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Forum

Adaptation for Growth Via Learning New Skills as a Means to Long-Term Functional Independence in Older Adulthood: Insights From Emerging Adulthood

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Abstract

Maintenance of functional independence, or the ability to perform daily tasks independently, is a hallmark of successful aging. Healthy older adults are considered functionally independent if they pass a short survey consisting of relatively simple daily activities, including grocery shopping and managing finances. We argue that aging research often has overlooked an important factor for long-term functional independence in a dynamic environment: adaptation for growth via learning new skills. Previous research has focused primarily on compensation and mitigating decline rather than growth. Given that adaptation for growth is at the core of intelligence, resilience, and neuroplasticity, we suggest that functional independence research with older adults could integrate adaptation for growth into the construct, following research on adolescent autonomy and emerging adulthood. After briefly reviewing research on functional independence and compensation in older adulthood, we offer suggestions to push forward gerontological research linking adaptation for growth and functional independence.

Keywords: Functional independence, Lifespan development, Successful aging, Emerging adulthood

Brief Overview of Functional Independence in Older Adulthood

Long-term functional independence, an individual's ability to successfully perform daily tasks with little to no assistance, is a core feature of successful aging (Rowe & Kahn, 1997). Older adults who maintain their independence are able to control when, where, and how they perform daily activities. However, many older adults experience declines in functional independence and cognitive abilities underlying daily activities (e.g., Dodge, Du, Saxton, & Ganguli, 2006; Han, Gill, Jones, & Allore, 2016; Park & Reuter-Lorenz, 2009). As the ability to prolong life increases due to medical advances, so does the susceptibility to functional decline, leading to an increased need for assisted living in later years.

Functional independence in healthy older adults is often measured by the activities of daily living (ADL) and instrumental activities of daily living (IADL) questionnaires (Lawton & Brody, 1970). The ADL questionnaire consists of six abilities for basic physical self-maintenance: Toileting, feeding, dressing, grooming, walking/sitting, and bathing. The IADL questionnaire consists of items regarding more complex, but still relatively simple, abilities in eight areas: use of the phone, shopping, cooking, housekeeping, laundry, use of transportation, use of medication, and financial management. The tasks are scored in a binary

fashion: an individual is given a score of 0 or 1 in each ability depending on whether he/she can perform the task and how much assistance is needed. Being able to perform all of the tasks listed in the questionnaire signifies that the older adult is functionally independent. These criteria for functional independence in older adults were inspired by research on functional independence in individuals with disabilities or cognitive impairment (Hamilton, Laughlin, Fiedler, & Granger, 1994; Heinemann, Michael Linacre, Wright, Hamilton, & Granger, 1994; Lawton & Brody, 1970). ADL and IADL questionnaires have been extremely useful measures to gauge basic levels of functioning and decline in older adults. Recent work has investigated ways of improving accuracy of these measures to accommodate individual circumstances and the preclinical range (e.g., Fieo, Austin, Starr, & Deary, 2011; Gill, 2010, 2017).

There are at least three issues with the functional independence construct in older adulthood and corresponding measures. First, there is an emphasis on monitoring changes within the older adult, perhaps due to an assumption that the environment is relatively static, rather than dynamic. However, older adults can transition into and out of states of functional dependence due to environmental changes, in addition to individual differences in circumstances that lead to difficulty and dependence (Gill, 2010, 2017). For example, if a grandmother moves to a new country to live with her adult children and she cannot speak the language or navigate streets or buses in a new country, she can transition suddenly from being functionally independent to dependent in terms of IADLs. This grandmother may experience temporary dependence, but then transition to less dependence or even independence as she learns new skills and adapts to her new surroundings. Fluidity and mechanisms of fluidity from independence to dependence (and perhaps back to independence), especially due to environmental changes, are not as well characterized by ADL and IADL questionnaires.

Second, research on maintaining functional independence generally focuses on compensation rather than growth. Therefore, very little is known about how to maintain functional independence in a dynamic environment in currently independent older adults. One of the earlier efforts informing the development of the IADL questionnaire with older adults discusses the importance of adaptation, in terms of returning to a previous baseline by coping with issues using limited and/or declining resources (Phillips, 1968). Mirroring these efforts is prior research and aging theories focusing on how older adults can adapt to compensate for losses (e.g., Baltes, 1997, such as choosing not to complete certain activities that they believe will not be successful) and how the environment can be adapted to fit the needs of older adults to support their functional independence (e.g., installing grab bars to facilitate showering; Golant, 2003; Miskelly, 2001; Mynatt, Essa, & Rogers, 2000). However, both of these approaches would lead the grandmother in the above example to settle into a new baseline where she is dependent on compensatory elements. Moreover, these approaches do not inform the prevention of decline in functional independence.

Third, to determine decline or growth, baseline levels are typically characterized by an earlier and static time point, such as in the behavioral intervention literature (e.g., standard ABAB designs). However, characterizing baseline levels with a dynamic, developmental model including co-occurring and evolving behaviors is more ecologically valid (see Kellam et al., 1991), and may encourage more research on growth rather than compensation. Given that cognitive decline is more apparent in novel versus familiar environments, the ability to increase from a current baseline (rather than return to a previous baseline via compensation) could be an important indicator of future functional independence. Indeed, the ability to adapt in terms of increasing from a current baseline is at the core of intelligence (Sternberg, 1997) and resilience (Masten, 1994), as well as neuroplasticity (e.g., Lövdén, Bäckman, Lindenberger, Schaefer, & Schmiedek, 2010).

The Importance of Adaptation for Growth on Functional Independence

Research on adaptation for growth can address these three issues related to maintaining functional independence in a dynamic environment. Compared to the amount of research on compensation, less research has focused on how older adults can increase from their current baseline to thrive in a new environment. In the example with the grandmother, she could learn a few words in a new language, learn to use ride sharing apps, and attend local events at community centers to make local friends. Adaptation for growth, involving engagement in new activities as the environment changes, is distinct from the popular notion of "staying active," which implies maintaining activities in a static environment. Moreover, learning in the latter approach is a casual activity to "stay sharp," whereas learning in the former approach is for independent survival.

The ability to perform daily tasks for functional independence depends on previously learned information and cognitive abilities, such as working memory (remembering and using information for a short duration) and cognitive control (switching between tasks; Marsiske & Willis, 1995; Thornton & Dumke, 2005). In addition, older adults have to adapt to many changes within themselves (e.g., biological, social, or cognitive changes) and in the environment (e.g., technological advances; Charness & Boot, 2009; Golant, 2003). In particular, adapting to changes within the environment, especially related to technological advances, has become more of a necessity as the changes become more prevalent, compared to just a few decades ago (Charness & Boot, 2009). Older adults also are now in the workforce longer, and are more frequently seeking "encore" careers after retirement (Quinn, 2010). Many of these changes can be disruptive, especially sudden environmental changes,

such as relocating and the exposure to advanced technological devices with little previous experience. When prior knowledge is irrelevant or obsolete, the learner has to acquire new information to be able to continue functioning independently, such as learning a new language and cultural customs in the example with the grandmother. Therefore, maintenance of functional independence may be an outcome of learning for adaptation. If the learner does not adapt to these changes, especially over several years or even decades, then functional and cognitive decline become increasingly apparent. Knowing how to learn and adapt to a variety of tasks in diverse situations allows learners to be more prepared at handling any changes that may emerge over time.

To be clear, the type of adaptation that we are focusing on in this paper refers to healthy strategies leading to growth, rather than maladaptive coping, such as avoiding new learning situations (e.g., new community center classes), to avoid uncertainty and making mistakes. Such maladaptive strategies may be useful in lowering stress levels, but would not be adaptive for long-term functional independence in a dynamic environment. We recognize that there is an important tradeoff between adaptation and preservation. For example, to avoid getting into a car accident, an older adult may avoid driving, and therefore end up staying at home alone more often. To avoid falling, an older adult may choose not to walk around as much, which may lead to decreased muscle tone. Naturally, there are cases when complete adaptation is harmful or not possible. However, sometimes maladaptive strategies emerge due to older subjective age (feeling older than one's actual age), low self-efficacy (perceived ability), low motivation, and a fixed mindset (belief that an ability cannot be developed) (e.g., Dweck, 2006; Kotter-Grühn, Kornadt, & Stephan, 2016), rather than actual physical or cognitive deficits, although these factors can be correlated (e.g., Stephan, Sutin, Luchetti, & Terracciano, 2018), and some, such as subjective age, can even predict future cognitive deficits (see Kotter-Grühn et al., 2016 for a review).

The idea that adaptation for growth is a requirement of functional independence is prevalent in research with younger age groups, particularly with adolescents and younger adults. The criteria used to evaluate functional independence in younger populations are quite different from those used for older adults. For instance, the "coming of age" and "emerging adulthood" literature highlights that the standard for functional independence ("functional autonomy") for these age groups relates to career readiness and career adaptability (e.g., Arnett, 2007), generally having the ability to develop strategies to achieve goals (e.g., Noom, Dekovic, & Meeus, 2001). In terms of career readiness, there is an emphasis on skill-building, which requires setting and achieving learning goals (Darling-Hammond, Wilhoit, & Pittenger, 2014). This literature suggests that younger adults are functionally independent when they are able to hold a steady job and adapt as needed to maintain a job. Many adolescents would pass the IADL, but their parents typically would not label their children as "functionally independent" perhaps until later in younger adulthood. Indeed, parental support seems to be necessary for emerging adults to be functionally independent (e.g., Inguglia, Ingoglia, Liga, Lo Coco, & Lo Cricchio, 2015).

Why are the standards for functional independence so different between younger adults and older adults? Perhaps functional independence is an age-sensitive construct: the criteria for someone to be functionally independent changes with age, corresponding to age-dependent tasks. For example, younger adults have to have a job to survive, whereas retired older adults with a pension or savings may not have this need. In addition, some have suggested that the purpose of younger and older adulthood is different. Prominent life-span theories propose that older adulthood is largely a period of mitigating losses and prioritizing socioemotional goals over cognitive/learning goals (Baltes, 1997; Baltes, Lindenburger, & Staudinger, 2006; Carstensen, 1992; Carstensen & DeLiema, 2018; Labouvie-Vief, 1980; Schaie & Willis, 2000). By contrast, adolescents and younger adults are trained to go beyond just being able to perform basic daily tasks to advance their life to become a productive adult, via, for example, finding fulfilling careers, being responsible caregivers, and becoming financially savvy (Hooley, Marriott, & Sampson, 2011; Schwartz, Cote, & Arnett, 2005). Having a high bar for functional independence (e.g., career readiness) means that younger adults are likely to adapt to personal and environmental changes over the long-term—essentially, achieving long-term functional independence.

Overall, the standard of functional independence in adolescence and younger adulthood (the ability to adapt by learning, especially in terms of developing skills for a career) is a much higher bar compared to functional independence in older adulthood (the ability to perform basic daily tasks). Given the emphasis on adaptation via learning in younger adulthood and the maintenance of functional independence from younger to older adulthood, perhaps integrating adaptation via learning into the functional independence construct would be useful for older adults. To be clear, we are not advocating that all older adults should be subjected to career development training, but rather that the type of adaptation for growth embedded in such training may engender long-term functional independence in healthy older adults.

Extending Theories on Compensation and Coping in Aging

Conceptualizing functional independence as an outcome of learning for adaptation dovetails with and extends theories on compensation, which typically relate to mitigating losses to return to a previous baseline (e.g., Selection,

Optimization, and Compensation Theory; Baltes, 1997; see also Brandtstädter & Greve, 1994; Heckhausen & Schulz, 1995). An influential model (Scaffolding Theory of Aging and Cognition; Park & Reuter-Lorenz, 2009; Reuter-Lorenz & Park, 2014) explains that learning in older adults leads to maintenance and compensation, whereas the ideas in the present manuscript focus on how learning may lead to growth. Although mitigating losses is an important focus, we argue that it is equally important to investigate how older adults can increase from their current baseline, especially among those who do not currently experience cognitive or functional deficits.

Returning to a previous baseline (compensation) and *increasing* from a current baseline (growth) may involve overlapping, yet different processes and strategies, although further research is needed to investigate this possibility. For example, theories focusing on compensation in older adults (e.g., Baltes, 1997; Brandtstädter & Greve, 1994; Heckhausen & Schulz, 1995) suggest that one way of coping with loss is by selecting to perform only some activities to avoid failure and disappointment. For example, in the dual-process model of assimilative and accommodative coping (e.g., Brandtstädter & Greve, 1994, see also Schulz & Heckhausen, 1996), the assimilative process includes changing the environment or situation to fit one's goals (e.g., using compensatory devices), whereas the accommodative process includes changing one's goals and beliefs (e.g., devaluing or avoiding previously attainable goals) to fit a situation.

In models related to growth (see Wu, Rebok, & Lin, 2017), making mistakes is a natural outcome of learning that should be embraced. Therefore, in contrast to the compensatory models of coping, approaches related to growth promote the maintenance of positive beliefs and goals *despite* current challenges (e.g., the notion of "not yet" from research on growth mindset, Dweck, 2006). Moreover, in approaches related to growth, experts (e.g., caregivers, instructors) who temporarily scaffold learning for a particular skill would provide "training wheels" with the intention of removing them when the learner reaches independence on that skill. By contrast, the goal of compensatory approaches is not to remove the training wheels, but rather to have the older adult seem capable due to the training wheels.

Whereas the older adult literature on coping highlights downgrading goals and situations, the infant to young adult literature emphasizes the importance of maintaining or upgrading goals despite setbacks. Although there are instances when goals and situations have to be downgraded in older adulthood, premature disengagement from activities due to surmountable setbacks or negative age stereotypes may be avoided, especially in relation to novel skill learning. Addressing these differences across literatures in future research would provide a deeper understanding of the possibility and underlying mechanism of growth in older adulthood.

Specific Implications From Reconceptualizing Functional Independence

There are at least three implications from reconceptualizing functional independence to include adaptation for growth. These implications simultaneously address three problems with current characterizations of functional independence in the gerontological literature. First, the current conception of what it takes to be a functionally independent older adult underestimates healthy older adults' capabilities and potential. What we are proposing would increase the upper bound to align with experiences of, for example, younger adults seeking their first careers and older adults seeking encore careers.

Second, when there is functional decline, the downward trajectory is relatively rapid, lasting only from a few months to a few years (e.g., Dodge et al., 2006), compared to other types of decline, such as cognitive decline lasting over decades (e.g., Park & Reuter-Lorenz, 2009). Including more than basic or simple functions in the criteria for functional independence may better inform the trajectory of functional decline prior to total dependence to allow for earlier interventions to delay or even prevent the need for assisted living.

Third, interventions aiming to promote functional independence have a very low target, leading to potential ceiling effects and misinformation about the mechanisms of maintaining functional independence (see also Fieo et al., 2011). With the exception of cognitive interventions, research on maximizing functional independence in older adulthood typically includes studies on how the environment can be constructed to allow older adults to "age in place" or compensate for cognitive and functional decline (e.g., Cutchin, 2003; Tang & Venables, 2000). If the gaps in our knowledge of functional independence are addressed, the application of and underlying research on functional independence would benefit.

Suggestions for Future Research

Based on these three implications, there are at least three avenues that future research on adaptation and functional independence in older adulthood can pursue. First, future research could expand the levels of functional independence to include adaptation for growth. The measurement and characterization of a "thriving" older adult (continued growth) could represent the highest level of functional independence, whereas the lowest level of functional independence could include maintenance of ADLs, which would be one step below maintenance of IADLs. One way of approaching this avenue of research is by developing a new questionnaire that includes these ideas to supplement the IADL and ADL questionnaires. This questionnaire would encompass willingness to learn new real-world skills for adaptation and growth. In terms of what constitutes a new real-world skill, we propose that learners naïve to any

particular activity may consider that activity a new skill. However, we propose that future research could focus on skills that take years to master (e.g., acting, Noice & Noice, 2013; language learning, Bak, Long, Vega-Mendoza, & Sorace, 2016) to avoid rapid ceiling effects in learning progress and low frequency of significant learning challenges. This construct likely would be related to self-efficacy (Bandura, 1977; Schunk, 1991), motivation (Wlodkowski & Ginsberg, 2017), and a sense of purpose and confidence in older adults (Carlson, Seeman, & Fried, 2000; Seeman, Unger, McAvay, & de Leon, 1999). This construct also may be related to the more general openness personality trait (McCrae & Costa, 1997) and need for cognition (i.e., enjoyment in activities that require effortful cognition, Cacioppo & Petty, 1982), which could encourage new learning, while avoiding entrenchment in routines (Zisberg et al., 2009). Although we have developed a questionnaire that could potentially be used for such purposes (Leanos, Coons, Rebok, Ozer, & Wu, 2018; Broad Learning Adult Questionnaire [BLAQ]), the new measure still requires rigorous psychometric testing and reliability assessments. One important aspect of this questionnaire is that it includes potential barriers for growth, including personality, motivation, and societal/environmental issues (e.g., friends who perpetuate negative age stereotypes). The measure by Leanos et al. (2018) could be expanded to include other barriers for learning, such as financial resources. This measure on willingness and ability to learn builds on prior retirement readiness research focusing mostly on financial readiness (e.g., Lusardi & Mitchell, 2010; Van Rooji, Lusardi, & Alessie, 2011).

Second, research on successful aging would be able to develop a more nuanced approach to different levels of "success," while raising the bar to the highest possible level of success. The majority of successful aging research has focused on maintenance and compensation (e.g., Depp & Jeste, 2006; Rowe & Kahn, 1997). Popular conceptualizations of successful aging also include learning new things (e.g., Phelan, Anderson, LaCroix, & Larson, 2004), which aligns with some prior research (e.g., Baltes et al., 1990). However, it is unclear in the literature whether the purpose of learning new things goes beyond maintenance and compensation to align with growth. Research on superagers, a subset of "successful agers," includes older adults who have cognitive abilities (especially memory), similar to those of younger adults (e.g., Harrison, Weintraub, Mesulam, & Rogalski, 2012). However, very little of that research has focused on learning for adaptation. Thus far, most studies on superagers have focused on neural mechanisms for cognitive reserve (Rogalski et al., 2013; Wang et al., 2017, although see Cook Maher et al., 2017). Perhaps even the definition of a superager could be expanded to include older adults with superior learning abilities, which overlaps with, but is distinct from, memory abilities.

Third, in terms of intervention research to maintain or even increase functional independence in older adults, we suggest that future research could design an intervention that promotes older adults' ability to learn *what* to learn and *how* to learn. Unlike rehabilitation interventions (e.g., for stroke patients) that specifically seek to attain functional independence, most cognitive interventions with healthy adults have aimed to maintain or increase cognitive abilities (e.g., Hertzog, Kramer, Wilson, & Lindenberger, 2008; Simons et al., 2016). The traditional cognitive training approach hypothesizes that improving cognitive abilities translates directly to functional independence. However, translating improved cognitive abilities to functional independence is still poorly understood. Many cognitive interventions either found no effect on IADLs or did not include a functional independence measure (see Simons et al., 2016; although see Rebok et al., 2014 and Willis et al., 2006 as notable exceptions). Rebok et al. (2014) found effects with self-reported IADLs 10 years after a 6-week cognitive training procedure, but it is not clear why the training had such long-term effects.

Instead of a direct link between improving cognitive abilities and functional independence, an alternative hypothesis is that functional independence in a dynamic environment develops from frequently learning a variety of real-world skills over the long-term, and cognitive abilities and motivation for learning are both outcomes and drivers of skill learning. This alternative hypothesis is more aligned with experiences typical of the first two decades in the life span (see Wu et al., 2017). Results from cognitive interventions thus far typically reveal that training outcomes align with the trained ability—in other words, what is trained is what is improved (e.g., Shipstead, Redick, & Engle, 2012; Simons et al., 2016; Stine-Morrow et al., 2014). Therefore, if a key intervention outcome is long-term, real-world skill learning for functional independence, one could hypothesize that interventions training real-world skills, rather than lab-based tasks, would be more successful at increasing functional independence over the long-term.

Training on how and what to learn could provide older adults not only with the trained skill, but also with the ability to learn how to learn. Once older adults face and overcome learning obstacles, such as knowing how to find an expert to explain difficult learning content, older adults can apply this approach to future learning challenges. Being shown that one can learn a difficult skill (i.e., mastery) could lead to increases in learning self-efficacy, which might encourage an older adult to continue learning new skills, exercising cognitive abilities relevant to the skills, and increasing social network quality and size, such as with new classmates (e.g., Chan, Haber, Drew, & Park, 2016; Park et al., 2014; Stine-Morrow et al., 2008, 2014). For instance, learning how to use technology may boost general self-efficacy with tech devices in older adults and create closer ties to their family and the community (e.g., Delello & McWhorter, 2017; Neves, Franz, Judges, Beermann, & Baecker, 2017). Given that technological advances are becoming more frequent (Charness & Boot, 2009), learners who do not keep up with the changes may become dependent on others, such as when

dealing with companies who only engage in online banking. Because prior skill learning interventions typically do not measure continued learning after the study or functional independence, the role of continued learning on maintaining or increasing functional independence is unclear and mostly speculative at this point.

In addition, given that many healthy older adults do experience cognitive decline, more research is needed to investigate the interactions of compensatory and growth approaches. For example, tailoring learning environments to older adults, such as prioritizing easier, purposeful activities at first may allow for a "foot-in-the-door" approach, whereby a smaller activity precedes a larger one. In general, some aspects of fitting the environment to the learners' needs (Golant, 2003), such as having easily accessible classes and having ergonomic desks and chairs, would free older adults' cognitive, emotional, and physical resources for learning. Once older adults adjust to these new levels of learning, these facilitators could be removed, and the learning content could become more demanding.

Conclusions

Although younger and older adults share the similar goal of maintaining functional independence for as long as possible, these two age groups differ in their approaches. Older adults focus more on sustaining the ability to complete basic daily tasks, whereas younger adults focus more on adaptation for growth in a constantly changing environment. We have argued that both the research and measurements (e.g., IADL questionnaire) of functional independence in older adulthood may be insufficient in pushing forward research investigating ways of maintaining or increasing functional independence over the long-term in healthy, nondemented older adults. Given that adaptation for growth is at the core of intelligence, resilience, and neuroplasticity, we suggest that functional independence research with older adults could integrate adaptation for growth into the construct. By doing so, we would develop a better understanding of the role of learning in successful aging, aligning this area of research with studies including younger populations. Younger adults and older adults both encounter periods of "rolelessness" during transitions from formal education to starting a career in younger adulthood, and from finishing a career to retirement in older adulthood (Antonucci et al., 2016). Therefore, bridging the adolescent autonomy literature with studies on functional independence in older adults would likely be mutually beneficial. Research on functional independence in older adults that integrates a life-course perspective, particularly in relation to adaptation for growth, has the potential to have a high impact on older adults' quality of life and well-being (Ryff, 1989).

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Conflict of Interest

None reported.

References

Antonucci, T. C., Berkman, L., Börsch-Supan, A., Cacioppo, J. T., Carstensen, L. L., Fried, L. F.,… Zissimopoulos, J. (2016). Society and the individual at the dawn of the 21st century. In K. W. Schaie & S. Willis (Eds.), *Handbook of the psychology of aging* (8th ed., pp. 41–62). London, UK: Elsevier.

Arnett, J. J. (2007). Emerging adulthood: What is it, and what is it good for?. *Child Development Perspectives*, **1**, 68–73. doi:10.1111/j.1750-8606.2007.00016.x

Bak, T. H., Long, M. R., Vega-Mendoza, M., & Sorace, A. (2016). Novelty, challenge, and practice: The impact of intensive language learning on attentional functions. *PLoS One*, **11**, e0153485. doi:10.1371/journal.pone.0153485

Baltes, P. (1997). On the incomplete architecture of human ontogeny: Selection, optimization, and compensation as foundation of developmental theory. *American Psychologist*, **52**, 366–380. doi:10.1037/0003-066X.52.4.366

Baltes, P. B., & Baltes, M. M. (Eds.). (1990). *Successful aging: Perspectives from the behavioral sciences*. New York, NY: Cambridge University Press. doi:10.1017/CBO9780511665684

Baltes, P. B., Lindenburger, U., & Staudinger, U. M. (2006). Life span theory in developmental psychology. *Handbook of Child Psychology*, **1**, 569–664. doi:10.1002/9780470147658.chpsy0111

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, **84**, 191–215. doi:10.1037/0033-295X.84.2.191

Brandtstädter, J., & Greve, W. (1994). The aging self: stabilizing and protective processes. *Developmental Review*, **14**, 52–80. doi:10.1006/drev.1994.1003

Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology*, **42**, 116–131. doi:10.1037/0022-3514.42.1.116

Carlson, M.C., Seeman, T., & Fried, L.P. (2000). Importance of generativity for healthy aging in older women. *Aging (Milano)*, **12**, 132–140. doi:10.1007/BF03339899

Carstensen, L. L. (1992). Social and emotional patterns in adulthood: Support for socioemotional selectivity theory. *Psychology and Aging*, **7**, 331–338. doi.10.1037/0882-7974.7.3.331

Carstensen, L. L., & DeLiema, M. (2018). The positivity effect: A negativity bias in youth fades with age. *Current Opinion in Behavioral Sciences*, **19**, 7–12. doi:10.1016/j.cobeha.2017.07.009

Chan, M. Y., Haber, S., Drew, L. M., & Park, D. C. (2016). Training older adults to use tablet computers: Does it enhance cognitive function? *Gerontologist*, **56**, 475–484. doi:10.1093/geront/gnu057

Charness, N. & Boot, W. R. (2009). Aging and information technology use: Potential and barriers. *Current Directions in Psychological Science*, **18**, 253–258. doi:10.1111/j.1467-8721.2009.01647.x

Cook Maher, A., Kielb, S., Loyer, E., Connelley, M., Rademaker, A., Mesulam, M. M.,…Rogalski, E. (2017). Psychological well-being in elderly adults with extraordinary episodic memory. *Plos One*, **12**, e0186413. doi:10.1371/journal.pone.0186413

Cutchin, M. P. (2003). The process of mediated aging-in-place: A theoretically and empirically based model. *Social Science and Medicine*, **57**, 1077–1090. doi:10.1016/S0277-9536(02)00486-0

Darling-Hammond, L., Wilhoit, G., & Pittenger, L. (2014). Accountability for college and career readiness: Developing a new paradigm. *Education Policy Analysis Archives*, **22**., 1–34. doi:10.14507/epaa.v22n86.2014

Delello, J. A., & McWhorter, R. R. (2017). Reducing the digital divide: Connecting older adults to iPad technology. *Journal of Applied Gerontology*, **36**, 3–28. doi:10.1177/0733464815589985

Depp, C. A., & Jeste, D. V. (2006). Definitions and predictors of successful aging: A comprehensive review of larger quantitative studies. *American Journal of Geriatric Psychiatry*, **14**, 6–20. doi:10.1097/01.JGP.0000192501.03069.bc

Dodge, H. H., Du, Y., Saxton, J. A., & Ganguli, M. (2006). Cognitive domains and trajectories of functional independence in nondemented elderly persons. *The Journals of Gerontology: Series A*, **61**, 1330–1337. doi:10.1093/gerona/61.12.1330

Dweck, C. (2006). *Mindset: The new psychology of success*. New York City, NY: Random House Publishing Group.

Fieo, R. A., Austin, E. J., Starr, J. M., & Deary, I. J. (2011). Calibrating ADL-IADL scales to improve measurement accuracy and to extend the disability construct into the preclinical range: A systematic review. *BMC Geriatrics*, **11**, 42. doi:10.1186/1471-2318-11-42

Gill, T. M. (2010). Assessment of function and disability in longitudinal studies. *Journal of the American Geriatrics Society*, **58**, S308–S312. doi:10.1111/j.1532-5415.2010.02914.x

Gill, T. M. (2017). Do the tenets of late-life disability apply to middle age? *Annals of Internal Medicine*, **167**, 818–819. doi:10.7326/M17-2550

Golant, S. M. (2003). Conceptualizing time and behavior in environmental gerontology: A pair of old issues deserving new thought. *The Gerontologist*, **43**, 638–648. doi:10.1093/geront/43.5.638

Hamilton, B. B., Laughlin, J. A., Fiedler, R. C., & Granger, C. V. (1994). Interrater reliability of the 7-level functional independence measure (FIM). *Scandinavian Journal of Rehabilitation Medicine*, **26**, 115–119.

Han, L., Gill, T. M., Jones, B. L., & Allore, H. G. (2016). Cognitive aging trajectories and burdens of disability, hospitalization and nursing home admission among community-living older persons. *Journals of Gerontology: Medical Sciences*, **71**, 766–771. doi:10.1093/gerona/glv159

Harrison, T. M., Weintraub, S., Mesulam, M. M., & Rogalski, E. (2012). Superior memory and higher cortical volumes in unusually successful cognitive aging. *Journal of the International Neuropsychological Society*, **18**, 1081–1085. doi:10.1017/S1355617712000847

Heckhausen, J., & Schulz, R. (1995). A life-span theory of control. *Psychological Review*, **102**, 284–304.

Heinemann, A. W., Michael Linacre, J., Wright, B. D., Hamilton, B. B., & Granger, C. (1994). Measurement characteristics of the functional independence measure. *Topics in Stroke Rehabilitation*, **1**, 1–15. doi:10.1080/10749357.1994.11754030

Hertzog, C., Kramer, A. F., Wilson, R. S., & Lindenberger, U. (2008). Enrichment effects on adult cognitive development: Can the functional capacity of older adults be preserved and enhanced? *Psychological Science in the Public Interest*, **9**, 1–65. doi:10.1111/j.1539-6053.2009.01034.x

Hooley, T., Marriott, J., & Sampson, J. P. (2011). *Fostering college and career readiness: How career development activities in schools impact on graduation rates and students' life success*. UK: University of Derby.

Inguglia, C., Ingoglia, S., Liga, F., Lo Coco, A., & Lo Cricchio, M. G. (2015). Autonomy and relatedness in adolescence and emerging adulthood: Relationships with parental support and psychological distress. *Journal of Adult Development*, **22**, 1–13. doi:10.1007/s10804-014-9196-8

Kellam, S. G., Werthamer-Larsson, L., Dolan, L. J., Brown, C. H., Mayer, L. S., Rebok, G. W., Anthony, J. C., Laudolff, J., Edelsohn, G., & Wheeler, L. (1991). Developmental epidemiologically based preventive trials: Baseline modeling of early target behaviors and depressive symptoms. *American Journal of Community Psychology*, 19, 563–584.

Kotter-Grühn, D., Kornadt, A. E., & Stephan, Y. (2016). Looking beyond chronological age: Current knowledge and future directions in the study of subjective age. *Gerontology*, **62**, 86–93. doi:10.1159/000438671

Labouvie-Vief, G. (1980). Adaptive dimension of adult cognition. In N. Datan & N. Lohmann (Eds.), *Transitions of aging* (pp. 3–26). New York, NY: Academic Press. doi:10.1016/B978-0-12-203580-7.50007-5

Lawton, M. P., & Brody, E. M. (1970). Assessment of older people: Self-maintaining and instrumental activities of daily living. *Nursing Research*, **19**, 278. doi:10.1097/00006199-197005000-00029

Leanos, S., Coons, J., Rebok, G. W., Ozer, D. J., & Wu, R. (2018). Development of the broad learning adult questionnaire. *The International Journal of Aging and Human Development*. doi:10.1177/0091415018784695

Lövdén, M., Bäckman, L., Lindenberger, U., Schaefer, S., & Schmiedek, F. (2010). A theoretical framework for the study of adult cognitive plasticity. *Psychological Bulletin*, **136**, 659–676. doi:10.1037/a0020080

Lusardi, A. & Mitchell, O. S. (2010). *How ordinary consumers make complex economic decisions: Financial literacy and retirement readiness, CFS Working Paper, No. 2010/11, Goethe University, Center for Financial Studies (CFS), Frankfurt a. M.*, http://nbn-resolving.de/urn:nbn:de:hebis:30-78630. Accessed August 7, 2018.

Marsiske, M., & Willis, S. L. (1995). Dimensionality of everyday problem solving in older adults. *Psychology and Aging*, **10**, 269–283. doi:10.1037/0882-7974.10.2.269

Masten, A. S. (1994). Resilience in individual development: Successful adaptation despite risk and adversity. In M. C. Wang & E. W. Gordon (Eds.), *Educational resilience in inner-city America: Challenges and prospects* (pp. 3–25). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

McCrae, R. R., & Costa, P. T., Jr. (1997). Personality trait structure as a human universal. *American Psychologist*, **52**, 509–516. doi:10.1037/0003-066X.52.5.509

Miskelly, F. G. (2001). Assistive technology in elderly care. *Age and Ageing*, **30**, 455–458. doi:10.1093/ageing/30.6.455

Mynatt, E. D., Essa, I., & Rogers, W. (2000). Increasing opportunities for aging in place. ACM Conference on Universal Usability, Washington, DC (pp. 65–71). New York: ACM Press.

Neves, B. B., Franz, R., Judges, R., Beermann, C., & Baecker, R. (2017). Can digital technology enhance social connectedness among

older adults? A feasibility study. *Journal of Applied Gerontology*. Epub ahead of print. doi:10.1177/0733464817741369.

Noice, H., & Noice, T. (2013). Extending the reach of an evidence-based theatrical intervention. *Experimental Aging Research*, **39**, 398–418. doi:10.1080/0361073X.2013.808116

Noom, M. J., Dekovic, M., & Meeus, W. (2001). Conceptual analysis and measurement of adolescent autonomy. *Journal of Youth and Adolescence*, **30**, 577–595. doi:10.1023/A:1010400721676

Park, D. C., & Reuter-Lorenz, P. (2009). The adaptive brain: Aging and neurocognitive scaffolding. *Annual Review of Psychology*, **60**, 173–96. doi:10.1146/annurev.psych.59.103006.093656

Park, D. C., Lodi-Smith, J., Drew, L., Haber, S., Hebrank, A., Bischof, G. N., & Aamodt, W. (2014). The impact of sustained engagement on cognitive function in older adults: The synapse project. *Psychological Science*, **25**, 103–112. doi:10.1177/0956797613499592

Phelan, E. A., Anderson, L. A., LaCroix, A. Z., & Larson, E. B. (2004). Older adults' views of "successful aging"–how do they compare with researchers' definitions? *Journal of the American Geriatrics Society*, **52**, 211–216. doi:10.1111/j.1532-5415.2004.52056.x

Phillips, L. (1968). *Human adaptation and its failures*. Oxford, England: Academic Press.

Quinn, J. F. (2010). Work, retirement, and the encore career: Elders and the future of the American workforce. *Generations*, **34**, 45–55.

Rebok, G. W., Ball, K., Guey, L. T., Jones, R. N., Kim, H.-Y., King, J. W.,… Willis, S. L. (2014). Ten-year effects of the ACTIVE cognitive training trial on cognition and everyday functioning in older adults. *Journal of the American Geriatrics Society*, **62**, 16–24. doi:10.1111/jgs.12607

Reuter-Lorenz, P., & Park, D. (2014). How does it STAC Up? Revisiting the scaffolding theory of aging and cognition. *Neuropsychology Review*, **24**, 355–370. doi:10.1007/s11065-014-9270-9

Rogalski, E. J., Gefen, T., Shi, J., Samimi, M., Bigio, E., Weintraub, S., Geula, C., & Mesulam, M. M. (2013). Youthful memory capacity in old brains: Anatomic and genetic clues from the Northwestern Super Aging Project. *Journal of Cognitive Neuroscience*, **25**, 29–36. doi:10.1162/jocn_a_00300

Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The Gerontologist*, **37**, 433–440. doi:10.1093/geront/37.4.433

Ryff, C. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology*, **57**, 1069–1081.

Schaie, K. W., & Willis, S. L. (2000). A stage theory model of adult cognitive development revisited. In M. K. R. Rubinstein & M. Moss (Eds.), *The many dimensions of aging: Essays in honor of M. Powell Lawton* (pp. 175–193). New York: Springer Publishing Co.

Schulz, R., & Heckhausen, J. (1996). A life span model of successful aging. *American Psychologist*, **51**, 702–714. doi:10.1037/0003-066X.51.7.702

Schunk, D. (1991). Self-efficacy and academic motivation. *Educational Psychologist*, **26**, 207–231. doi:10.1207/s15326985ep2603&4_2

Schwartz, S. J., Côté, J. E., & Arnett, J. J. (2005). Identity and agency in emerging adulthood: Two developmental routes in the individualization process. *Youth & Society*, **37**, 201–229. doi:10.1177/0044118X05275965

Seeman, T. E., Unger, J. B., McAvay, G., & de Leon, C. F. M. (1999). Self-efficacy beliefs and perceived declines in functional ability: MacArthur studies of successful aging. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, **54**, P214–P222. doi:10.1093/geronb/54B.4.P214

Shipstead, Z., Redick, T. S., & Engle, R. W. (2012). Is working memory training effective? *Psychological Bulletin*, **138**, 628–654. doi:10.1037/a0027473

Simons, D.J., Boot, W.R., Charness, N., Gathercole, S.E., Chabris, C.F., Hambrick, D.Z., & Stine-Morrow, E.A.L. (2016). Do "brain-training" programs work? *Psychological Science in the Public Interest*, **17**, 103–186. doi:10.1177/1529100616661983

Stephan, Y., Sutin, A. R., Luchetti, M. & Terracciano, A. (2018). Subjective age and risk of incident dementia: Evidence from the national health and aging trends survey. *Journal of Psychiatric Research*, **100**, 1–4. doi:10.1016/j.jpsychires.2018.02.008

Sternberg, R. (1997). The concept of intelligence and its role in lifelong learning and success. *American Psychologist*, **52**, 1030–1037. doi:10.1037/0003-066X.52.10.1030

Stine-Morrow, E. A. L., Parisi, J. M., Morrow, D. G., & Park, D. C. (2008). The effects of an engaged lifestyle on cognitive vitality: A field experiment. *Psychology and Aging*, **23**, 778–786. doi:10.1037/a0014341

Stine-Morrow, E. A. L., Payne, B. R., Roberts, B. W., Kramer, A. F., Morrow, D. G., Payne, L.,… Parisi, J. M. (2014). Training versus engagement as paths to cognitive enrichment with aging. *Psychology and Aging*, **29**, 891–906. doi:10.1037/a0038244

Tang, P., & Venables, T. (2000). Smart homes and telecare for independent living. *Journal of Telemedicine and Telecare*, **6**, 8–14. doi:10.1258/1357633001933871

Thornton, W. J. L., & Dumke, H. (2005). Age differences in everyday problem solving and decision making effectiveness: A meta-analytic review. *Psychology and Aging*, **20**, 85–99. doi:10.1037/0882-7974.20.1.85

Van Rooji, M., Lusardi, A., & Alessie, R. (2011). Financial literacy and retirement planning in the Netherlands. *Journal of Economic Psychology*, **32**, 593–608. doi:10.1016/j.joep.2011.02.004

Wang, X., Ren, P., Baran, T. M., Raizada, R. D. S., Mapstone, M., Lin, F., & the Alzheimer's Disease Neuroimaging Initiative. (2017). Longitudinal functional brain mapping in Supernormals. *Cerebral Cortex*. Epub ahead of print. doi:10.1093/cercor/bhx322

Willis, S.L., Tennstedt, S.L., Marsiske, M., Ball, K., Elias, J., Koepke, K.M.,…Wright, E.; ACTIVE Study Group. (2006). Long-term effects of cognitive training on everyday functional outcomes in older adults. *Journal of the American Medical Association*, **296**, 2805–2814. doi:10.1001/jama.296.23.2805

Wlodkowski, R. J., & Ginsberg, M. B. (2017). *Enhancing adult motivation to learn*. Hoboken, NJ: John Wiley & Sons.

Wu, R., Rebok, G. W., & Lin, F. V. (2017). A novel theoretical life course framework for triggering cognitive development across the lifespan. *Human Development*, **56**, 342–365. doi:10.1159/000458720

Zisberg, A., Zysberg, L., Young, H. M., & Schepp, K. G. (2009). Trait routinization, functional and cognitive status in older adults. *The International Journal of Aging and Human Development*, **69**, 17–29. doi:10.2190/AG.69.1.b