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HEALTH EDUCATION

Physical Education Teachers' Technology Self-Efficacy and Integration

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Abstract

Technology in education strives to parallel the high-tech world we live in. When students' learning environment reflects the ways in which they engage the world, they will excel in their education (Christen, 2009). Physical education teachers (PETs) have reported many barriers to using and integrating educational technology (e.g., Hill & Valdez-Garcia, 2020). PETs' perceived self-efficacy (SE) may play an important role in their ability to integrate technology. The purpose of this study was to explore in-service PETs' self-efficacy to integrate technology into their teaching. Method: Eighty-three in-service PETs (Male=31.3%, Female=68.7%), from around the United States, completed an online version of the previously validated Computer Technology Integration Survey for Physical Education (Krause, 2017). Analysis focused on relationships of participant's SE and technology use. Results indicate a relationship with the level of mastery experiences ($r=.48$, $p<.001$), technology training ($r=.45$, $p<.001$), social persuasion experiences ($r=.28$, $p<.001$), and (vicarious experiences ($r=.28$, $p<.01$), to participants' technology SE ($M=3.70$, $SD= .94$; 1-5 scale). Participants' specific technology training and use are presented, with corresponding correlations to indicate how well SE relates to use. Participants' SE was lower than physical education student teachers

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(Krause, 2017) but similar to PET education faculty (O'Neil & Krause, 2019). PETs may be well equipped to use educational technology after student teaching but may need more training to keep up with the ever-changing world of technology. Professional development opportunities for PETs should focus on providing mastery experiences over vicarious and social persuasion experiences. Furthermore, some educational tools (i.e., Plickers) are valued and used more when PETs have an adequate level of specific educational technology training. Future research should focus on measuring the effects of a professional development workshop on PETs' SE.

Introduction

Technology in education strives to parallel the high-tech world. When students' learning environment reflects the ways in which they engage the world, they will excel in their education (Christen, 2009). Research has noted the positive effects for both students and teachers of technology integration (Costley, 2014), which has led to national organizations and governing bodies, associated with teacher education, to establish a consistent revision of educational technology standards (International Society of Technology in Education 2018; National Board for Professional Teaching Standards, 2014; Society of Health and Physical Educators [SHAPE] 2017; U.S. Department of Education National Educational Technology Plan, 2017). SHAPE, the national organization for physical education (PE) teachers (PETs), has identified the need for technology standards for PET education (PETE) programs. PETE accreditation has included standards related to technology integration since 2001. Furthermore, the national physical education grade-level outcomes for PK-12 students require PETs to have some level of technology ability to help their students meet all the standards (SHAPE, 2013).

Even with an increased focus on quality technology standards for pre and in-service teachers, many have reported that they are not well prepared nor proficient (Gibbone et al., 2010; Hill & Valdez-Garcia, 2020; Juniu et al., 2013; Kretschmann, 2015). For teachers to utilize technology they must first be proficient with using them. Teachers' perceived self-efficacy (SE) plays an important role in a teacher's ability to integrate technology.

Bandura (1997) defines perceived SE as, "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). In other words, SE is an individual's belief in their ability to engage in a specific behavior. According to SE theory, when individuals have a higher SE toward a particular behavior, they are more likely to engage in that behavior. Therefore, PE teachers who have a higher SE toward technology integration are more likely to use technology to enhance their PE instruction. Bandura (1997) further explains that there are three sources of SE: mastery experiences, vicarious experiences, and social persuasion. These sources of SE provide avenues for individuals to develop their SE. For example, a mastery experience in PE includes a teacher successfully incorporating new technology into their instruction. A vicarious experience includes a teacher observing a colleague incorporating technology. Lastly, social persuasion includes feedback from others about using technology in PE. An individual can increase their SE through any combination of mastery, vicarious, or social persuasion experiences (Bandura, 1997).

Technology integration SE has been explored in PE pre-service (Krause, 2017) and with PET education (PETE) faculty (O'Neil & Krause, 2019). O'Neil and Krause (2019) showed that PETE faculty had moderate levels of technology integration SE. Krause (2017) found that pre-service PETs increased their SE to integrate technology during student teaching, with mastery experience having the greatest influence in overall SE. Although PETs can increase their SE using several sources, research to show which source produces the most significant increase in SE to integrate technology for in-service PETs is lacking. As to date, no peer-reviewed research on in-service PETs can be found.

O'Neil and Krause (2019) found that PETE faculty had the highest self-efficacy toward specific educational technology for LCD projectors and pedometers; Interactive whiteboards and classroom management software were the lowest. Kretschmann (2015) found secondary PETs were most proficient at using the internet and Word processing software. Krause (2017) found that PETE pre-service teachers had the highest access to specific educational technology for computers for teacher use, computers for student use, pedometers, and video cameras; computers had the highest daily use with 66.7%, followed by pedometers with 13.3% and computers for students use 10.7%. Conversely, the least accessible and used educational technology tools were personal digital assistants, electronic fitness equipment, and heart rate monitors. Additionally, specific technology training levels were highest for the internet and computer applications and the lowest training levels were personal digital assistant and global positioning system. Hill and Garcia (2020) found at least 70% of PETs (*N*=201) had access to: laptop(s) for personal use; digital projector(s); computer (s) connected to the internet (in a designated classroom); iPods; computer(s) connected to the Internet(outside of PE classroom); pedometers. Gibbone et al. (2010) identified that secondary PETs' most used technology equipment was Word processing. Wagner (2020) identified that PETs had some level of training with activity trackers (70.2%) and iPads (64.9%); Coaches Eye (mobile apps) had the lowest reported level of training with 31.6%.

While many studies have indicated specific educational technologies PETs have access to and use the most, it is not clear what role SE has played toward specific educational technology use. Therefore, the purpose of this study was to explore current PE teachers' SE toward technology integration. This research can assist school districts with adapting professional development opportunities to meet the need of their PE teachers. Research can also provide PETE programs feedback on how to structure their curriculum to effectively prepare their students. In addition, this study aimed to look at the relationship of in-service PETs' use of specific tech tools and their perceived competence to better inform professional development providers and PETE programs what in-service teachers are valuing.

Method

Participants

Ninety-three participants (Male 32.3%, Female 64.6%, some declined to answer; Age=42.71 years, SD=9.91; Caucasian 91.4%, African American 1.1%, Hispanic 6.5%, Asian 1.1%; years teaching=16.41 years SD=9.541) completed the survey. All participants were currently teaching PE at either the Elementary (64.5%), Middle School (26.9%), High School (18.3%), and/or Higher Ed (10.8%) level; participants could select multiple areas of where they teach. Due to the low response rate of higher-ed, their survey responses were eliminated from the analysis (*n=10*). Participants were recruited to complete the survey using social media (Facebook & Twitter) and e-mail. Researchers could not identify participants. All participants provided informed consent in compliance with the universities review board.

Instrumentation

The survey instrument used by participants was the Computer Technology Integration Survey for PE (CTIS-PE), which was identical from Krause (2017). Permission was granted by Krause to use and revise the CTIS-PE instrument for online data collection. The CTIS-PE consisted of items related to (a) SE to integrate technology in PE, (b) participant demographic information, (c) technology tool competency, and (d) technology tool use. CTIS-PE was originally intended for pre-service PE teachers and only minor changes were made. Revisions helped to ensure the language of the instrument was appropriate for in-service PE teachers. No changes were made to the SE portion; technology tools were updated to include more modern tools (i.e., Plickers, iPads, Chromebooks). After all modifications were made a small group (*n=10*) of inservice PE teachers completed the survey to ensure readability and usability. No further alterations were recommended.

The SE portion used a 16-item, five-response Likert scale survey to measure participants SE beliefs for technology integration. Participants rated their current level of confidence with statements regarding technology use on a scale from 1 to 5, with 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree. The CTIS-PE instrument SE measure developed by Krause (2017) has a Cronbach alpha reliability of .952. Participants then rated their level of success with integrating technology based on their own experiences (Mastery), experiences they observed from others (Vicarious), and feedback they have received from others to integrate technology (Social Persuasion). Participants responding using a five-response Likert scale ranging from very unsuccessful to very successful (not applicable was also an option). The last question in this section asked what technology integration requirements and/or expectations were expected of them from their school or district.

Responses were coded either as none, encouraged but not required, required.

The demographic section included age, gender, race, current grade level teaching, and teaching experience. CTIS-PE also asked participants to self-assess their level of technology competency for the following tools: aerobic equipment (treadmills, stair, climbers, bikes), activity monitors (pedometers, accelerometers), iPads, Chromebooks, or other personal devices for students to use, basic computer applications (e.g., MS Word, Excel, PowerPoint), educational website creation, digital video camera, exergames (e.g., Dance Dance Revolution, etc.), global positioning system, heart rate monitors, cell phone apps (e.g., Team Shake, Sworkit, etc.), music apps (Apple Music, Amazon Music, FIT Radio, Spotify, etc.), projector, overhead projector, Plickers, graphics editing software (Adobe, Canva, Gifs,), video editing software (i.e., Coaches eye, iMovie), Installing Hardware, and Installation of Software. Participants rated their level of competence on a scale of 1 to 4, with 1 = untrained, untrained (little or no experience learning the tool), 2 = trained (have been taught or learned on own), 3 = highly trained (consider self to be highly competent in the tool), or 4 = expert (have successfully used the tool in teaching PE). The final question in the technology tool competencies asked participants where or how they felt they learned how to implement these technologies. Selections included: (a) College/University general technology course, (b) PE-specific technology course, (c) Post-graduate technology course, (d) Professional conference or other workshop, (e) Colleague, and (f) Other. The final section asked participants questions related to their technology tool use. Participants rated their use on a 5-point Likert scale from very often to never (5-1).

Data Collection and Analysis

All procedures were approved by the researcher's university review boards. Participants completed the survey instrument using Google Forms. The survey was sent out on social media (i.e., Facebook and Twitter) and the researcher's e-mail list of PETs during the winter of 2019. Researchers had no ability to identify participants. All participants provided informed consent in compliance with the universities review board. Participants were encouraged to forward the survey link to other PETs. At the end of the two-month collection period data was analyzed using SPSS version 27 (IBM, 2020). Descriptive statistics, paired *t*-test, and one-way analysis of variance (ANOVA) were used to analyze demographic and individual response item data on the CTIS-PE instrument. All levels of significance were set with an alpha level at .05.

Inferential statistical analyses drew upon Pearson correlations to identify associations between the level of individual educational tools and the extent to which that educational tool was used. Additional post-hoc correlations were conducted between participants' learning environment and overall SE, the three elements of SE, overall technology training, overall technology use, and other demographic characteristics (age, experience, etc.).

Results

Descriptive Information on Participants

Participant (*N=83*) demographic data was collected for age, gender years teaching, race, and school placement. Age and number of years of teaching were normally distributed variables, with normal ranges of skew and kurtosis in normal ranges (George & Mallery, 2010, suggested a range -2 to 2 for both skew and kurtosis for normal ranges). See Table 1 for a full list of descriptive statistics.

The environment where participants learned to integrate technology varied, with professional development workshop and a colleague being the highest (see Table 1). Participants reported levels of training (*M*=2.44, *SD*=0.65*)* with technology as Untrained 19.5%, Trained 33%, Highly Trained 25.5%, and Expert 22.0%. Overall, participants fell between trained and highly trained with technology. Additionally, total technology training was a normally distributed variable, with skew of -0.02 and kurtosis of -1.03.

Participants' SE (*M*=3.70, *SD*=0.94) was a normally distributed variable, with a skewness value of -1.24 and a kurtosis value of 1.85. Participants' mastery experience (*M*=4.06, *SD*=0.96) was a slightly abnormal distributed variable, with skewness value of -1.50 and a kurtosis value of 2.60. Participants' vicarious experience (*M*=3.87, *SD*=1.21) was a slightly abnormal distributed variable, with skewness value of -1.81 and a kurtosis value of 3.52. Participants' social persuasion experience (*M*=3.85, *SD*=1.33) was a slightly abnormal

Table 1
Descriptive Characteristics of the Sample

Variable	*N*	Mean	*SD*
Age	83	42.94	10.21
Years teaching	83	16.48	9.90
Overall tech use	83	2.49	0.67
Gender			
Male	26	31.3%	
Female	57	68.7%	
Race			
Caucasian/White	75	90.4%	
Black/African American	1	1.2%	
Hispanic	6	7.2%	
Asian	1	1.2%	
Placement			
Elementary school	60	72.3%	
Middle school	25	30.1%	
High school	17	20.5%	
Tech Requirements (n=77)			
No requirements	52	62.7%	
Not required but encouraged	14	16.9%	
Required to use	11	13.3%	
Environment learned tech			
Professional development workshop	52	62.7%	
Colleague	36	43.4%	
College PE tech course	24	28.9%	
College tech course	21	25.3%	
Self-taught	22	26.5%	
Post-grad tech course	12	14.5%	
Social media/Twitter	6	7.2%	

distributed variable, with skewness value of -1.56 and a kurtosis value of 2.30.

Educational Technology Tools Perceived Levels of Training and Reported Use

Table 2 overviews descriptive statistics and bivariate correlations related to perceived levels of training and reported use of educational technology tools. Based on a 4-point, Likert-type response scale, results indicate that the educational technology tools participants

Table 2
Self-Efficacy Means & Standard Deviation for School Placement

	Training			How Often Used			Correlation	
Educational Technology	**N**	**M**	**SD**	**N**	**M**	**SD**	**N**	**R**
Fitness Equipment (treadmills, climbers, bikes)	83	2.31	0.84	83	1.54	0.96	83	.39*
Pedometers, accelerometers, etc.	83	2.51	0.84	83	2.46	1.25	83	.46*
iPads & Chromebooks	83	2.72	0.97	83	2.96	1.29	83	.61*
Computer applications (MS Word, PP, etc.)	81	3.11	0.85	83	3.36	1.33	81	.25**
GPS	83	2.07	0.89	83	1.48	0.79	83	.42*
Digital Video Camera	82	2.54	0.95	83	2.46	1.24	82	.45*
Exergames	83	2.20	0.91	83	2.11	1.02	83	.51*
HR Monitors	83	2.30	0.88	82	1.82	1.15	83	.43*
Phone Apps (e.g., Team Shake, Sworkit)	82	2.83	1.02	83	3.31	1.30	82	.60*
Music apps & services (Amazon Music, Spotify)	83	2.96	0.99	83	3.94	1.36	83	.57*
Projector	83	3.11	0.91	82	3.65	1.35	82	.34**
Overhead Projector	83	2.78	1.00	83	2.29	1.61	83	.36*
Plickers	83	2.27	1.12	83	2.14	1.34	83	.72*
Image editing apps (Adobe, Canva, Gifs)	82	2.03	0.99	82	2.12	1.18	82	.74*
Video Editing Apps (Coaches Eye, iMovie)	83	2.14	1.03	83	2.06	1.15	83	.59*

* p<.001

** p<.05

are the most trained on include "computer applications" (*M*=3.11, *SD*=0.85); "projector" (*M*=3.11, *SD*=0.91); and "music apps and services" (*M*=2.96, *SD*=0.85). Educational tools with the least perceived level of training are "image editing apps" (*M*=2.03, *SD*=0.99); "GPS" (*M*=2.07, *SD*=0.89); and "video editing apps" (*M*=2.14, *SD*=1.03). Based on a 5-point, Likert-type response (1-5), results indicate that the educational tools used the most include "music apps and services" (*M*=3.94, *SD*=1.36); "projector" (*M*=3.65, *SD*=1.35); and "computer applications" (*M*=3.36, *SD*=1.33). The tools used the least are GPS (*M*=1.48, *SD*=0.79), fitness equipment (*M*=1.54, *SD*=0.96), and heart rate monitors (*M*=1.82, *SD*=1.15).

The correlations in Table 2 indicate the degree to which PETs use of an educational technology tool aligns with that tool's level of perceived training; each tool's level of training and its overall use is statically significantly correlated to each other and most have a

Pearson-R value greater than .40. The largest correlations were for the level of training and reported use where "image editing apps" r=.74, p<.001; "Plickers" r=.72, p<.001; and "iPads & Chromebooks" r=.61, p<.001. The smallest correlations were found for the perceived level of training and reported use were "computer applications" r=.25, p=.03; "projector" r=.34, p<.01; and "overhead projector" r=.36, p<.001.

Relationships Among Sources of Self-Efficacy

Females and males were compared with independent samples *t*-test across SE, mastery experience, vicarious experiences, and social persuasion experiences with independent samples *t*-test. SE was the only variable with significant results (t (81) = 1.97, p=.05), with male's SE (n=26, M=3.99, SD=0.86) higher than females' SE (n=57, M=3.56, SD=0.95) by a magnitude of 0.43; equal variances could be assumed because Levene's Test of variance was not significant (p=.64). No other demographics variables (e.g., age, school placement) produced significant correlations with SE or one another.

A one-way ANOVA with planned contrast was conducted to see the differences between SE and the level of technology integration that was required by their school or district (none, encouraged but not required, required). The omnibus ANOVA indicated no statically significant difference among the groups [$F_{(2,74)}$ =2.23, p =.14]. Equal variances could be assumed because Levene's Test of variance was not significant (p=.26). Planned contrast revealed that participant SE who are not required to integrate technology (*M=3.57,* SD=1.08) were not statically significantly different from those who are encouraged (M=3.95, SD=0.69) and those who are required (M=3.96, SD=0.64) to use technology in their instruction (t=1.60, p=.11. d=0.78). One-way ANOVA was run to see if any statistically significant group differences in SE existed between placement (elementary, middle, high). The omnibus ANOVA indicated no statically significant difference among the groups [$F_{(2,80)}$ = 1.34, p = .26.].

Correlations were computed to identify the relationships between demographic factors, technology training, placement, and technology use with SE scores. Pearson correlations between SE and mastery experiences have a moderate positive relationship (r=.48, p<.001), which indicates that as participant's mastery experiences go up their overall SE increases. SE and vicarious experiences have a small posi-

Table 3
Means, Standard Deviations, and Intercorrelations for Self-Efficacy, Sources, and Training

Measure	M	SD	1	2	3	4	5
1. SE	3.70	0.94	—				
2. Mastery	4.06	0.96	.48*	—			
3. Vicarious	3.87	1.21	.28**	.29**	—		
4. Social Persuasion	3.85	1.33	.28*	.57*	.32*	—	
5. Tech Training	2.44	0.65	.45*	.39*	.24*	.36**	—

* p<.001

** p<.05

tive relationship (r=.28, p<.01), which indicates that as participant's vicarious experiences go up their overall SE increases. SE and social persuasion experiences have a small positive relationship (r=.28, p<.001), which indicates that as social persuasion experiences go up their overall SE increases. SE and overall technology training have a moderate positive relationship (r=.45, p<.001). A non-significant relationship was found between SE and age (r=-.16, p=.16) and SE and number of years teaching (r=-.12, p=.27). Additionally, no significant relationship between SE and the environments that learned to use educational tools was found. Significant correlations to SE are presented in Table 3.

Discussion

Self-Efficacy and Sources

This study examined PETs self-efficacy in integrating educational technology (M=3.70). This result is consistent with results from previous studies with in-service and PETE Faculty. Both Werner (2020) and O'Neil and Krause (2019) found identical levels of SE (M=3.7) to integrate educational technology for in-service PETs. To note, O'Neil and Krause (2019) had five different self-efficacy subscales and the reported average represents all five items.

Interestingly, and similar to Krause (2017), in-service PETs in this study had lower levels of SE compared to pre-service teachers at the beginning and after student teaching. This finding could indicate that PETE programs may be providing enough technology integration for their students. However, in-service teachers may be overwhelmed to keep up with learning new technologies, which is a similar finding in PETE faculty (O'Neil & Krause, 2019) and PETs (Hill & Garcia, 2020). Furthermore, pre-service PETs might have higher SE levels because PETE programs are required to include technology integration as part of their accreditation (SHAPE, 2017), whereas inservice PETs may have other perceived priorities. This is evident in the fact that only 11 participants in this study (out of 73) indicated that their school or district required them to use technology. While a non-significant difference of participants' SE whose district encourages or require technology integration was found, it did have a large effect size (*D=0.78*). Increasing sample size in future studies may help better identify how important it is for districts and schools to encourage technology integration. Besides increasing the sample size, future studies should examine what level of educational training is provided to PETs by their schools and districts. It could be that districts that encourage or require technology integration also provide more training for their teachers, which increases their SE and their likelihood to use educational technology.

Besides gender, no other demographic variables (age, years teaching, school placement) were significantly different or correlated to overall SE. The gender discrepancy should be taken lightly since females outnumbered men in this study more than two to one. Additionally, other studies that have had a more evenly representation of gender have not found this gender difference (Krause, 2017; O'Neil & Krause, 2019). With this in mind, Kretschmann (2015) did find some gender differences in PETs' attitude and beliefs in using and integrating educational technology. These differences may explain the gender difference in SE that was found in this study. Mastery experience was the highest correlated source of SE, which is also similar to other studies examining pre-service (Krause, 2017) and in-service PETs (Werner, 2020).

No specific ways of learning about technology produced significant differences. This result could indicate that PETs require some level of technology training during their PETE program, but it does not matter whether it is in a technology-specific course or integrated throughout their program. This finding is similar to Woods et al. (2008) who found that in-service PETs learn to use educational technology in a variety of environments, with professional development workshops and conferences being the most prominent. Consequently, professional development workshops were not a significant factor of SE in this study. This finding could indicate that professional development workshops focusing on educational technology need to be of better quality.

Educational Technologies

The educational technologies that PETs' use will be influenced by their availability (Krause, 2017). Additionally, a teacher being highly competent in using an educational technology tool does not predict its use (Woods et al., 2008). It is not surprising that having positive attitudes and beliefs towards specific educational tools does not increase a PETs use of that tool (Gibbone et al., 2008; Kretschmann, 2015). This could help explain why in this study, the most competent and the most used technology (i.e., computer applications) had one of the lowest correlations (*r=.24*). Surprisingly, image editing apps and Plickers had a relatively low training and use level but the highest correlation (respectively, *r=.74, 72*). This indicates that participants who have higher levels of training use Plickers and image editing apps more often. It appears that in-service PETs in this study were able to incorporate these technologies into their teaching that they find meaningful in a way that doesn't take away from their goals. Additionally, these tools can indicate a focus for professional development as a high value to PETs. Conversely, lower correlations can indicate a need to provide better access to educational technology and provide more training. For instance, projectors were one of the most used and most trained educational tools but had one of the lowest correlations (*r*=.34). This could be because those that are highly trained with this tool just don't have access to a projector. Furthermore, because of the lower correlation, it can indicate that those who have access value its use regardless of their level of training. For this reason, future studies examining SE should include what level of access teachers have to each educational technology tool. Additionally, this is important to include because this study found varied results in what educational tools are used most often when compared to past research on PETs (Krause, 2017; Werner, 2020).

Conclusion

This study highlights that in-service PETs need professional development provided on a continual basis to integrate educational technology. In-service PETs may graduate with a high level of SE but need professional development to continue staying up to date with new educational technologies. Furthermore, professional development efforts should focus on technology tools that PETs value and use the most. With this in mind, these sessions should try to maximize participants' hands-on mastery-type experiences. In this study, mastery experiences were almost two times higher in explaining overall technology SE than vicarious and social persuasion experiences. Professional development workshops in this study did not correlate to overall self-efficacy, which could indicate they were more sit-n-get type experiences (vicarious). While vicarious experiences do have some value in improving technology SE, this type of training may not be the best use of time and resources, especially considering that hands-on experiences are what PETs typically want the most (Baek et al., 2018).

Another option to provide more mastery-type experiences is schools and districts staffing a technology coach or specialist who is responsible for training and assisting technology integration. This trend was captured recently by Hill and Garcia (2020). Recently, these edtech coaches were identified as a positive influence in helping teachers transition to remote instruction during the COVID-19 pandemic (Bakhshaei et al., 2020). Future research could look at the role an EdTech coach has on PETs' SE.

Another area to examine is conducting this study with a larger sample that represents diverse geographical areas. Unfortunately, this study did not capture the actual educational technology use rates. Future studies should consider the integration of fieldwork and observations to more completely document the extent to which participants' educational technology integration SE aligns to their actual use. With this in mind, it could be helpful to examine the effects of professional development sessions focused on technology integration has on influencing PETs' SE and use.

This study has many limitations. The participants that completed the survey may have been more willing because they are more confident and interested in technology. Second, this study had a small sample size from unknown geographic areas, which makes the generalizability of the results difficult. Lastly, this study used self-reporting measures, which come with their own sets of concerns; participants might have been answering the more socially acceptable answer than being truthful; participants may not be able to assess themselves accurately.

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