capacity and desire for learning involving older individuals are not altogether different than younger individuals (Broady et al., 2010; Harada et al., 2010). However, the learning environment is different and must address the older student's or learner's rate of learning and retention (Broady et al., 2010). Most importantly, the environment must encourage feedback from the instructors (Broady et al., 2010).

A pilot or any older person with previous experience in their field through guided constructivist based feedback given by the facilitator can have a beneficial outcome in their ability to learn and adapt to new technology being introduced (Loyens et al., 2008). However, along with constructivist learning one needs to build or scaffold on previous learned experiences to form new lessons, which enhance and reinforce the learning process (Bednar et al., 1995). Scaffolding takes the learner from what *is known* to what *needs to be known*. Scaffolding is intended to support the learned behavior or change the learner by offering clarifications and drawing in the learner and confirming that the learner comprehends the displayed data.

However, instructor's efforts may be in vain if the older learner does not continue to pursue and persevere through their own desire to achieve success in their endeavors. Judge and Bono (2001) demonstrated that one of the four traits that correlated highest (.45 true score) by their subjects for job satisfaction and job performance was self-efficacy. If one has a high degree of self-efficacy, it will serve the older adult in a positive function and goal achievement (Bandura & Locke, 2003). Self-efficacy

and work related performance is considered to have a direct impact on one's ability to succeed (Stajkovic & Luthans, 1998). However, self-efficacy alone is not enough. If directions and guidance on accomplishing a task or learning a new technology is not mapped out, self-efficacy alone is insufficient; one needs to know what is expected of them. In learning technologically complex tasks, one must provide an appropriate means to accomplish the task (Stajkovic & Luthans, 1998). Managers or those responsible for the learner's progress in new technology should provide appropriate paths to learn and build self-efficacy (Stajkovic & Luthans, 1998). As the current study demonstrated in the literature review, utilizing scaffolding together with the constructivist design, facilitators can build the best possible method to achieve the development of HOTS needed for older adult learners to enhance the learner's own self-efficacy.

5.2 Implications for Practice

A need exists to change instructional training programs in avionics so older students do not become overwhelmed with the content. Instructors should provide older pilots the time and resources to discuss the material in a collaborative setting with classmates, mentors, advisors, and instructors to gain self-reliance beyond the classroom. The voices of the seven pilots have practical implications to shape the design of future educational programs optimizing the personal abilities of each student.

Participant pilots desired to give voice to the transitioning process and foster a safer and better move to TAA. While the study provided new insights into the process of aging adult learning, it only offered a sample of the rich data sources available. Additional research can be conducted on understanding and dealing with cognitive change, especially with programs that provide older adult learners with optimum opportunities to practice procedural knowledge. Perhaps through simulation pilots can accomplished this to a high degree of efficiency and be developmentally productive. The following are self-efficacy and self-regulated principles to guide instructors in helping the older student be successful in learning and applying new skills, especially in a technological environment.

Modeling

- Peers should work together on a task and can work among themselves.
- Encourage peers to work together.
- Groups should be developed so they are composed of novice students not more experienced so then the instruction is aimed at them and the experienced students need not be subjected to the same information over again.

Mastery Experiences

- Create routines insuring each training session follows a set order. Students need some control over their environment and know what to expect.
- Learning needs to be at the appropriate level for the student, which requires that the instructor understand at what level his/her students are performing.
- Situations need to be constructed so that students can put into practice what they learn.
- Instructors should provide support and encouragement to their students.
- Help students set goals that are reasonable and within their abilities; however, goals that need them to step out of their protective space will help both their cognitive and metacognitive skills.
- Help them self-regulate, an important attribute that they need to develop. Having students focus on the task and applying strategies such as managing their time and memory skills will teach them how to successfully reach their goals.

Verbal Persuasion

- Give positive feedback.

Physiological Arousal

- Instruction needs to be clear, if not, do not expect results or growth from the student.
- Check to make sure the student understands what you are conveying to them not what they think you mean but what is.
- To avoid misconceptions, give good examples and models.

Teach Self-Regulation Strategies

- Give students task that allow them to see that effort pays off and practice makes the learning process easier by way of mental modeling.
- There is a certain amount of effort required by the student. The more difficult the task, the more effort required. The student needs to understand this and not be discouraged by it.
- Help the student see the benefits of success in a task or exercise.
- Make sure strategy execution during practice is easy. (Bandura, 1997b)
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6 Conclusion

The research question was, "What is the experience of older pilots in training who are transitioning to technically advanced aircraft?" The theory that evolved was self-efficacy based on the categories that emerged and were grounded in the data. The emergent theory was grounded in the individual participant's comments regarding the main reason they perceived that the training helped them transition from standard cockpit instrument gauges to the new TAA cockpits based on computer screens and software. The strongest common theme that emerged from the data was identified as a person's own self-efficacy and self-regulation in pursuing his development to become competent in the system, which proved important in the individual's success in completing the program and fully transitioning from their former standing to their new position in the organization.

The three final selective codes reveal significant moments in the lived experiences of the participants and created a comprehensive representation of the essence of the study. The relationship between the three themes, (a) zone of proximal development, (b) attribution theory, and (c) Bandura's self-efficacy, was the heart of participants' perceptions of their ability to acquire the knowledge from the training programs to their successful application of that knowledge in the cockpit of the aircraft.

The three final selective codes validated the resulting emergent theory and related directly to the research question. The three themes produced the emergent theory of efficacy as the

overarching point of whether the old pilot would succeed or not. Self-efficacy and corresponding self-regulation of training proved to be the pivotal point in training and maintaining their positions in the organization. Older pilots' sense of self-efficacy was directly related to the research question. The answer ultimately pointed to older pilot's own experience and comfort with technology and not in the training received in and of itself.

As a researcher, I wanted to know what older students with preconceived ideas of flying experienced when their aeronautical world was advancing around them. The value of the study was that it offered authentic perspectives of insight into the mind of the older adult student and operator of high-pressure technology in a fast-paced environment. The research showed areas for improvement to be considered in the future for the safety of themselves and all others involved. P2 summed up the reality, "Well, we know that we, in . . . aviation as in anything else, we do not go backwards . . . the past is the past. We have to move forwards; we have to adjust to the . . . new environment."

References

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Clinical and Social Psychology, 4*(3), 359-373. doi:10.1521/jscp.1986.4.3.359

Bandura, A. (1994). Self-efficacy. In R. J. Corsini (Ed.), *Encyclopedia of psychology* (2nd ed., Vol. 3, pp. 368-369). New York, NY: Wiley.

Bandura, A. (1997a). Personal efficacy in psychobiologic functioning. In G. V. Caprara (Ed.), *Bandura: A leader in psychology* (pp. 43-66). Milan, Italy: Franco Angeli.

Bandura, A. (1997b). *Self-efficacy: The exercise of control.* New York, NY: W. H. Freeman and Company.

Bandura, A., & Locke, E. A. (2003). Negative self-efficacy and goal effects revisited. *Journal of Applied Psychology, 88*(1), 87-99. doi:10.1037/0021-9010.88.1.87

Bednar, A., Cunningham, D. J., Duffy, T., & Perry, D. (1995). Theory in practice: How do we link? In G. Anglin (Ed.), *Instructional technology: Past, present, and future* (2nd ed., pp. 100–112). Englewood, CO: Libraries Unlimited.

Broach, D., Joseph, K. M., & Schroeder, D. J. (2003). *Pilot age and accident rates report 4: An analysis of professional ATP and commercial pilot accident rate by age.* Oklahoma City, OK: Civil Aeromedical Institute.

Broady, T., Chan, A., & Caputi, P. (2010). Comparison of older and younger adults' attitudes towards and abilities with computers: Implications for training and learning. *British Journal of Educational Technology, 41*(3), 473-485. doi:10.1111/j.1467-8535.2008.00914.x

Brown, H. D. (1987). *Principles of language, learning, and teaching.* Englewood Cliffs, NJ: Prentice Hall.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Bureau of Labor Statistics. (2008). *Older workers: Are there more older people in the workplace?* Retrieved from http://www.bls.gov/spotlight/2008/older_workers/

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis.* London, England: Sage.

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Thousand Oaks, CA: Sage.

Department of Commerce. (2016, October 11). *Partnership for progress on the digital divide.* Retrieved from https://www.ntia.doc.gov/files/ntia/publications/ppdd-nbracomments.pdf

Federal Aviation Administration. (2004). *Industry training standards. FITS curriculum recognition criteria*. Retrieved from https://www.faa.gov/c/content/dam/faa/
airmen/training-testing/documents/inspector.pdf

Glaser, B. G. (1978). Theoretical sensitivity: Advances in the methodology of g rounded theory. Mill Valley, CA: Sage.

Glaser, B. G. (2007). *The grounded theory review: An international journal, 6(3).* Mill Valley, CA: Sociology Press

Hamblin, C. J., Gilmore, C., & Chaparro, A. (2006). *Learning to fly glass cockpits requires a new cognitive model.* Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting, 1977-1981.

Harada, E., Mori, K., & Taniue, N. (2010). Cognitive aging and the usability of IT based equipment: Learning is the key. *Japanese Psychological Research, 52*(3), 227-243. Doi:10.1111/j.1468-5884.2010.00440.x

Heath, H., & Cowley, S. (2004). Developing a grounded theory approach: a comparison of Glaser and Strauss. *International Journal of Nursing Studies, 41*(2) 141–150. doi:10.1016/S0020-7489(03)00113-5

Holton, J. A. (2007). *Rehumanising knowledge work through fluctuating support networks: A grounded theory. In B. G. Glaser, & J. Horton (Eds.). The grounded theory seminar reader.* Mill Valley, CA: Sociology Press.

Holton, J. A. (2008). Grounded theory as a general research methodology. *Grounded Theory Review: An International Journal, 2*(7), 67-93.

Homko, C. J. (2011). *The effects of age and recency of experience on the completion of complex tasks in a technologically advanced aircraft*. (Master's thesis). Available at ProQuest Dissertations and Theses database. (UMI No. 1501836)

Judge, T. A., & Bono, J. E. (2001). Relationship of core self-evaluations traits—self-esteem, generalized self-efficacy, locus of control, and emotional stability—with job satisfaction and job performance. *Journal of Applied Psychology, 86*(1), 80-92.

Lave, J. (1988). *Cognition in practice: Mind, mathematics and culture in everyday life*. New York, NY: Cambridge University Press.

Loyens, S. M. M., Magda, J., & Rikers, M. J. P. (2008). Self-directed learning in problem-based learning and its relationships with self-regulated learning. *Educational Psychology Review, 20*(4), 411-427. doi:10.1007/s10648-008-9082-7

Patton, M. Q. (2001). *Qualitative research and evaluation methods* (3rd ed.). Newbury Park, CA: Sage.

Redmond, B. F. (2010). Self-efficacy theory: Do I think that I can succeed in my work? *Work Attitudes and Motivation*. Retrieved from https://wikispaces.psu.edu/display/
PSYCH484/7.+Self-Efficacy+and+Social+Cognitive+Theories

Säljö, R. (2003). Representational tools and the transformation of learning. In B. Wasson, U. Hoppe, & S. Ludvigsen (Eds.), *Designing for change in networked learning environments*. Dordrecht, The Netherlands: Kluwer Academic Publishers.

Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A meta-analysis. *Psychological Bulletin, 124*(2), 240-261. doi:10.1037/0033-2909.124.2.240

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park, CA: Sage.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and theory for developing grounded theory* (2nd ed.). Newbury Park, CA: Sage.

Technically Advanced Aircraft (TAA). (2003). *How do you define a technically advanced aircraft?* http://www.sunlakesaeroclub.org/updates_web_data/060212/Question.htm

Tuomi-Gröhn, T., & Engeström, Y., (2003). Conceptualizing transfer: From standard notions to developmental perspectives. In T. Tuomi-Gröhn & Y. Engeström, (Eds.), *Between school and work: New perspectives on transfer and boundary-crossing* (pp. 19–38). New York, NY: Pergamon.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1979). Consciousness as a problem in the psychology of behavior. *Soviet Psychology, 17*(4), 3-35.

Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Child Psychiatry, 17*(2), 89-100. doi:10.1111/j.1469-7610.1976.tb00381.x