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Preface

In this issue, Grover, Miller, and Porter studied "mature" adults (age of participants was greater than 55) in order to investigate their SDL practices and how SDL beliefs and practices relate to perceived quality of life. Due to the continued increase in this age group, the role of SDL as a mechanism for growth and coping demands further study.

As a coping strategy, Herod and Kop examined the SDL of members of on online self-help group created for those experiencing Complex Post Traumatic Stress Disorder. Research such as this continue to emerge that focus on the myriad ways that SDL and technology intersect in informal adult learning.

Bartholomew studied the aforementioned SDL and technology intersection in the formal learning setting of middle school. Studies must continue in this regard not only to better understand the role of technology-supported SDL with student achievement but also to better understand how to increasingly develop learner self-directedness as early as possible via compulsory education.

Finally, Ponton used an estimation technique in a research brief to develop normative statistics for the Appraisal of Learner Autonomy (a self-efficacy measure). With data that do not represent a given population's stratified demography, this technique provides a method for calculating descriptive statistics that better represent a population of interest.

Acknowledgement

Professor Lucy Guglielmino has served as editor/coeditor of the *International Journal of Self-Directed Learning* since its inception in 2004. Although becoming Professor Emeritus in 2011, she continued her editorship with fervor and diligence. Working with Prof. Long (coeditor, 2004-2008), with Prof. Hiemstra (coeditor, 2009-2010), alone (2011-2015), and with me (guest editor, 2016-2017), she dynamically led this journal from a nascent publication to one that represents a significant body of SDL literature. As this year represents her last as editor, she deserves our society's appreciation for helping to build a publication that archives our scholarship while engenders continued thought and spirited debate.

Thank you Lucy!

Michael K. Ponton, Guest Editor

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CONTENTS

MATURE ADULT LEARNERS, SELF-DIRECTED LEARNING PRACTICES, AND QUALITY OF LIFE

Kenda S. Grover, Michael T. Miller, and Sarah A. Porter

Research suggests that a connection exists between self-directed learning and personal wellness. The purpose of this exploratory study was to build on this research by examining how mature adults, in particular, view their self-directed learning practices and individual characteristics. Another goal was to examine whether their view differs based on their perceived quality of life. Participants were members of an organization that offers educational opportunities for adults most of whom have reached retirement age. They completed a survey designed to gather information about their community participation and independent learning practices. Participants reported they were in control of and take responsibility for their learning. Results varied little based on participants' perception of their quality of life. This study was intended to establish a foundation for future research on how mature adult learners, especially those in retirement, engage in self-directed learning and the impact it has on overall health and wellness.

Keywords: self-directed learning, mature adult learners, quality of life

In the United States, the number of mature adults is growing dramatically. The U.S. Census Bureau (Ortman, Velkoff, & Hogan, 2014) has predicted that the number of adults over the age of 65 will reach 92 million by 2060. From 2015 to 2060, the population increase of those under the age of 18 will be 11.8%, the number of people age 18 to 64 will increase by 18.2%, and those 65 and older will increase by 105.2%. It is predicted that by the year 2030, 20.6% of the population in the United States will be 65 and older; that is approximately 74 million people.

While the population of older adults is expanding, their level of educational attainment is also increasing. In 2000, 69.5% of adults age 55 and older had completed high school or higher and 15.6% had completed a bachelor's degree or higher (U.S. Census Bureau, 2000). By 2015, 86.7% of adults age 55 and older had completed high school or higher and 28.6% had completed a bachelor's degree or higher (U.S. Census Bureau, 2015).

This growth means that an increasingly significant number of people will face the challenging transition that accompanies retirement or an important life shift with both positive and negative outcomes. For many mature adults entering retirement, the transition is welcomed and rewarded. Postponed vacations, home improvement projects,

and the opportunity to give back to the community are common examples of events that take place during the process. Second careers and avocations, whether pursued for pay or not, that have long been postponed because of time and other commitments are finally embarked upon.

For others, the decision to retire can be difficult. Ending a professional career is often accompanied by feelings of losing a personal or professional identity and filling time previously consumed by work has been well documented as a difficult task for many individuals (Reitzes & Mutran, 2006). The process of redefinition is frequently accompanied by physical and social changes. Some of these changes can be forecasted such as downsizing to a smaller home, and some are unexpected such as experiencing health related problems, unexpected death, mobility issues, etc. The transition can also result in a myriad of other problems. Sedentary behaviors like watching television and nonsocializing become commonplace and lead to problems such as depression and health related challenges due to inactivity.

However, as the percentage of adults who have attained at least a secondary credential increases, so too might the percentage of adults who would participate in educational programs in retirement. Research has demonstrated that prior educational attainment is the most accurate predictor of participation in both formal and informal educational activities (Merriam, Caffarella, & Baumgartner, 2007; Valentine, 1997; Ventura-Merkel & Doucette, 1993). More than ever before opportunities for mature adults to engage in learning activities that are purposeful and provide opportunities for knowledge acquisition, personal growth, and social interaction exist. These occasions to learn encompass topics ranging from personal health and caregiver support to history and music, to financial literacy, to using technology to remain in contact with family and friends. "Active ageing," a term used by the World Health Organization (WHO, 2002), refers to continued participation and engagement in the business of life—socially or spiritually—in terms of civic, economic, and cultural affairs. Learning can be a means toward active aging and through learning older adults can maintain sound cognitive processes as well as social engagement both of which contribute to personal health and wellbeing.

With a growing population of mature adults, there is reason to continue previous work exploring why one group of individuals excel into retirement and senior living when others do not and what impact participation in learning activities may have on them. This study sought to examine this phenomenon, in part. The purpose for conducting this exploratory study was to investigate the nature of learning activities in which adults in this life stage are involved and whether their view of their learning in terms of self-directedness and behavior impact how they perceive their quality of life.

Self-Directed Learning

Self-directed learning (SDL) was defined by Merriam and Cafferella (1991) as a "form of study where learners have primary responsibility for planning, carrying out, and evaluating their own learning experiences" (p. 41). SDL can be described either as dimensions of the learning process such as planning and managing one's learning or as a personal attribute of an individual learner (Cafferella, 1993). SDL as a personal

attribute has been defined as a disposition to seek out and engage in activities whereby the learner assumes responsibility for autonomously developing and designing learning endeavors (Brockett, 1983). Knowles (1975) provided one of the most widely accepted definitions of SDL:

> Individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. (p. 18)

SDL is integral to adult development as changes related to transitions in life stages and roles are often the impetus for undertaking a learning activity (Lamdin, 1997). Several studies have investigated older adults' motivation for participating in postretirement learning activities, and the most commonly reported motivations can be classified as cognitive or academic interest (Brady & Fowler, 1988; Bynum & Seaman, 1993; Furst & Steele, 1986; Perkins & Robertson-Tchabo, 1981), personal growth and satisfaction (Scala, 1996), and social contact or social relationships (Furst & Steele, 1986). Lamb and Brady (2005) identified two additional categories of benefits as perceived by participants: opportunities for enhancing self-esteem and opportunities for spiritual renewal. Kim and Merriam (2004) found that cognitive interest is the most influential factor followed by social contact. The same study found that motivation is often related to external factors; those who were less motivated by social stimulation tended to be more educated, had lived in the town longer, and were currently married (Kim & Merriam, 2004). These findings are similar to those of Truluck, Kim, and Valentine (2010) who studied the most popular activities based on participation rates in a program focused on learning for retirees. While there was participation in special interest groups, a travel and study group, and social activities, members participated most heavily in actual courses related to topics such as the renaissance, strength training, and computer skills as well as in a lunch and learn series on topics such as stem cell research and environmental issues.

Regardless of their reason for participation, engagement in SDL has been positively related to higher satisfaction of life in older adults specifically (Brockett, 1985, 1987; Brockett & Hiemstra, 1991; Fisher, 1986, 1988; Gardner & Helmes, 1999). Study results have indicated active older adults have a significant positive relationship with educational attainment, less anomia, the propensity to engage in SDL, and awareness of SDL activities (Fisher, 1986, 1988). The activities themselves might occur in formal environments such as events offered by institutions of higher education, in nonformal environments such as a health club or senior center, or informally when, for example, a person decides to learn how to play a musical instrument.

The Osher Lifelong Learning Institutes (OLLIs) are one type of program that fall under the categories of formal or nonformal education. Osher Institutes offer non-credit programming for adults age 50 and older and are currently supported in 119 postsecondary institutions in the United States (Bernard Osher Foundation, 2005). Each OLLI program designs unique programming to meet the needs and interests of the participants and invites the participants to instruct others in areas of personal interest or

expertise. A recent study asking OLLI directors to define a learning community found that they generally viewed OLLI programs as learning communities in that each program has common goals, participants' sense of ownership, sustained relationships among participants, holistically engaged learners, and meaningful peer interactions (Brady, Cardale, & Neidy, 2013).

Opportunities to learn in general either in solitude or with others can lead to numerous positive outcomes. In a longitudinal study on the relationship between well-being and participation in learning by older adults, Jenkins (2015) found that informal learning—in this case through activities such as education, music and arts groups, and exercise classes—can enhance well-being. However, his research also revealed that this was truer for those with some higher education than for those who had little or none. Participants engaging in nonformal education in Sweden also reported that learning impacted their well-being in a positive way (Aberg, 2016). The acquisition of knowledge and skills and the social dimension of learning impacted their perception of well-being; learners reported that engaging with others was not only a motivator to join study circles they belonged to but a positive outcome as well.

Learning in a more formal environment has the power to help mature learners maintain a sense of self and navigate the inevitable transitions that accompany the aging process. It can be a means toward maintaining independence and avoiding reliance on others and to support older members of their community. Further, learning is a way to stay relevant, to connect with and learn from others, and to support the personal belief that one can still improve his or her life situation (Escolar Chua & Guzman, 2014).

Literature on the benefits of self-directed learning among older adults in particular is not as well-established as the outcomes mature adults experience from learning generally, but there is evidence that a positive relationship exists. Brockett (1985) suggested that older adults who learn to be more self-directed have the potential to increase independence and life satisfaction. His study revealed that a person with a high level of self-directedness is also likely to have a high level of life satisfaction, and a relationship exists between "perceived life satisfaction and the extent to which one sees oneself as possessing skills and attitudes needed in self-directed learning" (Brockett, 1985, p. 218).

According to Roberson (2005), older adults have used personal learning of a nonformal nature as a means of coping with the changes in their lives and aging successfully. Adjustments in a person's life situation can be the impetus for studying a particular topic such as a health issue, and learning provides a way to stay busy after a loss, to acquaint someone with the activities of their grandchildren, and to better relate to those offspring as well. For retirees, choosing a learning activity was found "to be personally fulfilling, enhanced their retirement, and broadened their view of themselves" (Roberson, 2005, p. 229).

Method

The method of data collection for this study was administration of an online survey instrument consisting of 53 items. The questionnaire was distributed using a convenience sampling technique to approximately 450 members of a learning institute

for seasoned adults. The adult learning society was comprised of individuals in a specific midsouthern community of approximately 70,000 residents. These individuals voluntarily paid membership dues of $50 to take leisure-oriented classes, ranging from one day seminars to long term courses of up to 10 weeks. The program has a national affiliation with other similar programs and is coordinated through a local higher education institution.

The instrument was comprised of four demographic questions and one question related to the participants' perceived quality of life. Participants also indicated their participation in activities or groups in their community such as social action groups, civic organizations, and recreational activities.

Thirteen Likert-type scale questions were identified from related literature to gauge participants' perceptions of their control of their own learning. These questions reflected literature on how adults take responsibility for and make a plan for their learning and whether and how they identify resources to help them learn (Brockett & Hiemstra, 1991; Candy, 1991; Garrison, 1997; Guglielmino, 1977; Knowles, 1975; Tough, 1979). Based on the findings of these studies, behavioral elements that were repeated and consistent across the research were selected for inclusion in the study. The questions were developed to align with the behavioral nature of individual control of learning and characteristics that typify a self-directed learner rather than those that might examine SDL as an instructional technique.

Findings

Members of the adult learning society were sent an email message with a link to the survey instrument along with a description of the study and a request to participate. Two additional follow-up email messages were sent with a total of 73 respondents ultimately completing the survey although one respondent did not answer the question about age group identification. The membership listing distribution included 451 possible participants, meaning that the survey had a 16.18% response rate. Although the response rate was lower than desired, it was accepted as usable for the descriptive nature of the study.

The first section of the survey included five self-report descriptive questions for respondents to complete. As shown in Table 1, the survey respondents were mostly female (n = 49, P = 67%), over the age of 65 (n = 59, P = 81%), were currently married (n = 48, P = 66%), had completed a college or graduate/professional degree (n = 64, P = 88%), and just over half indicated that they were very satisfied with their quality of life (n = 43, P = 59%).

As shown in Table 2, survey participants were asked to identify which community activities or programs they were a part of. They were specifically asked to identify all categories of activities that they were involved in, and the most commonly identified organizations and activities were taking classes for self-interest (n = 62), volunteer activities (n = 49), recreational activities (n = 46), social groups (n = 35), community service (n = 32), and arts groups (n = 25).

Table 1. *Profile of Survey Respondents*

Variable	*n*	*P*
Gender		
Male	24	33
Female	49	67
Age Group		
50-55	0	0
56-65	13	18
Over 65	59	81
Marital Status		
Currently Married	48	66
Divorced	11	15
Widowed	10	14
Single/Never Married	4	5
Formal Education Completed		
High School	1	1
Some College, No Degree	8	11
College Degree	23	31
Graduate, Professional Degree	41	56
Self Perception of Quality of Life		
My quality of life could not be any better	43	59
My quality of life could be a little better	25	34
My quality of life could be much better	5	7

Table 2. *Mature Learners Perspectives of Their Community Participation*

Activities	*n*
Classes for self-interest	62
Volunteer activities	49
Recreational activities (gardening, fishing, etc.)	46
Social groups (PEO, Elks, etc.)	35
Community Service (United Way, animal shelters, hospitals, church)	32
Arts groups (community theater, studio art, etc.)	25
Political organizations	14
Community action groups (Save a historic building)	14
Social action groups (voter registration)	13
Sports groups (running clubs, biking groups, bowling league, etc.)	9
Civic organizations (Kiwanas, Rotary, etc.)	2

Note. Participants were allowed to identify as many activities as they wished.

Survey participants were asked to rate their agreement-level with a series of prompts that describe personal control of learning. As shown in Table 3, participants agreed most strongly with the statements that they *are in control of their own learning activities* (*M* = 4.40, *SD* = 0.54), *take responsibility for their own learning* (*M* = 4.36, *SD* = 0.58), that they *consider themselves independent persons* (*M* = 4.36, *SD* = 0.73), and that they *consider themselves curious persons* (*M* = 4.36, *SD* = 0.67). The respondents agreed-to-strongly agreed with 11 of the 13 statements, and two statements had mean ratings that were below 4.0, meaning that the respondents had neutral perceptions of them. They included the personal use of *technology to learn on their own* (*M* = 3.93, *SD* = 0.76) and when they want to learning something *they make a plan* (*M* = 3.82, *SD* = 0.75).

Table 3. *Mature Learners Perspectives on Their Control of Learning*

Learning control perspectives	Min	Max	*M*	*SD*	s^2
I am in control of my own learning activities.	3.00	5.00	4.40	0.54	0.29
I take responsibility for my own learning.	3.00	5.00	4.36	0.58	0.34
I consider myself an independent person.	2.00	5.00	4.36	0.73	0.53
I am a curious person.	3.00	5.00	4.36	0.67	0.45
I am motivated to learn on my own.	3.00	5.00	4.33	0.62	0.39
I take responsibility for what I learn.	3.00	5.00	4.32	0.55	0.30
I frequently work independently.	3.00	5.00	4.32	0.70	0.49
I engage in new things that are personally useful.	3.00	5.00	4.17	0.60	0.36
When learning something new, I am able to decide if I am successful.	3.00	5.00	4.11	0.56	0.32
When learning something new I am able to identify resources to help me.	2.00	5.00	4.10	0.64	0.42
I am goal-oriented.	1.00	5.00	4.07	0.78	0.61
I use technology to learn on my own.	1.00	5.00	3.93	0.76	0.58
When I want to learning something I make a plan.	2.00	5.00	3.82	0.75	0.56

As shown in Table 4, responses to the survey were then stratified by those who indicated that their quality of life *could not be any better* (*n* = 43) and then collapsing the cells that contained respondents who perceived that their quality of life could be better (*a little better n* = 25 and *could be much better n* = 5). The titles on the table, for clarity, referred to the first group as "Great" as in the individuals perceived their quality of life to be great. The second category was that the individuals perceived that their quality of life "Could Improve." Participants who indicated they have a great quality of life agreed most strongly with the statement "I frequently work independently" (*M* = 4.46) followed closely by "I consider myself an independent person" (*M* = 4.44) and "I

am a curious person" (*M* = 4.44). Respondents who reported that their quality of life could not be improved were neutral about *making a plan when they wanted to learn something* (*M* = 3.88). Those respondents who reported their quality of life could be improved agreed most strongly with the statements that *they are motivated to learn on their own* (*M* = 4.51), *are in control of their own learning activities* (*M* = 4.40) and that they *take responsibility for their own learning* (*M* = 4.33). They were neutral about *making a plan when they want to learn something* (*M* = 3.73), *using technology to learn on their own* (*M* = 3.76), being goal oriented (*M* = 3.76), engaging in things that are personally useful (*M* = 3.96), and being able to determine success in learning something new (*M* = 3.97).

Table 4. *Comparison of Perspectives on Quality of Life and Control of Learning by Those with Great Quality of Life and Quality of Life that Could be Improved*

Learning control perspectives	Great *M* (*n* = 43)	Could Improve *M* (*n* = 30)
I control of my own learning activities.	4.37	4.40
I take responsibility for my own learning.	4.37	4.33
I consider myself an independent person.	4.44	4.16
I am motivated to learn on my own.	4.41	4.51
I am a curious person.	4.44	4.26
I take responsibility for what I learn.	4.37	4.23
I frequently work independently.	4.46	4.10
I engage in new things that are personally useful.	4.20	3.96
When learning something new, I am able to decide if I am successful.	4.20	3.97
When learning something new I am able to identify resources to help me.	4.11	4.06
I am goal-oriented.	4.25	3.76
I use technology to learn on my own.	4.02	3.76
When I want to learning something I make a plan.	3.88	3.73

Discussion and Conclusions

This study was an attempt to develop a foundation for a larger investigation into mature adults' engagement in SDL and whether differences exist in SDL beliefs and practices in relation to how people perceive their quality of life. Americans are living longer; this presents a need to explore the relationship between autonomous learning and constructs such as personal well-being and active aging (WHO, 2002). Participants in this study, however, represent a very narrow segment of the aging population. They live in a midsized metropolitan area and are members of an organization whose primary purpose

is to deliver learning opportunities to mature learners. As such, they are involved in purposeful, intentional learning on a regular basis and likely characterize just a small population of computer literate adults who have the time, resources, and self-assurance to participate in structured learning sponsored by an institution of higher learning.

Most participants in the study reported taking classes for self-interest, which is the nature of classes offered by the organization. They were well educated and reported they were very satisfied with their quality of life. In general, participants agreed they take ownership of their learning and believe themselves to be independent, perhaps a result of their prior educational experiences. When responses were considered in light of how they perceived their quality of life, those who indicated they have a "great" quality of life seem to also see themselves as independent, curious people. Even those who said their quality of life could be improved indicated they take control of and are responsible for their learning.

Other results from the study did not support those from previous investigations into SDL practices. Several authors (Brocket, 1983; Caffarella, 1993; Knowles, 1975; Merriam & Caffarella, 1991) have suggested that self-directed learners establish a plan for their learning. Contrary to prior research, this group was neutral about this behavior, which leads to additional questions about what prompts their learning and how they then take action when they identify a need or desire to learn something. It is plausible that people, regardless of how self-directed they are in their learning, do not know how to establish a plan for themselves. This question should be modified and broken down into specific behaviors that constitute making a plan. This group also reported they are not necessarily using technology to learn. How then, in addition to attending classes, are they accessing information and what resources do they consider viable? The one question not asked was whether participants evaluated their own learning, another behavior that according to some (Knowles, 1975; Merriam & Caffarella, 1991) characterizes self-directed learning. Being that they were neutral about planning their learning, they might not engage in this practice either.

Other questions emerge from this study. For example, what is it that mature adults want and need to learn, who sponsors these learning opportunities, and how can learners be encouraged to take advantage of them when they are available? How do adults from more rural areas or those who have not attained the same level of formal education engage in learning, and what about those who do not have access to or participate in a program whose sole purpose is to provide learning opportunities?

A more challenging question to answer than those related to behavior and access is how self-directedness in learning relates to mature adults' quality of life and active aging. Prior research has suggested a positive relationship exists between engagement in SDL and life satisfaction (Brockett, 1985, 1987; Brockett & Hiemstra, 1991; Fisher, 1986, 1988; Gardner & Helmes, 1999). To draw further conclusions about a possible relationship between the two, the construct "quality of life" should be explored more thoroughly. Additional research should also focus on learning that is prompted by, for example, a health crisis, issues with financial literacy, or even a second career and must investigate populations of learners with varying levels of education, resources, and activity. Objective, quantifiable data measures such as financial wealth, health measures, etc., could also be identified and tied to quality of life indicators, and such data points

could also be tied to self-reported data about how mature adults see their own quality of life and their projections for the future. Such research would require further validation of data collection tools and research protocols. The participants' level of education and their involvement in one learning organization are prominent aspects of the current study. Diversifying and expanding the population and including those who do have access to or are not comfortable with technology and represent other life situations would provide a richer picture of the role learning plays in the perceived quality of life of mature learners.

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IT'S NOT JUST ABOUT SUPPORT: SELF-DIRECTED LEARNING IN AN ONLINE SELF-HELP GROUP

Lori Herod and Rita Kop

Emerging technologies have opened up the field of education and made it possible for human beings to connect with other people, create and exchange information and digital resources, and support and learn from others in an open networked environment. Numerous self-help groups have sprung up online, and suggestions have been made that talking and listening to a screen does improve mental health. It is further suggested that when undertaken in a positive, supportive discussion forum in which members are active participants, self-directed learning (SDL) will foster understanding, validation, and acceptance of mental health challenges. It is also claimed that this will enhance a sense of empowerment, autonomy, competence, relatedness, and a degree of recovery. But does it really? We critically analyzed participants' SDL in one such open online network, Out of the Storm, that has in excess of 3,500 members with Complex Post Traumatic Stress Disorder. Empirical research using the lenses of connectivism, actor network theory, social constructivism, and self-determination theory was carried out to find out more about the SDL experiences of participants.

Keywords: self-directed learning, online learning, open education, online self-help groups, social constructivism, connectivism, actor network theory, self-determination theory, lay expertise, Complex PTSD

The purpose of this research was to investigate the self-directed learning (SDL) experiences of members of an online self-help group for people with Complex Post Traumatic Stress Disorder (CPTSD). The data from this study will add to a growing body of knowledge about informal SDL in online groups and its nature, purpose, and outcomes. Our question was the following: How do participants in an online self-help group experience SDL?

In the case of this study, the precipitating issue relates to a psychological stress disorder. CPTSD is an emerging psychological construct that has rapidly been gaining attention in mental health circles and by those who suffer from it. However, it has not yet been recognized as an official diagnosis (Hyland et al., 2016). It is in the midst of ongoing debate by clinicians and researchers about the diagnosis that those who suffer from the disorder must look online for information and support from peers. Out of the Storm (OOTS) is an online self-help forum that started in August 2014 and has grown

from two to over 3,500 members. This rapid growth led us to ask about SDL in this peer-to-peer learning environment.

Online self-help groups framed around a physical or mental health issue are becoming increasingly popular as an easily accessible and widely available option for people not only to find support in trying times but also to engage in SDL about a medical/psychological problem they are experiencing (Grover, 2015; Kazmer et al., 2014; Sosnowy, 2014). SDL was defined by Knowles (1975) as a process "in which individuals take the initiative with or without the help of others in diagnosing their learning needs" and then locate relevant resources to find the information and develop the skills they need (p. 18). However, as suggested by Bouchard (2011), SDL is not only seen by researchers as a process but also as related to a personal predisposition and as an environmentally determined phenomenon. The choice to engage in a SDL episode might be triggered by a personal important life event that calls for a personal investigation, or it could be caused by the opportunities that the environment has to offer such as the availability of technology to develop communities of interest around a certain topic. The wave of emerging open networked technologies has in fact facilitated a proliferation of informal and self-directed learning and are heralded as the solution to deal with an abundance of information while at the same time providing opportunities for community building and communication at a scale not seen before (Kop & Fournier, 2010).

Literature Review

Online self-help networks and communities of interest have sprung up to support people in this quest for quality knowledge and information. In an educational context, online learning networks have materialized. These are sometimes organized and sometimes free flowing, depending on the needs and interests of the participants in the networks. This development has even contributed to the emergence of new theories of knowledge and learning such as actor network theory (ANT; Latour, 2005) and connectivism (Kop & Hill, 2008). As already suggested, SDL is one theoretical perspective to use as a lens in informal online networks. ANT and connectivism add additional dimensions related to SDL in a technology rich informal context. ANT fits with a social constructivist perspective of learning and knowing and posits that there is a symbiotic relationship between the materials humans use and the humans themselves when interacting on networks. Connectivism suggests that the openness of online networks, the diversity of participants, the willingness to share resources and information, and the autonomy of participants all contribute to SDL and knowledge creation. From a social constructivist perspective, SDL is enhanced by active engagement with others while engaging in a variety of experiences. Connectivism and ANT espouse that the two-way communication capacity of social media creates a symbiotic relationship between people and technology (Anderson & Dron, 2011; Kop & Fournier, 2010; Latour, 2005). It is within and because of this symbiosis that people are able to engage in the type of informal SDL that takes place in online self-help groups such as OOTS.

Social interactions are seen to be important in the process of SDL. Interacting and sharing experiences on OOTS seems to fit with these theoretical perspectives, but what might also influence people's participation is motivation; thus, we suggest that self- determination theory (SDT) would also be an important theoretical perspective to use for our research in an online learning network such as OOTS. It is clearly related to SDL and especially focusses on human motivation. According to Ryan and Deci (2013), our abilities to grow and learn might be innate abilities, but our motivation to do so is, as current perspectives of motivation in the SDT perspective suggest, heavily influenced by social-contextual factors that will help or hinder this inner process.

CPTSD is a psychological stress disorder that develops as a result of ongoing exposure to trauma and from which there is no real or perceived possibility of escape (e.g., childhood emotional/physical/sexual abuse; Cloitre et al., 2012; Courtois, n.d.). It is an accumulation of *interpersonal* trauma that distinguishes CPTSD from (simple) PTSD in which trauma is typically *impersonal* involving an event of limited duration (e.g., an accident or disaster; Courtois, 2014). The rapid growth of the OOTS network to support people with CPTSD suggests a need to connect with people with the disorder. Grover (2015) suggested that the ability to connect with peers online is especially important, perhaps even crucial, for those who are dealing with a disorder or illness that is not well known. She found that mothers of children who had had a pediatric stroke turned to the Internet and other parents because little or no information was available from physicians. Most felt their SDL was critical to their children's health and in some cases their survival.

There has been some related research into SDL in online self-help groups. Van Uden-Kraan et al. (2008) studied participation in three different online self-help groups for people with breast cancer, fibromyalgia, and arthritis. They identified a range of empowering and disempowering processes and outcomes of which the key empowering process was the "exchange of knowledge and sharing of experience" (p. 406). Their findings regarding disempowering processes led us to believe that uncertainty about the quality of the information gleaned from others, any negative aspects of the knowledge learned, and the negative behavior of some participants would be important issues to consider in our study on SDL of online self-help groups.

However, as Kazmer et al. (2014) found in their study of an online community for people with Amyotrophic Lateral Sclerosis, participants "socially construct their own authoritative knowledge" (p. 10) away from the knowledge and diagnoses provided by the medical profession. This is similar to one of the findings of Grover's (2015) research that SDL involved a "peer-to-peer network where participants became co-creators of knowledge and a repository of resources" (p. 8), which was crucial to the treatment and ongoing management of their children's health.

This is an interesting finding at a time that community building technologies are emerging and also theories of knowledge and learning are developing that highlight the importance of contextual factors in learning such as technology. The emergence of particular technologies has given a new interest in theories of knowledge and learning, ranging from social constructivism to connectivism (Anderson & Dron, 2011). The essence of these theories is the suggestion that the emerging social networks can help people in their need for critical analysis and validation of knowledge and information to

support their SDL and the future development of networks. Morrison and Seaton (2014) suggested that "the conjoining of self-directed learning strategies within the context of an informal learning community, using online communication tools and affordances, is an exciting and relatively unexplored territory" (pp. 30-31). From an adult education perspective, what is exciting is that disparate people can come together easily in their SDL endeavors in a way that would not have been possible in the past when the emphasis on learning was on formal education.

The recent proliferation of peer-to-peer online connectivity means that learners do not necessarily need to engage in formal learning coordinated by institutions. Instead they can "rely on the aggregation of information and informal communication and collaboration available through social media to advance their learning" (Kop & Fournier, 2010, p. 2). As espoused by ANT, this attests to the power and possibilities of bringing humans and technology ("actants") together in the creation of something new (Latour, 2005). In the case of online self-help groups such as OOTS, it is a dynamic and fluid context in which isolated/stigmatized sufferers can connect, validate, and engage in SDL about a topic.

However, some researchers have suggested that informal online SDL may in fact diminish competence. For example, Fischer (2009) contended that while the transition from Web 1.0 to 2.0 and social media created a fundamental shift from a consumer to an active engagement culture, participants might not always have the experience to be able to make the most of the possibilities offered by the technologies. In contrast, in a study of bloggers with Multiple Sclerosis (MS), Sosnowy (2014) found that living with the disease provided powerful "lay expertise" that is highly valued by those seeking to learn about a chronic illness such as MS. Similarly, Morrison and Seaton (2014) found that "lived experience is a cornerstone of expertise, a highly regard commodity" (p. 37).

The suggestions from the literature led us to this research project as we found it to be valuable to understand how people in one online self-help group, OOTS, would actually experience their SDL.

Method

Beyond the obvious desire for support, the ability to engage in informal peer-to-peer SDL to deal with confusion regarding CPTSD seems to be a major reason many are drawn to OOTS. We found it important to confirm this empirically by gathering data on what was involved in this learning. Thus, the overarching research question was the following: How do participants in an online self-help group experience SDL?

Design

To gather data a mixed methods paradigm was used that involved both qualitative and quantitative methods through an anonymous online questionnaire involving Likert and open-ended questions respectively. This was a pragmatic choice and seen to be the best fit with the research question and with the context of gathering data from participants

with CPTSD. This meant that more direct data gathering methods, such as interviews or focus groups, might negatively affect their condition and be undesirable.

Sampling

A recruitment message was posted at OOTS asking for participants. Nineteen active members volunteered and were asked to complete an online questionnaire anonymously. Neither the real identities nor the forum names of participants were known to the researchers, and only nonidentifying demographic information was requested. The questionnaire was based on our review of the literature and involved questions related to the participants' experience of SDL at OOTS.

Analysis

For the quantitative data analysis, the online software's capacity for analysis was used. The qualitative data were coded and analyzed according to emerging themes in the data.

Ethical Considerations

The study adhered to the Canadian Tri-Council ethics principles for carrying out research on human participants. One of the researchers is the site founder and a regular participant at OOTS that raised the potential for ethical and confidentiality issues for both her and the participants. To lower any risk, each participant completed the questionnaire anonymously. This measure was intended to reduce or eliminate any possibility of biased behavior (positive or negative) by the researcher in her role in which she has the administrative responsibility and capability to edit or remove posts and to warn or ban members. It was also decided to take the unusual step of not revealing her real identity so that she may avoid any OOTS members gaining access to her email or other personal information. Both the recruitment letter (forum post) and the informed consent form advised OOTS members of this and suggested that any questions or concerns might be directed to the other investigator. Thus, there was little to no risk to participants given that the questionnaire was completely anonymous, they were aware that they would not be told the researcher's real identity, participation in the study was voluntary, and that they could withdraw at any time. All participants read and agreed with the informed consent form before completing the questionnaire.

Findings

The study offered the potential to question a global audience as was apparent from the data that included responses from 19 participants representing seven countries. There were nine respondents from America; four from the United Kingdom; one each from Australia, Canada, Holland, and New Zealand; and two who did not specify their country. As discussed in the following sections, the findings of this study confirm members joined not only for support but also to engage in SDL.

Connectivism and Actor Network Theory in SDL

Connecting online with others with the condition was important, and moreover necessary, given that not a single participant learned about CPTSD from a physician. This may be one reason why so many with CPTSD turn to the Internet for information; that is, the medical community's knowledge about the disorder lags behind the mental health field and sufferers must look elsewhere for information. All but one participant had learned about CPTSD and OOTS via an Internet search (n = 15) or another online forum (n = 3). In keeping with connectivism and ANT, this suggests that the two-way communication facilitated by social media creates a symbiotic relationship between people and technology (Anderson & Dron, 2011; Latour, 2005). It seems that because of this symbiosis people are able to engage in the type of SDL that takes place in self-help groups such as OOTS. In effect, social media allow sufferers to connect, validate, and legitimize the disorder *for themselves* without having to wait for front line health care providers to become knowledgeable enough to diagnose and refer them to treatment.

This was an important aspect of SDL at OOTS. For example, members often post about being misdiagnosed because of a lack of knowledge about CPTSD or receiving inappropriate/ineffective or even harmful treatment by mental health professionals who know about PTSD but not CPTSD. One such treatment is Eye Movement Desensitization and Reprocessing (EMDR), which is a common and effective treatment for PSTD. However, when used to treat CPTSD, EMDR can trigger overwhelming *emotional* flashbacks by tapping into an accumulation of unresolved, interpersonal trauma. This contrasts with PTSD in which treatment involves v*isual* flashbacks and short term, impersonal trauma (e.g., car accident). By identifying the differences in effectiveness for PTSD and CPTSD through lived experiences, OOTS members coconstruct knowledge and take action (e.g., consider alternate treatments) they might not otherwise be able to if not for this informal learning network. This also highlights a finding in a study by Kazmer et al. (2014) that the users of the community make decisions on the value of the knowledge and information to the particular community.

All respondents said they joined OOTS because it is accessible 24/7 (*True*, n = 1; *Very True*, n = 17), and free (*True*, n = 3; *Very True*, n = 11), which supports the notion that two-way networked communication creates opportunities for informal SDL. Learners do not necessarily need to engage in formal learning coordinated by institutions but can instead make use of the aggregation of information and informal communication and collaboration available through social media to advance their learning. In the case of online self-help groups such as OOTS, it is a dynamic and fluid context in which isolated/ stigmatized sufferers can connect, validate, and engage in SDL about a topic. As discussed in the next section, a significant finding in this study is the value of lay expertise and social constructivism in SDL.

Lay Expertise and Social Constructivism in SDL

When asked to rate the statement "Learning from others at OOTS is important to me," almost all respondents answered in the affirmative (*True*, *n* = 1; *Very True*, *n* = 17). Moreover, as depicted in Figure 1 over two-thirds of respondents rated the quality, relevance, and usefulness of their learning from other members as *High*, which reflects the value and credibility respondents accord what they learn from peers. This was confirmed by Sosnowy (2014) who suggested that "lay expertise" is highly valued by participants of self-help groups and similarly by Morrison and Seaton (2014) who found in their study of SDL in an online self-help group that it is of great importance to participants to be able to *learn with and from peers*. According to Merriam and Bierema (2014), "the social construction of knowledge [is] central to self-directed learning" (p. 37).

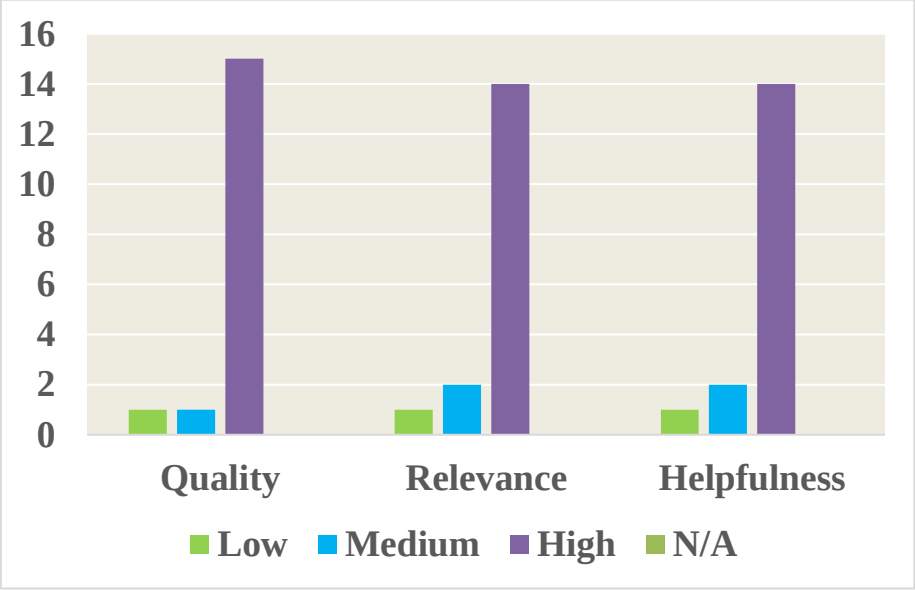

Figure 1. Quality, relevance, and helpfulness of learning at OOTS.

The findings in this study confirm that SDL is enhanced by shared experience, which was seen to be a valuable and valued resource. For example, one respondent stated the following:

> I feel relieved meeting someone else with a similar situation - I can learn what is based on the CPTSD and what is just regular life, from others who understand why I can't tell the difference all the time. I don't feel judged for my ignorance when working with and learning from peers.

Another participant wrote, "I try to relate with other people's experiences rather than reading books. I prefer to address what I know is going on with me, and see what I do and do not have in common with other participants."

Over two-thirds (n = 17) of respondents said they learned about CPTSD by posting back and forth with other members (*Moderate Amount*, n = 5; *A Lot*, n = 9), and by reading members' posts (*Moderate Amount*, n = 5; *A Lot*, n = 12). Only a small number indicated they also learned via emailing privately with other members (*A Little*, n = 3; *Moderate*, n = 1; *A Lot*, n = 0; *Not At All*, n = 14), and none of the respondents reported learning by talking with other members via Skype or phone. These data suggest that while learning from/with peers is important, group learning is more desirable than one-on-one. One reason for this may relate to the fact that members receive individualized feedback from numerous members when posting in a forum of thousands of members as opposed to emailing privately with a select few. When asked to rate the truth of the statement, "Learning at OOTS is important to me because I receive individualized answers to questions," over half said this was *True* (n = 3) or *Very True* (n = 10).

Another reason for this may be the anonymity SDL in the OOTS community affords members many of whom suffer from high levels of social anxiety. When asked to rate the statement "Anonymity is important to me," 16 responded *True* (n = 1) or *Very True* (n = 15). This is an interesting finding that led us to wonder what role anonymity plays in the SDL of respondents. One clue may lie in a respondent's comment, "I have been able to share things on OOTS forums I have not yet divulged in therapy." That is, anonymity creates a safe space in which stigmatized/isolated sufferers can connect and explore difficult issues with fewer repercussions than in a face-to-face environment.

SDT and SDL

SDT posits that people have three main psychological needs—autonomy, competence and relatedness—that contribute to intrinsic motivation and are important to one's self-concept and health and sense of well-being (Deci & Ryan, 2016). It is this last construct of "relatability" or an individual's need to feel a sense of belonging that may help to understand the apparent contradiction between the connection respondents in this study felt to other members and the anonymity of the forum. For example, one respondent wrote, "I cannot relate to anyone in my personal life more than I relate to the members of this site. It has been instrumental to my recovery." Another wrote, "I do not feel alone, and there is so much validation here. There has never once been an instance of 'you're doing something wrong,' 'you need to change how....' There has only been positive reinforcement, encouragement and advice." A third said, "It's hard for me to relate to people who don't have complex trauma in a meaningful or healing way." Thus, it is the shared lived experience of CPTSD that allows members to relate and connect with one another despite the anonymity of the forum. This is also what propels their SDL forward.

The findings also indicate that SDL at OOTS contributes to members' need for competence (to feel effective in life) and autonomy (to have control over one's life). All

respondents in this study indicated that they were better informed about CPTSD (*Somewhat True*, *n* = 1; *True*, *n* = 4; *Very True*, *n* = 14) and more accepting of having the disorder (*Somewhat True*, *n* = 4; *True*, *n* = 3; *Very True*, *n* = 11). Two-thirds said their learning had empowered them in their daily lives (*Somewhat True*, *n* = 5; *True*, *n* = 3; *Very True*, *n* = 6) and when dealing with professionals involved in their care (*Somewhat True*, *n* = 6; *True*, *n* = 4; *Very True*, *n* = 4).

However, not all the comments about learning from others in the forum were positive and reflect the notion that many who come to OOTS do have difficulty relating to others because of the disorder. For example, one participant wrote, "I find that most members are too involved in their own issues and of course they often introduce bias into their advice. Based on their own experiences and knowledge or lack of." Several respondents (*n* = 8) reported feeling uncomfortable posting or experiencing difficulties with other member as barriers to their learning; that is, concern or fear of being rejected, judged, or left out. One commented, "As to not 'feeling comfortable' posting—yes, but not because OOTS has many mean people; it's more my fear of always feeling judged." Another wrote, "Often participants will answer those they have developed a relationship with and I've often been ignored on there." A third said, "Sometimes I'm so paranoid and take it personally when I don't get a response or people can't help me." Given that a major symptom of CPTSD pertains to difficulties with relationships (e.g., mistrust of others, feeling like an outsider, fear of rejection), it is understandable that even anonymous posting might be problematic for some members and may explain the high numbers of members who read but do not post at OOTS. In general, however, it can be said that the anonymity of online self-groups such as OOTS affords those with a stigmatizing/isolating disorder the opportunity to connect with others who share the same lived experience and fulfill their need to belong *in relative safety*. This also fosters the learning experience.

This last finding reflects a similar finding by Grover (2015); that is, membership in the group of mothers whose child suffered a pediatric stroke meant a better understanding and information of issues when meeting with health professionals. This reflects one of the main benefits of SDL: "individual learners can become empowered to take increasingly more responsibility for various decisions associated with the learning endeavor" (Hiemstra, 1994, p. 1). In the case of OOTS members, it may be to seek out mental health professionals who are specifically trained and experienced in treating *Complex* PTSD versus (simple) PTSD.

These data highlight a major aspect of SDT that "begins with the assumption that people are by nature active and engaged. When in supportive or nurturing social conditions, they are naturally inclined to take in knowledge and values and to more fully integrate the regulation of behaviors" (Deci & Ryan, 2016, p. 9). Those who join OOTS are intrinsically motivated to learn more about CPTSD and doing so in a positive, peer-to-peer context enhances learning which in turn can foster hope and recovery. Almost all respondents in this study reported feeling more optimistic/hopeful about recovering due to what they had learned at OOTS (*Somewhat True*, *n* = 8; *True*, *n* = 6; *Very True*, *n* = 3). Over half said what they had learned at OOTS had helped them to recover (*Somewhat True*, *n* = 10; *True*, *n* = 1; *Very True*, *n* = 3). The positive

learning outcomes identified in this study suggest participants' feelings of competence were enhanced rather than diminished.

The findings in this study with respect to learning from OOTS resources support the notion that being active participants in SDL fosters feelings of competence. A majority said they had learned a *Moderate Amount* (n = 6) or *A Lot* (n = 9) from the resources at the website and rated the quality (Q), relevance (R), and usefulness (U) of these resources as *Medium* (Q, n = 2; R, n = 1; U, n = 1) to *High* (Q, n = 13; R, n = 14; U, n = 14). This is likely because members contribute resources to the forum on an ongoing basis, which means they are relevant, timely, and enhance learning. This is supported in a study by Morrison and Seaton (2014) who found that resources frequently showed up in discussion threads to add depth or clarity to what was being discussed, resulting in "incremental growth of knowledge via multiple and focused resource contributions" (p. 35).

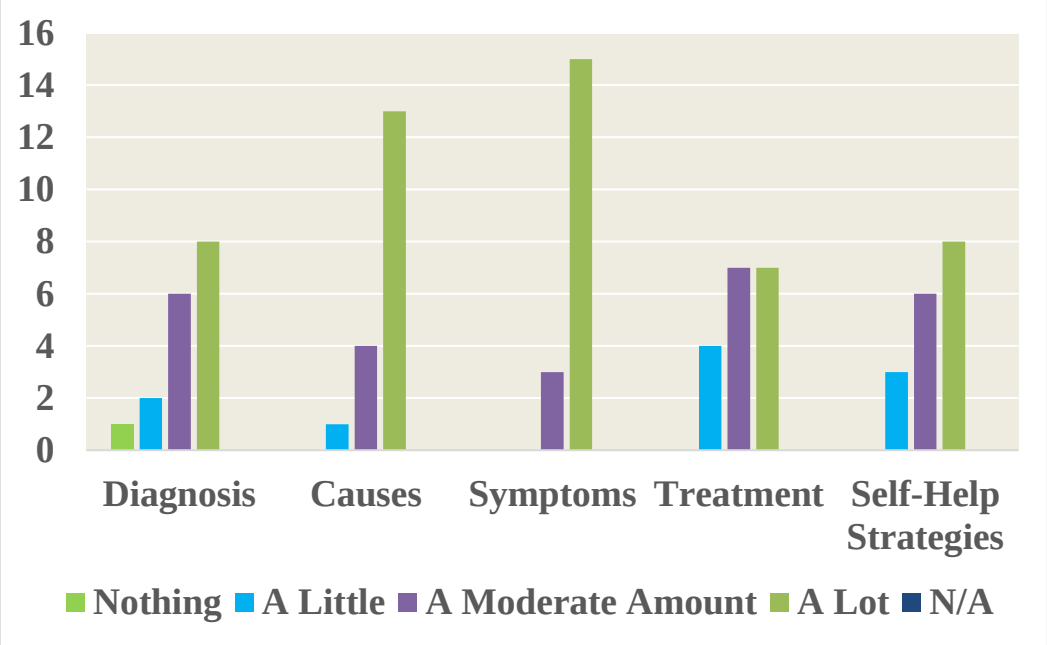

Figure 2: Ratings of how much respondents learned about CPTSD at OOTS.

As depicted in Figure 2, when asked what they had learned about various aspects of CPTSD, a majority of respondents reported learning a *Moderate Amount* or *A Lot*, respectively, about the diagnosis (n = 6, n = 8), causes (n = 4, n = 13), symptoms (n = 3, n = 15), treatment (n = 7, n = 7), and self-help strategies (n = 6, n = 8). When asked what if anything they would like to see more of in terms of learning content/resources at OOTS, respondents only suggested expanding existing topics. Treatment (n = 5) topped the list followed by symptoms (n = 4); self-help strategies (n = 4); relationships (n = 4); parenting (n = 4); diagnosis of CPTSD (n = 3); employment (n = 3); education (n = 2); raising awareness (n = 2); and advocacy, prevention, and

causes (n = 1). Again, the fact that no new content was requested is likely because members regularly contribute resources and suggest new discussion forums/subforums. This type of active and engaged participation is also considered a key characteristic of SDL (Merriam & Bierema, 2014).

These findings suggest that one benefit of SDL is that participants are *contributors* to rather than mere *consumers* of learning resources and opportunities (Fischer, 2009). From the perspective of SDT, being actively involved in shaping, growing, and refining the learning environment in an ongoing and as needed basis can contribute in a positive way to the affective needs of members (i.e., competence, autonomy, and relatedness; Ryan & Deci, 2013). They also illustrate a characteristic of connectivism in which learning constitutes making connections and sharing resources and experiences (Anderson & Dron, 2011).

Conclusion

CPTSD is a relatively recent diagnostic construct which is the subject of some debate by mental health professionals, and confusion on the part of sufferers who consequently turn to the Internet to learn from others who have the disorder. The ubiquity and accessibility of social media provides people in this situation with the opportunity to engage easily in informal SDL. This was not possible in the past and represents a major shift in adult education and learning. Thus, the intent of this research was to add to the knowledge regarding SDL via social networking. This study investigated the experience of informal SDL by members of OOTS, an online self-group for people with CPTSD.

The findings of this study confirmed what other research has recently demonstrated; that is, social networking can be an effective way for people with a concern or interest to engage in informal SDL autonomously outside of more formal education. In accordance with connectivism and ANT, key to this is the symbiosis of human and technology created by social media. Further, as demonstrated in this study the two-way communication capability of these networks fosters the coconstruction of knowledge by members of the network. This is in keeping with social constructivist theory in which learners make meaning of their experience through interaction with others and the environment; that is, the "sociocultural context" (Merriam & Bierema, 2014, p. 36). Surprisingly, it was the anonymity of the forum that participants said helped them to connect with others and open up thereby enhancing their SDL. SDT offers some insight into why this may be the case.

It was clear from the findings of this study that the social aspects of online networking also contributed to participants' sense of relatability. That is, they felt a sense of belonging and of being understood, validated, and supported. In turn, this appears to have contributed to participants' feelings of competence and autonomy in learning about, managing, and recovering from the disorder. Two other contributors that were identified with respect to these characteristics of self-determination included the lay expertise of participants and their active involvement in various aspects of the forum. As in other research regarding informal, online SDL, lay expertise was highly valued by the community. OOTS members possess expertise because of their lived

experience of CPTSD and, thus, competence and the autonomy to make decisions regarding treatment and recovery. Being active in their learning sets members up as contributors rather than simple consumers of information that also may engender a sense of competence and autonomy. In the case of OOTS members specifically, this study highlights that informal SDL led to understanding, validation, and acceptance of the disorder as well as a degree of recovery. In more general terms, the findings confirm that when undertaken in a positive, supportive forum, informal SDL fosters a sense of empowerment, autonomy, competence, and relatedness.

Finally, a number of questions related to SDL and the theoretical lenses used in this study were identified for future research. A first question related to SDL and social constructivism is "What is the role of lay expertise in knowledge building and SDL in online self-help groups?" A second question regarding SDL, connectivism, and ANT is "What is the role of Social Media in informal, online SDL and the co-construction of knowledge?" Finally, a third question related to SDT is "What if any measures can be taken in online self-help groups to encourage feelings of autonomy, competence, and relatedness?" Data regarding these questions would undoubtedly add to our knowledge about informal, online SDL via social media.

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MIDDLE SCHOOL STUDENT TECHNOLOGY HABITS, PERCEPTIONS, AND SELF-DIRECTED LEARNING

Scott R. Bartholomew

Today's students are growing up in a digital world with constant connectivity, instant access to information, and new technological developments at every turn. The feasibility, effectiveness, and possibilities of students leveraging technological tools around them for learning are the subject of continual debate (Becker, 2017; Bowen, 2012; Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011). In this study, 706 middle school students from 18 classes worked in groups of 2-3 to complete an open-ended engineering design challenge. Students completed design portfolios and constructed prototypes in their groups in response to the design challenge. Classes were divided with some receiving access to mobile devices during the study while others did not. In addition to the quantitative data collected, qualitative interviews were conducted with students and teachers. Findings show that student self-directed learning was positively correlated with access to technology, skill in using technology to perform a variety of tasks, and time spent using technology. Conversely, self-directed learning in students was negatively correlated with student social media use and video-game playing.

Keywords: self-directed learning, middle school, technology, mobile devices

Pew (2017) estimated that almost half of students around the world have access to smartphones. This technology access carries with it a host of new expectations, temptations, and possibilities (Prensky, 2007). With access to more information through technology and technology tools, today's students have great potential for self-directed learning (SDL; Fahnoe & Mishra, 2013). However, relatively little is known about the relationship between student technology access, habits, and the potential link to their own self-directed learning (Fahnoe & Mishra, 2013; Liu, Navarrete, & Wivagg, 2014; Teo et al., 2010).

Considering the ever-changing landscape around student technology habits and self-directedness in learning, this research sought to identify possible relationships between a variety of potentially-influential variables related to student technology habits, perceptions, and student self-directedness in learning. These findings will contribute to overall discussions around mobile devices, technology, and self-directed learning in K-12 settings. This study examined data from 706 middle school students

enrolled in an introductory Technology & Engineering Education (TEE) class with some students receiving ubiquitous access to mobile devices during a design unit and other students having no access.

Statement of the Problem

Although much has been done to research self-directed learning in adults (Fahnoe & Mishra, 2013; Liu, Scordino, Geurtz, Navarrete, K, & Lim, 2014; Teo et al., 2010), less work has been done with K-12 students (Lee, Tsai, Chait, & Koht, 2014), especially middle school students (Teo et al., 2010). Additionally, although research into relationships between a personal characteristics and self-directed learning has been done (Cosnefroy & Carre, 2014; Guglielmino, 1977; Hiemstra, 2006; Lee et al., 2014), less work has been done around student technology habits and self-directed learning (Fahnoe & Mishra, 2013; Lee, et al., 2014). An understanding of the SDL habits, abilities, and technological-relationships among middle school students would assist teachers, administrators, and policy-makers as they make important decisions around student technology access, use, and integration.

Research Questions

Using a mixed-methods approach, this study investigated two research questions:

- RQ_1: How do students perceive self-directed learning and the opportunities for self-directed learning in school settings?
- RQ_2: What relationship, if any, exists between student technology habits and student self-directed learning?

Quantitative data from student survey responses related to their own technology habits using a modified version of the Self-Directed Learning with Technology Scale (Teo et al., 2010) and qualitative interview responses were collected from 706 middle school students. All data were collected in TEE classes in conjunction with work on an open-ended engineering design challenge.

Self-Directed Learning

The ability to direct one's learning has been identified as a crucial skill for success of 21st century learners (Fahnoe & Mishra, 2013; Partnership, 2017; Zsiga & Webster, 2007). SDL includes a "students' ability to self-assess their own learning needs in order to carry out activities to inquire and find out about the things they want to know" (Van Deur, 2004, p. 167). SDL combines both an understanding of what is not known with an understanding of what activities need to be undertaken to obtain the needed knowledge and "characterize[s] peak performers in all walks of life" (Costa & Kallick, 2004, p. 57). Operationally, self-directed learning is defined by Knowles (1975) as

> a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes. (p. 18)

Middle School Student Self-Directed Learning

Although most SDL research has focused on adults and university level students (Fahnoe & Mishra, 2013; Liu, Scordino, et al., 2014; Teo et al., 2010), there have been limited efforts towards SDL research with K-12 students (Agra, Blanchard, & Wehmeyer, 2000; Lee et al., 2014; Mok, Leung, & Shan, 2005). Characteristics of self-directed learners were identified by my review of pertinent literature from 2000 to present around middle school students and SDL. The literature highlighted several connections between SDL, learners' traits, and environmental characteristics (see Figure 1).

Learner Trait	Reference
a strong desire to learn and curiosity	Mok, Leung, & Shan, 2005; Saeednia, 2011; Van Deur, 2004; Van Deur & Murray-Harvey, 2005
high levels of self-efficacy	Heller & Sottile, 1996; Van Deur 2004; Van Deur & Murray-Harvey, 2005
learner ability to incorporate learning strategies	Mok, Leung, & Shan, 2005; Van Deur & Murray-Harvey, 2005
self-motivation	Van Deur, 2004; Van Deur & Murray-Harvey, 2005
time-management skills	Mok, Leung, & Shan, 2005; Van Deur, 2004; Van Deur & Murray-Harvey, 2005
the ability to set learning goals	Mok, Leung, & Shan, 2005; Van Deur, 2004
creativity	Doering & Henrickson, 2015

Environmental Characteristic	Reference
the presence of a problem to be solved	Agra, Blanchard, & Wehmeyer, 2000; Saeednia, 2011; Van Deur & Murray-Harvey, 2005
a positive classroom environment	Heller & Sottile, 1996; Van Deur, 2004; Van Deur & Murray-Harvey, 2005
group work settings	Heller & Sottile, 1996; Mok, Leung, & Shan, 2005; Van Deur, 2004
the presence of technology	Fahnoe & Mishra, 2013
student media literacy skills	Jolls, 2015

Figure 1. Middle school student learner traits connected to SDL.

Technology Access and Self-Directed Learning

Three works were instrumental in guiding this research. In 2006, Hiemstra discussed the ways the Internet is changing how people learn, gather information, and assimilate knowledge. Hiemstra examined the changes in SDL as a result of the ubiquitous nature of the Internet. In 2013, Fahnoe and Mishra utilized the newly-developed Self-Directed Learning with Technology Scale (Teo et al., 2010) to investigate the relationships between 6th grader's SDL and technology use. Fahnoe and Mishra reported that students in the technology rich environment were statistically significantly more self-directed in their learning than their classmates in the traditional classroom, suggesting that technology carries with it the possibility of increasing and encouraging self-directed learning in K-12 students. Finally, in 2014, Lee et al. published an exploration of students' perceptions of SDL with and without technology. They found that students who engaged in self-directed learning in face-to-face contexts without technology also engaged in self-directed learning practices in technology supported contexts, suggesting that self-directed learning practices may happen independently of the presence of technology. Considering these publications and the general lack of SDL research around middle school students, the influence of student technology use and habits on their self-directed learning practices remains an area warranting further investigation and research.

Self-Directed Learning With Technology Scale

Although most studies around SDL have utilized the Self-Directed Learner Readiness Scale (Teo et al., 2010), this scale was developed for an adult audience (Guglielmino, 1977) and does not have a specific connection to technology. The Self-Directed Learning with Technology Scale (SDLTS) was developed in 2010 by researchers at Nanyang Technological University who sought to develop an SDL scale more suited for K-12 students that also combined a technology component. Teo et al. (2010) described this instrument as

> a self-report instrument to measure self-directed learning with technology among young students…. The *SDLTS* offers an alternative to existing measures of self-directed learning which were mostly designed for older students (e.g., adult, university) and do not include the technology element. Comprising two factors, the *SDLTS* measures respondents' perceptions in terms of their self-management and intentional learning. (p. 1769)

The SDLTS, which includes six questions around self-management and intentional learning with technology, has been utilized and validated (Fahnoe & Mishra, 2013; Teo et al., 2010) and has shown promise specifically for identifying the SDL in younger students with a specific emphasis on how technology may play a part in the students' SDL. The SDLTS was selected for use in this study based on the age of the participants and the recent success and validation of the instrument. The questions in the SDLTS were modified minimally to broaden the topic of each question from a

focus on "computers" to a focus on computing technologies (e.g., "computers" was changed to "computers and/or mobile devices" in line with the research questions and design).

Mobile Devices in K-12 Settings

Although a comprehensive review of the literature related to mobile devices in K-12 settings is beyond the scope of this work, key findings can provide context. Mobile device ownership among youth aged 4 to 14 has experienced double digit growth since 2005 and is expected to follow a similar trajectory moving forward (Common Sense Media, 2013; NPD Group, 2008; Shuler, 2009). A Pew study of American teens found that 73% of teens have access to a smart phone and "92% of teens go online daily and 24% say they are online 'almost constantly'" (Lenhart, 2015, p. 1). Another study (Common Sense Media, 2017) found that American teens spent an average of 9 hours a day on media, most often through mobile devices. These findings are not confined to the United States as estimates show that 43% of the world now has smartphone access (Pew, 2017).

According to an analysis by Hwang and Tsai (2011), "mobile and ubiquitous learning research has greatly advanced in the recent 5 years" and "students from higher education and elementary schools have remained the major samples of mobile and ubiquitous learning research" (p. 67). Similarly, Liu, Scordino, et al. (2014) noted that "literature has shown a significant increase in recent years in terms of publications reporting both projects relating to and studies being conducted on mobile technology use in education" (p. 326). Hwang and Tsai (2011) shared several other ideas: mobile and ubiquitous learning research has greatly advanced in recent years, most research is being conducted with higher education and elementary school students, most studies on mobile devices were not specific to any learning domain, and the majority of research conducted related to mobile learning has been conducted outside of the United States.

Liu, Scordino, et al. (2014) reported that of 63 articles reviewed, 21% compared the effectiveness of mobile learning to traditional learning settings while 79% represented exploratory investigations of mobile learning in K-12 settings. Over half of the studies cited originated in Taiwan with only 11% originating in the U.S. Additionally, most K-12 studies examined elementary school students with studies researching mobile devices and middle school students representing the least amount (14%). These findings from both meta-analyses demonstrate several key areas of necessary research, and this study was guided in part by these areas of ambiguity.

Method

Situated in a large suburban school district (over 75,000 students) located in the Western United States, the participants in this study were mainly from a suburban middle class population with a small free/reduced lunch student population (16%). Six teachers in this district were recruited for participation in this study based on willingness to participate, similar teaching level and experience, comparable class/course loads, and recommendations from the district supervisor. The teachers

implemented the study in the introductory-level Technology & Engineering Education course for middle school students at their school, and a total of 706 students from 18 classes were recruited for participation in this study through the teachers. The duration of this study was 2 weeks (five 90-minute class periods). Data for the classrooms, teachers, and schools with respect to student socioeconomic status, class size, enrollment, and student GPA were all compared across classes and relative comparability was found.

Students were placed into groups, provided with instruction related to engineering design, and tasked with solving an open-ended engineering design challenge related to designing and creating a new pill holder/dispenser for a client (see Figure 2). The students in the experimental group were informed that they would be allowed ubiquitous access to mobile devices (either their own or a school-provided device) for the duration of the project for use in conjunction with their work on the project. Students in the control group maintained the already present district wide restrictions on mobile device access during class.

Quantitative Data Collection

Prior to the study all students completed a prestudy questionnaire that included modified questions from the SDLTS as well as questions related to demographics, their technology habits and use, and their experience and comfort with technology. After the study the students participated in a poststudy questionnaire with similar questions. The majority of questions were Likert scale questions with values ranging from 1 to 5 (i.e., 5 = *strongly agree*, 4 = *somewhat agree*, 3 = *neither agree nor disagree*, 2 = *somewhat disagree*, 1 = *strongly disagree*). Using a unique identifier, the student responses from the pre and poststudy questionnaire were matched following the study. Prior to analysis the data were conditioned to remove incomplete and duplicate entries and statistical tests for the appropriate assumptions were conducted.

Qualitative Data Collection

After the study 30 students were selected for interviewing by their teachers; teachers were instructed to identify a mix of students based on their performance in class (e.g., two high-performing students, two low-performing students, and one average-performing student). Interviews were semistructured with questions revolving around self-directed learning, access to mobile devices, and student perceptions of the project. All responses were transcribed and coded descriptively and thematically using Saldaña's (2013) recommendations. In this 3-step process, the responses were coded first by identifying keywords that embodied the overall content of each response. In the next step the keywords were used to generate "ideas" or "themes" that represented each response. In the final step, the themes were combined to reach overall themes for each question from all the responses that were used to expand upon and clarify findings related to the research questions.

Engineering design challenge

Context: An elderly individual enjoys traveling internationally. Ideally, this person would like to travel internationally between 2-3 months of the year. This person has a few ailments and allergies that require medication. In addition this person also takes vitamins.

Challenge: You have been hired to design a new medicine dispenser for this client. Your design should:

1. Be easy to use
    a. Easy to open and close
    b. Easy to get pills in and out
2. Assist this person in remembering when to take the pills
    a. Day of the week and time of day
    b. Correct number of pills that should be taken.

Criteria & Constraints: Your design should:

1. Remind the person when to take each pill (that is: time of day and day of the week).
2. Remind the person how many of each pill to take.
3. Be small enough to fit easily in a purse, handbag, backpack, or pocket for travel (should fit easily within an 8" x 8" x 8" cube)
4. Be childproof (that is: difficult for a child to open).

Resources: The breakdown for when pills should be taken and the quantities is included here.

Pill Name	Pill Size	Number taken at each dose	When to take the pill
Vitamin A	0	2	Monday (morning)
Vitamin B	2	1	T/TH (night)
Vitamin C	1	1	Sunday (morning)
Iron	2	1	M/W/F (morning)
Allegra D	0	1	Daily (morning)
Potassium	1	1	Daily (night)
Sodium	0	1	T/TH (morning)

	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
AM	Allegra D Vitamin C	Allegra D Vitamin A Iron	Allegra D Sodium	Allegra D Iron	Allegra D Sodium	Allegra D Iron	Allegra D
PM	Potassium	Potassium	Potassium Vitamin B	Potassium	Potassium Vitamin B	Potassium	Potassium

Pill Size 0
M&M Mini
Height: .35"
Width: .35"
Thickness: .2"

Pill Size 1
M&M Candy
Height: .47"
Width: .47"
Thickness: .25"

Pill Size 2
M&M Peanut Butter
Height: .6"
Width: .6"
Thickness: .3"

- *For this design challenge you can assume that all pills are the sizes and shapes shown above and listed in the table*

Supplies:
Students will be provided with tools, materials, and supplies to proto-type and build while they are designing. Students should plan carefully to conserve materials as no additional materials will be provided. All material does not need to be used in the design. Building items include:

General Supplies
- Plastic bag containing all supplies
- 10 3x5 cards
- 2 copies of the engineering design process
- 2 copies of the engineering design challenge
- 1 pair of dice
- 2 red pencils
- 2 green pencils
- 1 Pentax Fujifilm instant camera (paper groups)
- Film (paper groups – 130 sheets per teacher)
- 1 pad of post-it notes

Handling collection
- 3 small bottles
- 1 small piece of cardboard
- 1 spool of thread
- 3 Sewing Needles
- 2 strips of cloth
- Wire (2' picture hanging wire, no. 2)
- Clay (one 4 oz. container)

Modeling Collection
- 1 plastic cup
- Plastic (one 12" x 12" sheet - .007" thickness)
- Cardstock (two 8.5" x 11" sheets, assorted colors)
- Rubber bands (approximately 25, assorted sizes/shapes)
- String (polyester kite string, 3')
- Paper clips (20 small, 10 large)
- Straws (ten flexible neck)
- Dowel (four .125 X 4")
- 20 m&m's minis (to represent pill size 0)
- 15 m&m's (to represent pill size 1)
- 10 m&m's peanut butter (to represent pill size 2)
- 5 buttons
- 4 clothespins
- 20 jumbo craft sticks
- 15 toothpicks
- 10 small cups with lids
- 10 interlocking craft sticks
- 10 Pipe cleaners

Classroom Supplies (provided by the teacher)
- Tape (masking tape, 1 roll)
- Hot glue gun and glue (10 glue sticks)
- Scissors (1 pair)
- Paper (8.5" x 11" sheets, white)

Evaluation Rubric: students will complete a design portfolio that will document their process as they design their product. Students will be rated based on their design portfolio and their final product using the rubrics below.

Portfolio Evaluation

Item	Evaluation Criteria	Weight Value
Questions/Prompts	Each question or prompt was responded to by the students with an explanation, picture, or drawing.	2
Pictures	Each picture box contains a picture representing student work. Pictures demonstrate a logical progression of the product through the design process.	1
Design Process	Steps of the engineering design process are clearly demonstrated by the students in the portfolio.	1
Overall Portfolio	Portfolio is easy to read, follow, and understand	1
Self-directed Learning	Student demonstrated self-directed learning in their portfolio creation	1

Product Design Evaluation

Item	Description	Weight Value
Criteria and Constraints	Designed product satisfies provided criteria and constraints	1.5
Feasible & Functional	Designed product is both feasible and functional	1.5
Aesthetics	Design product is aesthetically pleasing	1
Creativity	Designed product demonstrates original thought, insight, and innovation	1

Figure 2. Engineering design challenge.

Findings

Following conditioning and diagnostics tests to ensure sound results all data were analyzed using SPSS statistical software (Version 23). Although the vast majority of surveys were completed, several factors including missing responses, absent students, and attrition resulted in small variation in total number of responses for each question. The findings, in alignment with the research questions, are as follows:

Research Question 1: How do Students Perceive Self-Directed Learning and the Opportunities for Self-Directed Learning in School Settings?

To investigate this research question students were asked three open-ended questions in the semistructured interviews. Each of these questions sought to further understand students' perceptions of SDL and the opportunities for SDL in educational settings. The student responses for each question and the emerging themes are outlined here.

What does self-directed learning look like? Prior to the semistructured interviews students were read the definition for SDL—included previously (Knowles, 1975)—and asked to describe what SDL might "look like" if they were to view it in a classroom. Student responses themed on student's internal desire to learn (coded 6 times) and choice (coded 3 times); for example, students shared the following:

> *[SDL is], someone trying to learn something like, like by themselves like, if they want to instead of like, so um, like asking people about it and maybe going on the internet to find out the answer.*
>
> *I think [SDL]is like if you want to learn something and you kind of teach yourself at it instead of like having someone teach you, like, you learn like, on the internet how to do it and then like teach yourself.*
>
> *[SDL is] somebody actually choosing what they have to do and what they want to do in their education.*

Thinking about your experience at school—outside of this study—how much opportunity is there for self-directed learning at school? Student responses to this question were varied but themed around two ideas: (a) the current *structure* of schools makes SDL difficult (coded 8 times) and (b) students need choice for SDL (coded 3 times). The curriculum, the class structure, the teachers, and the rules were all cited as limiting facets of the current educational structure on SDL. For example, students remarked the following:

> *There is not a lot [of opportunities for SDL at school] because even if [the teachers] try, to do something like that, there's not a lot of, resources they can use. Because you can't use your phones and… a lot of the websites you need to get to are probably blocked.*

Not very [many opportunities for SDL], because there's a set thing that the teachers are supposed to teach you and they teach you that.

Thinking about this study, how did your own self-directed learning and the self-directed learning of your peers compare with times past? To determine if the opportunities for SDL in school were contingent on a certain type of project the students were asked to compare their own SDL and that of their peers with other classroom experiences in school outside of this research. Specifically, students were asked to compare the opportunities for SDL during the open-ended engineering design challenge with other learning opportunities at school. Student responses seemed to indicate that students believed the open-ended engineering design challenge presented more opportunities for SDL than other opportunities based on the "openness" of the problem and the opportunities for student "choice" (coded 6 times). Two students remarked the following:

I feel like there was more [opportunities in this assignment] than usual, like… Cuz, I felt like it was more, like, open to the students, not as much, like, the teachers are telling you what to do.

There was a ton more [SDL in this assignment], cuz you didn't have to do a certain type of pill bottle, you just kinda, design it with your own, with the supplies that you were given, and you got it right with the ends on it, on it and stuff.

Overall it appeared that the students equated SDL with student choice and that SDL was somewhat at odds with the current educational system, structure, and norms. Students repeatedly highlighted the need for students to learn about things *they* were interested in and to emphasize what *they* wanted to learn.

Research Question 2: What Relationship, if any, Exists Between Student Technology Habits and Student Self-Directed Learning?

The second research question revolved around potential relationships between student technology habits and their self-directed learning. In addition to identifying their own technology habits, the students were asked about access and skill with a variety of technologies, tools, and processes related to their technology habits. These questions asked students to identify how many minutes were spent each day using a variety of technologies and engaging in various behaviors with these technologies. To answer the second research question the responses of students to these questions were compared with the student's self-directed learning as obtained through the modified SDLTS. Prior to analysis tests were run to check for instrument reliability that produced a Cronbach's alpha of .7 suggesting acceptable internal consistency.

Using correlational analysis techniques, a Pearson correlation was obtained between student SDLTS scores and student access to computers and mobile devices

(see Table 1). These questions were not binary (yes/no); rather, they presented several options related to the amount of time spent with various items. Of the relationships investigated, access to and the use of computers at home was significantly positively correlated with self-directedness in students (r = .09, p < .05), suggesting that more access and time spent on the computer at home was correlated with higher self-directedness in students. Additionally, the number of computers or mobile devices a student had access to at home and school was also significantly correlated with higher levels of self-directedness in students (r = .14, p < .01). The other relationships were not significant suggesting that student SDL may not be related to these factors.

Table 1. *Student SDLTS Score and Computers and Mobile Devices Access and Use*

Technology Habit Questions	*r*	Sig. (2-tailed)	*N*
Do you have access to a computer at home? If so, how much time do you spend on your *home* computer daily?	0.09*	.03	547
Do you have access to a computer at school? If so, how much time do you spend on your *school* computer daily?	0.01	.80	549
Do you have access to a mobile-device at home? If so, how much time do you spend on this mobile-device daily at *home*?	0.05	.23	551
Do you have access to a mobile-device at school? If so, how much time do you spend on a mobile-device daily at *school*?	0.04	.40	552
How many computers and/or mobile devices do you have access to at *home and school*?	0.14**	.00	554

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

Students were asked about their daily use of technology in specific applications. Students were not asked to differentiate between mobile device and computer use but rather to report the amount of time spent *daily* (in minutes) on each of the tasks listed (see Table 2). None of the relationships demonstrated statistical significance suggesting that time spent in any one of these areas was not significantly correlated with higher or lower self-directed learning in students.

Students were further asked to identify, using a scale ranging from *never or once a year* to *several times a day*, how often they used a mobile device to perform a variety of specific tasks. These tasks were identified based on the functionalities of mobile devices and the *SpeakUp* survey projects that have advocated for mobile device inclusion in the classroom (Project Tomorrow, 2011, 2012a, 2012b, 2013, 2014). The findings (see Table 3) show statistically significant relationships for all the identified tasks suggesting that more frequent student participation in the listed tasks with mobile devices corresponded with higher levels of self-directedness in students.

Table 2. *Student SDLTS Score and Student Daily Use in Specific Applications*

How much time do you spend daily on the following?	*r*	Sig. (2-tailed)	*N*
Daily Facebook use (in minutes)	-0.02	.57	543
Daily Twitter use (in minutes)	0.04	.36	543
Daily Instagram use (in minutes)	-0.07	.12	543
Daily Snapchat use (in minutes)	-0.04	.30	543
Daily text-messaging (in minutes)	-0.02	.65	543
Daily YouTube use (in minutes)	-0.01	.83	543
Daily personal email use (in minutes)	0.05	.22	543

Table 3. *Student SDLTS Score and Average Time Spent on Specific Tasks*

On average over the past year (in an out of school settings) how often have you used a mobile device to _____?	*r*	Sig. (2-tailed)	*N*
Manage, create, or manipulate digital photos, digital audio, or digital videos?	.10*	.02	555
Access information via the Internet?	.25**	.00	555
Learn new skills?	.25**	.00	555
Communicate with others through text, phone call, or email?	.15**	.00	555
Send pictures, videos, or audio files to someone else?	.10*	.02	555

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

Recognizing the difference between the amounts of time spent on a task and actual skill level with a task, students were asked to identify how skilled they perceived themselves being using a 5-point Likert-scale with options from *not skilled at all* to *very skilled*. In every case student skill level with the identified tasks was significantly correlated with higher levels of self-directed learning in students (see Table 4). Each of these relationships was significant at the .01 level and represents a small to medium effect size (Cohen, Cohen, West, & Aiken, 2013) suggesting that high levels of self-directed learning in students may correspond with skill in the identified tasks. In terms of practical significance these relationships signify areas for further discussion, observation, and investigation and may help identify potential skills which may assist in developing SDL in students.

Finally, students were asked to quantify the percentage of time during an average day spent in several technology-related/enabled activities. Student responses revealed that students spent most of their time watching videos or listening to music (*M* = 28.13%) followed by playing video games (*M* = 23.60%), working on homework (*M* = 18.23%), messaging or communicating with friends (*M* = 17.82%), on social media (*M* = 11.72%), and creating content to share with others (*M* = 3.88%). Percentage of time spent playing video games and percentage of time spent on social media were both significantly negatively correlated with self-directed learning in students suggesting that as students allocated a greater percentage of their time spent with technology to either video games or social media their own self-directed learning decreased (see Table 5).

Table 4. *Student SDLTS Score and Student Skill-level With Different Tasks*

How SKILLED are you at using a mobile device to _____?	*r*	Sig. (2-tailed)	*N*
Manage, create, or manipulate digital photos, digital audio, or digital videos?	.26**	.00	555
Access information via the Internet?	.34**	.00	555
Learn new skills?	.37**	.00	555
Communicate with others through text, phone call, or email?	.21**	.00	555
Send pictures, videos, or audio files to someone else?	.23**	.00	555

**Correlation is significant at the 0.01 level (2-tailed).

Table 5. *Student SDLTS Score and Allocation of Total Time Spent With Technology*

What percentage of your time on the computer or with mobile devices is spent on the following?	*r*	Sig. (2-tailed)	*N*
Messaging or communicating with friends (through voice or text)?	-.01	.84	555
Watching videos or listening to music?	-.03	.42	555
Playing video games?	-.09*	.04	555
Working on homework?	.06	.14	555
Creating content that you will share with others (e.g. videos, pictures, etc.)?	.08	.08	555
On social media (e.g. Facebook, Twitter, Instagram, etc.)?	-.15**	.00	555

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

To further investigate students' technology habits and their self-directed learning, several (n = 30) students were asked about mobile device technologies and the possible connection between mobile devices, access to technology, and self-directed learning in semistructured interviews. Students were asked if they believed mobile devices improved or hindered self-directed learning. Students were further questioned about the rationale for their response using open ended questioning. The student responses themed around two major ideas related to SDL: (a) mobile devices enable behavior that is good, bad, self-directed, or something else (coded 12 times), and (b) mobile devices can supplement traditional classroom learning (coded 11 times). Student responses included the following:

Mobile devices enable behavior:
I think [mobile devices in the classroom] would help some kids, but some kids would just play on them, and then, maybe look up a few things

[Mobile devices in the classroom would] help. Well, if people are responsible and they only use them for things that they needed to, they could use Google or something if they have it on their phone and look things up.

Mobile devices can supplement traditional classroom learning:
I think it would help. Because it would like, it would, um, like, tell, help the student understand like what they are learning, like they can search it up if they are not understanding something, like, getting the teacher's help, they could look it up instead of bothering the teacher.

I think [mobile devices in the classroom] could help. Cuz…Mm, what if they need information and stuff they don't know about? Because, then it gives them, then they can, also really learn more.

These student responses identified connections and possibilities for SDL with relation to technology use and access but also noted that mobile devices enabled whatever kind of behavior students chose (i.e., good or bad). Specific affordances of mobile devices were highlighted, and students identified interactions and ways mobile devices could supplement classroom learning. Although these interview questions and student responses were specific to mobile devices, these ideas may be applied more broadly to technology with the accompanying habits, access, and potential connections with self-directed learning (Fahnoe & Mishra, 2013; Mentzer, 2011).

Discussion

Student access to, engagement with, and experiences around technology are critical to understand as we move into an increasingly connected and technological world. SDL, a clearly identified trait for success in 21st century learners (Partnership, 2017), and the potential relationships with technology were explored in this study with middle school students. Although the findings from this research are limited by the students, teachers, and design projects in this study, the implications may prove useful in guiding future research and efforts around improving middle school student SDL. As an additional note, the significance of the correlational relationships identified in this study should be viewed with an understanding and recognition of the practical significance (i.e., effect size) of the results and the implications of these findings. This study was exploratory by nature and the results are far from conclusive; however, these findings may serve to dictate future discussions and pathways for research around technology, mobile devices, and self-directed learning.

Student Perceptions of SDL at School

When asked about SDL at school, students repeatedly expressed the need for student choice both in the actual problem and the method of solving the problem. Students identified the current "structure" of education as a possible deterrent; rules, regulations, norms, assessments, and assigned-work are all things that may inhibit student choice opportunities for SDL. Although the students felt comfortable taking charge of their learning, they felt inhibited by current structures and systems. Teachers and administrators should recognize these feelings and move towards a change in culture, structure, and environment if they wish to encourage more SDL. Student choice could

become a guiding factor in these changes, and students could be allowed a more prominent voice in their education not only in how they respond to a question but also in the actual question they are responding to.

Students noted that the problem at hand (i.e., an open ended engineering design problem) fostered more opportunities for SDL than other learning experiences they encountered in school. Although it is not feasible for the introduction of open ended engineering design problems into every subject, there is room for an increase in open ended problems across all subjects, and design challenges are not solely suitable for TEE classrooms.

Technology Habits and Self-Directed Learning

Although increased access to technology and technology tools was correlated with more SDL in students, these findings were specific to access and tools at home, not at school. Efforts in balancing the gap between the haves and the have nots should continue to emphasize the need for access and opportunities for all students *both inside and outside* of school.

In the student interviews, the students highlighted two key points related to SDL and technology: mobile devices, or technology, enable behavior (good or bad), and mobile devices may be a tool for supplementing classroom learning. Although a variety of efforts have been focused on educating students *about how technology can help with learning*, efforts are needed to *help students make correct choices and exercise discipline* in their technology use. Although many efforts have been made to get technology tools such as mobile devices into classrooms, these efforts may fall short in accomplishing the overall task of increasing student SDL. It appears from this research that students need access to these tools *and* the accompanying training, supervision, and assistance in using them wisely.

Time spent by students on almost all tasks related to social media—the most popular thing for students to do with a mobile device (Pew, 2017)—was negatively correlated with SDL (the exception being email). However, time spent on specific educational pursuits such as accessing new information, learning new skills, communicating with others, and managing and sending files were all significantly positively correlated with higher SDL in students. This was true for both the time spent on these tasks and the student skill-level in accomplishing these tasks. A renewed emphasis on positive and productive technology habits, decisions, and behaviors may lead to an increase in student SDL.

The findings from this study raise many additional questions and areas for further research, but the clear message for educators is the need to refocus efforts on training students *how* to use technology for increasing student SDL. Rather than simply getting the latest technology tools, efforts must also emphasize *how* the tool will be used. This in no way suggests that technology tools such as mobile devices or computers cannot or should not be used for social media or entertainment; rather, the findings from this study simply highlight the need for teachers, administrators, and parents to work together to assist students in using technology to further unlock the potential for increasing their SDL through intentional learning tasks and approaches.

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APPRAISAL OF LEARNER AUTONOMY: AN ESTIMATION OF NORMATIVE STATISTICS FOR U.S. NONTRADITIONAL ADULTS

Michael K. Ponton

As psychological instruments become more widely used, normative descriptive statistics of mean and standard deviation gain in importance in order to serve as referential standards for comparison. However, a sample that is truly representative of a given population (i.e., a large, random sample) is rarely available for providing these statistics. The Appraisal of Learner Autonomy (ALA), which measures self-efficacy in autonomous learning, has been used in research around the world for over a decade. The purpose of this research brief is to generate normative statistics (i.e., mean and standard deviation) for U.S. nontraditional adults (aged 25-64) with minimally a high school education by using a previously proposed estimation technique with a nonrepresentative sample of data (N = 817). The presentation of this technique may prove useful to others wanting to generate such statistics in addition to the normative statistics provided to researchers using the ALA.

Keywords: Appraisal of Learner Autonomy, learner autonomy, normative statistics, descriptive statistics, estimation technique

In 2005, the Appraisal of Learner Autonomy (ALA) was added to the battery of instruments that constitute the Learner Autonomy Profile (LAP; licensed to Human Resource Development Enterprises, HRDE). In conjunction with the LAP, this instrument—designed to measure self-efficacy in autonomous learning (Ponton, Derrick, Hall, Rhea, & Carr, 2016)—has been administered to well over 2,000 participants for HRDE sanctioned research around the world (primarily the U.S. and southeast Asia). Such research has focused on theory generation (e.g., Ponton, Derrick, Confessore, & Rhea, 2016), instrumentation issues (e.g., Ponton, Carr, Schuette, & Confessore, 2016), self-efficacy enhancement (Ginnings & Ponton, 2017), and HRDE's various coaching initiatives. Numerous studies have produced a database that includes over 2,000 ALA scores; however, this database is not representative of any specific population.

As research interests in self-directed learning often focus on the nontraditional adult learner (i.e., aged 25 and older) and in light of potential cultural effects suggested to be related to learner autonomy (cf. Ng & Confessore, 2010), there would be great

benefit if normative statistics on the U.S. population of nontraditional adults were available for comparison purposes. Due to the increasing use of the ALA, the purpose of this research brief is to generate the normative statistics of mean and standard deviation by using a previously proposed estimation technique (Ponton & Rovai, 2006). As this technique has heretofore been unpublished, presentation of this technique may prove useful to other researchers with a similar interest.

Estimation Method

Ponton and Rovai (2006) presented a method for calculating the exact pooled mean and standard deviation when given the mean, standard deviation, and sample size for several groups to be pooled; that is, this technique would produce the mean and standard deviation if all the raw data were available for analysis. The usefulness of this technique was argued for meta-analysis and effect size studies (Ponton & Rovai, 2006).

Relevant to the present research brief, Ponton and Rovai (2006) also indicated that this technique could be modified for estimation purposes via targeted group proportions of interest. Such estimation is required when desired proportions (e.g., representative of a population) do not reflect those of the independent variables produced by a nonprobability sample. Modifying their exact solution as they suggested, the technique is as follows:

Let:

k = number of groups
n_i = sample size of i^{th} group
w_i = weighting of i^{th} group
M_i = mean of i^{th} group
$N = \sum_{i=1}^{k} n_i$ = pooled sample size.

The mean square statistic is given by

$$MS = \frac{n-1}{n} s^2 . \quad (1)$$

For the pooled sample, the pooled mean is the weighted mean given by

$$M_P = \sum_{i=1}^{k} w_i M_i . \quad (2)$$

The weighted solution for the pooled mean square is then given by

$$MS_P = \sum_{i=1}^{k} w_i \left[MS_i + \left(M_i - M_P \right)^2 \right] \quad (3)$$

where the pooled variance and standard deviation, respectively, are given by

$$s_P^2 = \frac{N}{N-1} MS_P \quad (4)$$

$$s_P = \sqrt{s_P^2}\,. \quad (5)$$

For the present research brief, the goal is to calculate M_p and s_p that represent normative mean and standard deviation, respectively, for the ALA. In order to complete this calculation, the weighting factor *w* for the population is required as well as the mean and standard deviation for all levels of independent variable combinations to be weighted.

Data

The data from a nonprobability sample of 817 adults were analyzed. These data were generated from numerous studies around the world using the LAP. Although the original database consisted of an excess of 2,000 cases, I deleted any cases associated with study names—such names were included in the database provided by HRDE—that could remotely be construed as being a non-U.S. study. In this way, I attempted to only include data of U.S. adults in the analysis via conservative filtering. The independent demographic variables collected with the LAP and of present interest in defining a population are as follows: age, highest level of education (i.e., high school, baccalaureate, and graduate), and gender. *For the present study, the initial population of interest was U.S. adults, aged 25 or higher, and minimally high school educated.*

Analysis

In order to generate the weighting factor *w* to be used in equations 2 and 3, demographic information for the population was required. Ryan and Bauman (2016) presented the 2015 percentages of U.S. nontraditional adults with various minimum levels of education (see Table 1) for four age ranges. In order to transform the percentages from *minimum* to *maximum* levels in order to match the HRDE data, differences were calculated between the contiguous percentages presented in Table 1 (see Table 2). In order to remove adults without a high school education, the percentages presented in Table 2 were divided by the percentage of adults with a minimum high school education presented in Table 1 (see Table 3).

Ryan and Bauman (2016) also presented the percentages of U.S. nontraditional adults by gender with various minimum levels of education (see Table 4); however, these data were not presented by age. Thus, due to the similarity of percentages by gender in Table 4, the present estimation will assume a 50-50 distribution based upon gender.

Table 1. *Minimum Educational Attainment by Age (Ryan & Bauman, 2016)*

		P (minimum credential)		
Age	*n* (millions)	HS	Bachelor	Graduate
25-34	43.00	90.5	36.1	10.9
35-44	39.92	88.7	36.3	13.8
45-64	83.21	89.4	32.0	12.1
65 and older	45.99	84.3	26.7	11.3

Table 2. *Maximum Educational Attainment by Age*

	P (maximum credential)		
Age	HS	Bachelor	Graduate
25-34	54.4	25.2	10.9
35-44	52.4	22.5	13.8
45-64	57.4	19.9	12.1
65 and older	57.6	15.4	11.3

Table 3. *Maximum Educational Attainment by Age for High School Graduates*

	P (maximum credential)		
Age	HS	Bachelor	Graduate
25-34	60.1	27.8	12.0
35-44	59.1	25.4	15.6
45-64	64.2	22.3	13.5
65 and older	68.3	18.3	13.4

Table 4. *Minimum Educational Attainment by Gender (Ryan & Bauman, 2016)*

		P (minimum credential)		
Gender	*n* (millions)	HS	Bachelor	Graduate
Male	101.89	88.0	32.3	12.0
Female	110.25	88.8	32.7	12.0

Unfortunately, there was minimal ALA data in the 65 and older range with one education category containing no data; thus, *the population was further delimited to the age range 25-64*. The resultant weighting factors are presented in Table 5 for the three

age ranges used by Ryan and Bauman (2016), three highest levels of education, and two gender categories as per the defined population. As an example calculation, the weighting factor for the 25-34 range, high school educated males was determined as follows: .601 (see Table 3) * .5 (gender assumption based upon Table 4) * 43 / (43.00 + 39.92 + 83.21) (see frequency data in Table 1) = .078 (see Table 5). Note that the summation of all weighting factors should equal 1 (barring round off errors) thereby indicating the entire population is accounted for.

Table 5. *Weighting Factors (Ages 25 to 64)*

Age	Education (Max)	Gender	*w*
25-34	HS	Male	.078
		Female	.078
	Bachelor	Male	.036
		Female	.036
	Graduate	Male	.016
		Female	.016
35-44	HS	Male	.071
		Female	.071
	Bachelor	Male	.031
		Female	.031
	Graduate	Male	.019
		Female	.019
45-64	HS	Male	.161
		Female	.161
	Bachelor	Male	.056
		Female	.056
	Graduate	Male	.034
		Female	.034

Note. 50-50 weighting by gender used.

The descriptive statistics required for the analysis are presented in Table 6 for the ALA (possible range 0-900). For the entire nonprobability sample (N = 817), M = 602.2 and s = 150.0. Using equation 2, M_p = 577.5. Using M_p and equations 1 and 3, intermediate factors are presented in Table 7; completing the calculation for equations 3-5, MS_p = 23006.5 and s_p = 151.8.

Table 6. *Appraisal of Learner Autonomy: Descriptive Statistics*

Age	Education (Max)	Gender	*M*	*s*	*n*
25-34	HS	Male	488.3	273.5	6
		Female	563.4	134.7	35
	Bachelor	Male	507.9	143.4	12
		Female	568.4	154.2	51
	Graduate	Male	577.2	136.7	30
		Female	584.2	130.1	96
35-44	HS	Male	535.0	21.2	2
		Female	543.6	187.7	40
	Bachelor	Male	653.3	159.7	10
		Female	587.8	141.3	44
	Graduate	Male	612.0	145.7	66
		Female	633.2	145.8	110
45-64	HS	Male	563.8	78.5	9
		Female	617.2	149.0	29
	Bachelor	Male	613.3	160.0	6
		Female	565.2	159.4	54
	Graduate	Male	633.7	127.5	63
		Female	639.6	150.8	154

Note. $M = 602.2$ and $s = 150.0$ for the raw data ($N = 817$).

Table 7. *Intermediate Factors for Estimate Calculation*

M	*SD*	*n*	*MS* (eq. 1)	$MS + (M - M_p)^2$ (eq. 3)
488.3	273.5	6	62335.2	70291.8
563.4	134.7	35	17625.7	17824.5
507.9	143.4	12	18849.9	23694.1
568.4	154.2	51	23311.4	23394.2
577.2	136.7	30	18064.0	18064.1
584.2	130.1	96	16749.7	16794.6
535.0	21.2	2	224.7	2031.0
543.6	187.7	40	34350.5	35499.7
653.3	159.7	10	22953.7	28699.3
587.8	141.3	44	19511.9	19618.0
612.0	145.7	66	20906.8	22097.1
633.2	145.8	110	21064.4	24166.9
563.8	78.5	9	5477.6	5665.3
617.2	149.0	29	21435.4	23011.5
613.3	160.0	6	21333.3	22614.9
565.2	159.4	54	24937.8	25089.1
633.7	127.5	63	15998.2	19156.6
639.6	150.8	154	22593.0	26449.4

Note. $M_p = 577.5$.

Discussion

The results of the present analysis are an estimate of the normative mean, 577.5, and standard deviation, 151.8, for the ALA (cf. $M = 602.2$ and $s = 150.0$, respectively, for the raw data analyzed) for a U.S. population with at least a high school education in the age range 25-64. The weighting factors in Table 5 can be repeatedly used as more data are acquired thereby providing more refined estimates particularly with respect to independent variable combinations where few data were available for the present analysis (cf. frequencies in Table 6). If more data are acquired in other age ranges, the analysis can be altered following the method presented. Similarly, data from other instruments can be analyzed using the present method in order to generate associated normative statistics useful for comparison purposes.

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