Learning Styles in Problem-based Learning Environments

Impacts on Student Achievement and Professional Preparation in University Level Physical Therapy Courses

David J. Edwards[1], Lori Kupczynski[2] & Shannon L. Groff[3]

[1] Associate Professor of Physical Therapy, Wheeling Jesuit University, Wheeling, West Virginia, USA

[2] Professor of Education, University of St. Augustine for Health Sciences, St. Augustine, Florida, USA

[3] Professor of Education and English, Florida State College at Jacksonville, Jacksonville, Florida, USA

Correspondence: Lori Kupczynski, College of Health Sciences, University of St. Augustine for Health Sciences, St. Augustine, Florida, USA. E-mail: lkupczynski@usa.edu

Received: May 10, 2019 Accepted: June 9, 2019 Online Published: June 11, 2019

doi:10.5430/ijhe.v8n3p206 URL: https://doi.org/10.5430/ijhe.v8n3p206

Abstract

It is unknown if matching students' preferred learning style with course delivery style improves academic success and further study is warranted in this area (Feely & Biggerstaff, 2017; Newton & Miah, 2017). Recently, there has been a call to better identify and understand the preferred learning styles of physical therapy education students and the effect this has on education (Brudvig, Mattson, & Guarino, 2016; Lowdermilk, 2016). While the benefit of matching teaching and learning styles has been investigated in other academic disciplines, it has not been investigated in physical therapy education. The purpose of this study was to determine if student preferred learning style is related to success in a learner centered problem-based learning formatted class and program, specifically for physical therapy students. Results provide insights into preferred learning styles and student achievement in a problem-based learning centered Doctoral level Physical Therapy Program.

Keywords: learning styles, physical therapy, student achievement, industry preparation

1. Introduction

1.1 Introduction to the Study

It is unknown if matching students' preferred learning style with course delivery style improves academic success and further study is warranted in this area (Feely & Biggerstaff, 2017; Newton & Miah, 2017). Some authors reported that learning styles may not even exist (La Lopa, 2013; Newton & Miah, 2017), while others argued that learning styles are a key component of teaching and learning (Abdallah, Al-Zalabani, & Alqabshawi, 2013; Anderson, 2016; Conti, 1986; Gilkakjani, 2012; Kharb, Samanta, Jindal, & Singh, 2013; Zhou, 2011). Conti (1986) suggested that there are two primary teaching styles in adult education, namely learner centered and teacher centered styles. Students could be identified as preferring education in one of these distinct styles.

Previous studies found that matching course delivery style to preferred learning style improved student success (Abdallah et al., 2013; Clark & Latshaw, 2012; Lasry, Charles, & Whittaker, 2014; Letele, Alexander, & Swanepol, 2013; Naimie, Siraj, Piaw, Shagholi, & Abuzaid, 2010). Opponents of this theory have reported that learning styles are not important (Newton & Miah, 2017; La Lopa, 2013) and that it is not beneficial to match delivery style with preferred learning style (Doyle & Rutheford, 2003 as cited in Letele et al. 2013; Rogowsky, Calhoun & Tallal, 2015). These points, though divergent, encourage further investigation.

Additionally, students could use the knowledge of their preferred learning style to help them decide which program to attend and to identify why specific learning areas are difficult (Anderson, 2016). This could also help students ask questions about specific program delivery styles, especially if the program identifies as a hybrid. Many hybrid programs are offered in various combinations including case-based, problem-based, modified-problem-based, life-span based, guide-based and traditional education (CAPTE, 2017). The major question becomes whether or not a course/program delivery system matched to students' preferred learning styles, either teacher centered or learner centered, could improve academic success.

1.2 Physical Therapy Education

Recently, there has been a call to better identify and understand the preferred learning styles of physical therapy students and the effect this has on education (Brudvig, Mattson, & Guarino, 2016; Lowdermilk, 2016). While the benefit of matching teaching and learning styles has been investigated in other academic disciplines, it has not been investigated in physical therapy education. As suggested by past researchers, identification of student preferred learning styles could enable physical therapy education programs to adjust course or program formats to better fit physical therapy students' needs (Gilakjani, 2012; Kharb et al., 2013). The Commission on Accreditation in Physical Therapy Education (CAPTE, 2017), states that approximately 75% of physical therapy education programs are hybrids, consisting of program deliveries that are a blend of delivery styles including lecture, case-based learning, systems-based learning, and problem-based learning. Identifying student-learning preferences, and whether matching these preferences to course delivery style is beneficial, could allow program administrators to adjust the course style to assist student learning.

Physical therapy graduates need to be competent and prepared healthcare practitioners (American Physical Therapy Association [APTA], 2015). Physical therapists are now direct access clinicians, patients no longer need to visit a physician before seeing a physical therapist, which puts new graduates on the front-line of medical access. Physical therapy educators have the all-important task of ensuring that students are graduating prepared to meet these expectations. Identifying students' preferred learning format in physical therapy education and whether teaching and learning preferences should match could be crucial to the education process.

CAPTE (2017) has identified three major delivery styles used by physical therapy education programs. The program teaching formats include a problem-based learning (PBL) format, a traditional lecture-based format, and a hybrid format. A hybrid format includes a combination of more than one delivery style (CAPTE, 2017). Although much of the literature reports that adult learners are best suited to being taught via learner centered education styles (Abdallah et al., 2013; Weimar, 2013), currently only approximately 1.7% of physical therapy education programs identify as being purely problem-based learning (PBL), which is a classic learner centered pedagogy (CAPTE, 2017). CAPTE (2017) also reported that 3.4% of programs identify as a modified problem-based learning format where classes early in the curriculum are taught with traditional teacher centered methods and later courses are more learner centered PBL style courses. Of physical therapy education programs across the country, 10.7% are traditional lecture-based programs, a teacher centered format, and 75% of physical therapy education programs are hybrid programs which include combinations of traditional, systems-based, modified-problem-based, guide-based, case-based, problem-based, and lifespan-based styles.

1.3 Statement of the Problem

Being direct access clinicians, new physical therapy graduates can be presented with serious pathologic conditions that, with mishandling or non-identification, could have catastrophic consequences for their patients. It is vital that physical therapy programs educate in a manner that is the most effective, not only for students' benefit, but for the benefit of their patients' post-graduation. An understanding of preferred learning styles and whether a match of delivery style and learning is effective, could be beneficial to ensure maximum student comprehension before graduation.

While in theory the matching of teaching and student preferred learning styles should boost academic achievement (Anderson, 2016; Letele et al., 2013; Gilakjani, 2012), this topic had never been investigated in physical therapy education. Before determining if course delivery style or teaching habits should be adjusted based on student preferred learning style, it was essential to determine if matching of the two actually improves academic success. If matching improves success, teachers and programs should then adjust course delivery style to accommodate students learning style, resulting in enhanced topic mastery and success. Students could also benefit by choosing a program that delivers courses in the style that most closely matches their preferred format. To date, there has been no development of a knowledge base in this area.

1.4 Review of the Literature

Understanding teaching and learning styles may play a pivotal role in delivering the most effective education (Anderson, 2016; Gilakjani, 2012; Haq, Yasmeen, Ali, & Gallam, 2012; Kharb et al., 2013). A professor's teaching style is a label associated with various identifiable sets of behaviors in the classroom that are practiced no matter the content (Conti, 1986). Conti (1989) defined teaching styles as "the internal qualities of the facilitator that affect classroom behaviors" (p. 4). Learning style preference is included in one's learning style and incudes a student's choice in one learning condition or style over another (Brown, 2000).

Identification of learning style may also help students to enhance their own learning through self-awareness, which will help them identify courses in which they may have more difficulty (Anderson, 2016). It has been suggested that an understanding of learning styles is vital to ensuring teachers can adapt their teaching style appropriately (Haq et al., 2012; Kharb et al., 2013), ensuring students stay motivated to learn and ensuring teachers understand the reason for difficulty with learning in a specific area (Anderson, 2016; Gilakjani, 2012; Zhou, 2011). If the teacher does not understand his or her students' preferred learning style, or how he or she learns best, choosing a teaching style could be difficult (Anderson, 2016).

Problem-based learning (PBL) is a student-oriented approach that requires students to do research, combine theory and practice, find practical solutions over a defined problem, and use their knowledge and skills (Demirel & Dagyar, 2016; Savery, 2006). Barrows (2002) explains PBL allows students to gain effective skills for problem-solving through different research and experiences in the education field and to accumulate knowledge through learning, team work, different subjects, and disciplines. Primary goals for PBL in health sciences and related courses are to foster clinical reasoning, problem-solving skills, self-directed learning, communication skills and deep understanding of concepts and principles in the curriculum (Azer, 2007).

Problem-based learning (PBL) was the learner centered delivery style used in this study. PBL has been shown to create a more positive attitude amongst students (Demirel & Dagyar, 2016) and improve metacognitive awareness and critical thinking skills more so than lecture-based methods (Gholami et al., 2016). Problem-based learning is utilized in the field of physical therapy education as a stand-alone delivery style, and also as a hybrid delivery style in which it is combined with other traditional lecture-based styles (CAPTE, 2017).

The term student-centered learning can be used interchangeably with the term learner centered education. Learner centered education supports a more collaborative mode by practicing behaviors that encourage students to take responsibility for their own learning. The classroom focus is on the learner (Conti, 1986; Weimar, 2013). Teacher centered instruction is the traditional classroom setting in which the professor is a "giver" of information and the student passively "receives" the information. Lecture-based class format is an example of teacher centered learning (NCLRC, 2004).

There is little research on the learning styles of physical therapy students (Brudvig et al., 2016). Identifying learning styles can be challenging as there a reported 71 learning style surveys/instruments in the literature (Coffield, Mosley, Hall, & Ecclestone, 2004). These tools vary and may explain the debate in the literature concerning matched teaching/learning style. Brudvig et al., (2016) reported that all studies examining physical therapy student learning styles, and the relationship between learning styles and critical thinking, have used the Kolb model for learning styles, specifically the Kolb Learning Style Inventory.

The conceptual framework that guided this research is Gary Conti's (1982) concept of teaching and learning styles. Conti (1982) reported that a teacher can educate through two main styles, which are teacher centered style or learner centered style. The teacher centered style is a more traditional lecture-based mode of instruction, and learner centered style is more a collaborative style that allows student choice and active learning (Conti, 1982).

No specific literature could be found on whether physical therapy students prefer learner centered or teacher centered education. As Brudgvig et al. (2016) reported, there is currently a paucity of literature on the learning styles of physical therapy students. Lowdermilk (2016) suggested that more research is needed in the area of physical therapy student learning styles.

Conti (1982) developed the Principles of Adult Learning Scale (PALS) that was validated and proven reliable and used frequently (Barrett, 2004; Clavon, 2014; Curran, 2013; Ervin, 2012; Nessipbayeva & Egger, 2015; Scheuermann, 2005; Wilson, 1994). The Principle of Adult Learning Scale, a 44-item survey developed by Conti, is used to identify whether a professor practices a teacher centered or a learner centered education style (Conti, 1982). The Perceived Learning Style Inventory developed by Spoon and Schell (1998) is a modification of the PALS survey that is 44 items in length. It identifies whether a student prefers to be educated with a learner centered or teacher centered class delivery style (Spoon & Schell 1998). Spoon and Schell (1998) modified the instrument to be used with students to identify their learning style preference as teacher- or learner centered. This study focused on the relative importance of matching course delivery style with student preferred learning style in physical therapy education.

1.4 Purpose of the Study

The purpose of this study was to determine if student preferred learning style is related to success in a learner centered problem-based learning formatted class and program, specifically for physical therapy students. There has been a call in the literature for further clarification of whether matching student learning style to course delivery style improves

academic success (Feeley & Biggerstaff, 2017; Ford & Chen, 2001; Vrenken, McChiery, & Visser, 2006). Further investigation into these topics could help to ensure that physical therapy educational programs are providing the best means for producing autonomous, self-directed, direct-access graduates.

The overarching research question in this study was: Does a physical therapy student's preferred learning style, as determined by their score on the Perceived Learning Style Inventory (Spoon & Schell, 1998), have a relationship to his or her level of success when enrolled in a physical therapy course/program that is delivered in a learner centered style of instruction? Three specific research questions guided this investigation: RQ1: Is there a significant relationship between student course grade in a learner centered course and total score on the Perceived Learning Style Inventory? RQ2: Is there a significant relationship between student final examination score in a learner centered course and total score on the Perceived Learning Style Inventory? And RQ3: Is there a significant relationship between student Scorebuilders examination score in a learner centered program and total score on the Perceived Learning Style Inventory?

2. Method

The first two dependent variables in the study included course grade and final exam score in DPT Clinical Science VI, which is a classic learner centered course delivered in a problem-based learning format. The third dependent variable was Scorebuilders comprehensive examination score, which was taken at the end of the physical therapy program didactic work. The Scorebuilders comprehensive examination (Scorebuilders, 2017) is a mock National Physical Therapy Examination and it is used by the DPT program to gauge student program achievement and to track outcomes. The independent variables were total student score on Perceived Learning Style Inventory. This was measured using the quantitative score of 0-220 from the student's survey. The higher the score the more learner centered education that student preferred. The lower the score on the survey, the more teacher centered education that student preferred. The relationship of matching preferred learning style and total DPT program style was also investigated using the Scorebuilders comprehensive exam score and survey score.

2.1 Population and Sample

In this study, students included only second year Doctor of Physical Therapy (DPT) students who were enrolled in a learner centered physical therapy course and program. The courses identified for the study use only a learner centered PBL curriculum format. For this reason, again, purposive sampling was used. The target sample size was 57 students from the DPT program. Per CAPTE (2017) aggregate data, the average cohort size in physical programs is 45, and there are 4 identified purely PBL programs in the country. This left a total population to choose participants from at 180 students. Thus, having a sample of 57 students represented approximately one-third of the population that could have been chosen for the study. The DPT program was located at a Midwestern private university.

2.2 Procedures

The Perceived Learning Style Inventory (Spoon & Schell, 1998) was used to identify students' preferred learning styles in this study. Students filled out the PAL survey during term seven of their physical therapy education program. Student's course grade and then final examination grade for Clinical Science VI and the student's Scorebuilders comprehensive examination score were included.

3. Results

3.1 Description of the Sample

The data was analyzed using SPSS for Windows Version 25. Table 1 represents the descriptive statistics from the study. The mean Perceived Learning Style Inventory scores were calculated as were mean values for the sample's Clinical Science VI final examination score, Clinical Science VI final course grade and Scorebuilder's comprehensive examination score.

Table 1. Descriptive Measures for Study Variables

Study Variable	Mean Score
Perceived Learning Style Inventory	141.94 (*SD= 17.29*)
(n=57, n= 49)	143.41 (*SD= 15.56*)
Clinical Science VI Final Exam Score (n=49)	88.04 (*SD= 4.13*)
Clinical Science VI Final Course Grade (n=49)	91.74 (*SD= 2.80*)
Scorebuilders Exam Score (n=57)	69.36 (*SD= 5.78*)

The mean survey score represented a consensus among participants that teacher centered delivery is preferred over learner centered delivery. Scores between 0-145 indicate that the student prefers teacher centered education and scores from 146-220 indicate that the student prefers learner centered education. The closer to 220, the more learner centered education the student prefers.

3.2 Statistics and Data Analysis

The first research question in the study investigated if there was a correlation between course grade in a learner centered course and whether or not performance improved with the matching of teaching and preferred learning style. This investigated the benefit or non-benefit of matching course delivery style to student preferred learning style. Table 2 represents the data associated with research question one.

Table 2. Correlation Between Preferred Learning Style and Final Course Grade

	n	Pr/Sp *r and r_s - values*	Pr/Sp p-values
Correlation Output PLSI Score and CS Final Score	49	.02, .04	.852, .768

Note: PLSI Score= Perceived Learning Style Score. CS= Clinical Science n= sample size. *r-value*= correlation coefficient. p-value= probability of type I error. Pr= Pearson. Sp= Spearman.

The two variables were not correlated through Pearson correlation, $r(47)= .02$, $p > .05$ nor were they correlated through non-parametric Spearman correlation, $r_s(47)=.04$, $p>.05$. A linear regression was also run to assess for a predictive relationship, and a significant regression equation was not found $F(1,47)=1.01$, $p>.05$, with an R^2 of .02. It appears that there is no relationship between students total score on Perceived Learning Style Inventory and course grade.

The second research question investigated if there was a correlation between student final examination score in a learner centered course and whether or not performance improved with the matching of teaching and preferred learning style. This investigated the benefit or non-benefit of matching course delivery style to student preferred learning style. Pearson correlation and follow-up linear regression analyses were run. To investigate preferred learning style, the results of the student's Preferred Learning Style Inventory was used as the independent variable and to investigate exam performance, the student's final examination grade in Clinical Science VI was used as the dependent variable. Table 3 represents the data associated with research question two.

Table 3. Correlation Between Preferred Learning Style and Clinical Science Final Exam Grade

	n	*r- value*	p-value
Correlation Output PLSI Score and CS Final Examination Score	49	.14	.319

Note: PLSI Score= Perceived Learning Style Inventory Score. CS= Clinical Science n= sample size. *r-value*= correlation coefficient. p-value= probability of type I error.

The assumptions testing for Pearson correlation were all met. The variables were not correlated in the Pearson correlation, $r(47)= .14$, $p > .05$. A linear regression was also run to assess for predictive relationship and a significant regression equation was not found $F(1,47)=.03$, $p>.05$, with an R^2 of .00. There is no relationship between student final examination grade and score on the Perceived Learning Style Inventory.

The third research question focused on whether or not a relationship existed between preferred learning style and whether or not program delivery style match improved success as determined by the Scorebuilders examination. This investigated the benefit or non-benefit of matching total DPT program delivery style to student preferred learning style. Table 4 represents the data associated with research question three.

Table 4. Correlation Between Preferred Learning Style and Scorebuilders Comprehensive Score

	n	*r- value*	p-value
Correlation Output PLSI Score and Scorebuilders score	58	-.19	.142

Note: PLSI Score= Perceived Learning Style Inventory Score. Scorebuilders score= Scorebuilders comprehensive examination score. n= sample size. *r-value*= correlation coefficient. p-value= probability of type I error.

All assumptions for Pearson correlation were met. The two variables were not correlated in the Pearson correlation, $r(55)= -.19$, $p>.05$. A linear regression was also run to assess for predictive relationship and a significant regression equation was not found ($F(1,47)=2.21$, $p>.05$, with an R^2 of .03. No relationship was found between Scorebuilders comprehensive examination score and score on the Perceived Learning Style Inventory.

4. Discussion

The purpose of this study was to identify if any benefit exists to matching course/program delivery style with student preferred learning style in a physical therapy course/program. There has been a call in the literature to examine the learning style preferences in physical therapy education (Brudvig et al., 2016) as well as to identify if matching teaching and preferred learning style improves academic performance (Feely & Biggesrstaff, 2017). Currently, the data on the preferred learning styles in physical therapy education are very limited and there is no information on the effect of match or mismatch of preferred learning styles in DPT education. Producing physical therapy graduates that are autonomous, life-long learners is of great importance to the physical therapy field and also for the new graduates' patients (APTA, 2015). Ensuring that the optimal delivery method is being used to help with academic performance and knowledge achievement is vital.

The results showed that there was no relationship total score on the Perceived Learning Style Inventory and academic performance. The current study builds on prior research that suggested matching teaching and learning styles was not beneficial (Dincol et al., 2011; Doyle and Rutherford, 2003 as cited in Letele et al., 2013; Feeley& Biggerstaff, 2017; La Lopa, 2013; Newton & Miah, 2017).

As much of the past literature is split on whether or not a benefit to matching delivery and preferred learning style exists, it is not surprising that this study found a non-benefit and the null hypotheses were accepted. It is possible that students in different subjects may benefit or not benefit from matching depending upon the material or subject matter that needs to be learned. It seems that in DPT education, the benefit is not present per results of the current study.

Students who preferred teacher centered education were still able to thrive in the PBL learner centered course program, as were students who preferred learner centered education, and again, there was no relationship between learning style preference and whether or not the student did well in the course or program. One other conclusion drawn from this study is that students who prefer either teacher or learner centered education can do well in a course or program that is delivered in a PBL format.

The first implication that can be drawn from this study is that DPT students in the Midwest actually prefer a teacher centered education style. Although it was determined that DPT students prefer teacher centered education, and there is literature to that effect, the current trend in education is to the contrary (Eagan et al., 2014; Freeman et al., 2014), it is not conclusive to imply that learner success is dependent upon course or program delivery. Students in the learner centered, problem-based course/program were successful regardless of the match or mismatch of delivery style. This is contradictory to previous literature which suggested there was a direct correlation between the two (Clark & Latshaw, 2012; Ford & Chen, 2001; Lasry et al., 2014; Letele et al., 2013; Naimie et al., 2010).

The second implication relates to the benefit or non-benefit of matching and how this relates to improved academic performance. Again, many past authors have argued that there is a significance in matching teaching style with learning style (Clark & Latshaw, 2012; Ford & Chen, 2001; Lasry et al., 2014; Letele et al., 2013; Naimie et al., 2010). These contradictions within the literature expound on the need to investigate the correlation and success of students in regard to learning and teaching styles. This study builds on the available evidence in this topic area.

The third implication is that PBL has been validated as an educational style that can be effective for students who learn best through either of the major modes of teaching and is thus accommodating to student learning needs. The final implication relates to the teachers in DPT programs. The results of this study imply that a teacher or DPT program with a learner centered course or program delivery style should not try to adjust course format or program format simply to match what the cohort of students in the course prefer to improve academic performance. The results suggest no relationship between matching course/program delivery style and improving academic success. Per the results of the current study, this action most likely would not improve outcomes and create unneeded change. The findings of this study suggest that it is likely that students will accommodate to the delivery style and still perform well, whether the delivery and learning preference match.

The results of this study have shed light on the learning style preferences of DPT students as well as the non-benefit of matching student preferred learning style with course/program delivery style. While this study found there was no benefit, a PBL program was used as the mode of learner centered education and other modes of learner centered education nor teacher centered education were studied. Future research should investigate if the same results occur when the learner centered mode of education changes and pedagogies including PLTL and/or POGIL are used. It is possible that formats used with PLTL and POGIL will not produce the same success as PBL when the student preferred learning style does not match. As reported by Weimar (2013), learner centered practice can mean many things, and this could result in different outcomes.

Future research should also investigate the results when a teacher centered mode of education is used. It is possible that students who prefer learner centered education will not thrive as well in a teacher centered course/program even though students who preferred teacher centered education were still able to thrive in a learner centered course. Lecture based education may not be as accommodative to learner centered students as PBL was for teacher centered students. This would reflect the current trend in higher education, which represents a shift away from teacher centered practice (Eagan et al., 2014; Freeman et al., 2014).

References

Abdallah, R., Al-zalabani, A., & Aqabawi, R. (2013). Preferred learning styles among prospective research methodology course students at Taibah University. *Journal of Egyptian Public Health, 88*(1), 3-7. https://doi.org/10.1097/01.EPX.0000427506.57924.c1

Anderson, I. (2016). Identifying different learning styles to enhance the learning experience. *Nursing Standard (2014+), 31*(7), 53. https://doi.org/10.7748/ns.2016.e10407

APTA. (2015). *Vision 2020*. Retrieved from http://www.apta.org/Vision2020/

Azer, S. (2007). *Navigating problem based learning.* Australia: Churchill Livingstone.

Barrett, K. R. (2004). *A comparison of online teaching styles in Florida community colleges* (Doctoral Dissertation). Retrieved from https://www.learntechlib.org/p/123728/

Barrows, H. (2002). Is it truly possible to have such a thing as PBL? *Distance Education, 23*(1), 119-122. https://doi.org/10.1080/01587910220124026

Brown, D. H. (2000). *Principles of language learning & teaching* (4th ed.). New York: Longman.

Brudvig, T., Mattson D. J., & Guarino A. J. (2016). Critical thinking skills and learning in entry-level doctor of physical therapy students. *Journal of Physical Therapy Educators, 30*(4), 3-10. https://doi.org/10.1097/00001416-201630040-00002

Clark, S., & Latshaw, C. (2012). Effects of learning styles/teaching styles and effort on performance in accounting and marketing courses. *World Journal of Management, 4*(1), 67-81.

Clavon, A. M. (2014). *The teaching styles of nurse educators at private and public universities in the northern and southern regions of the United States* (Doctoral dissertation, Keiser University). Retrieved from https://search.proquest.com/openview/4764038478b03040c1d749e63752ee71/1?pq-origsite=gscholar&cbl=18750&diss=y

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Learning styles and pedagogy in post-16 learning: A systematic and critical review*. London, UK: Learning and Skills Research Centre. Retrieved from http://www.leerbeleving.nl/wp-content/uploads/2011/09/learning-styles.pdf

Commission on Accreditation in Physical Therapy Education (CAPTE). (2017). *Aggregate program data.* Retrieved from

http://www.capteonline.org/uploadedfiles/capteorg/about_capte/resources/aggregate_program_data/aggregateprogramdata_ptprograms.pdf

Conti, G. (1982). The principles of adult learning scale. *Adult Literacy and Basic Education, 6*(3), 135-146. https://doi.org/10.1002/ace.36719894303

Conti, G. (1986). Teaching-learning styles and the adult learner. *Lifelong Learning, 9*(8), 20-24. Retrieved from http://www.conti- creations.com/PALS_resources.htm

Conti, G. (1989). Assessing teaching style in continuing education. In E. R. Hayes (Ed.). *Effective Teaching Styles* (pp 3-15*).* San Francisco: Josey-Bass.

Curran, M. K. (2013). *The teaching styles and use of adult learning theory among nursing professional development educators* (Doctoral dissertation Walden University). Retrieved from https://eric.ed.gov/?id=ED554386.

Demirel, M., & Dagyar, M. (2016). Effects of problem-based learning on attitude: A meta-analysis study. *EURASIA Journal of Mathematics, Science & Technology Education, 12*(8), 2115-2137. https://doi.org/10.12973/eurasia.2016.1293a

Dincol, S., Temel, S., Oskay, O., Erdogan, U., & Yilmaz, A. (2011). The effect of matching learning styles with teaching styles. *Procedia-Social and Behavioral Sciences, 15*, 854-858. https://doi.org/10.1016/j.sbspro.2011.03.198

Eagan, M. K., Stolzenberg, E. B., Berdan Lozano, J., Aragon, M. C., Suchard, M. R., & Hurtado, S. (2014). *Undergraduate teaching faculty: The 2013–2014 HERI Faculty Survey*. Los Angeles: Higher Education Research Institute, UCLA. Retrieved from https://www.heri.ucla.edu/monographs/HERI-FAC2014-monograph.pdf

Ervin, B. (2012). *Learner-centered education: bridging the gap between ideal and actual practice* (Doctoral dissertation). Retrieved from http://rave.ohiolink.edu/etdc/view?acc_num=dayton1354295092

Feeley, A., & Biggerstaff, L. (2017). Exam success at undergraduate and graduate-entry medical schools: Is learning style or learning approach more important? *Teaching and Learning in Medicine, 27*(3), 1-6. https://doi.org/10.1080/10401334.2015.1046734

Ford, N., & Chen, S. Y. (2001). Matching/mismatching revisited: An empirical study of learning and teaching styles. *British Journal of Educational Technology, 32*(1), 5–22. https://doi.org/10.1111/1467-8535.00173

Freeman, S., Eddy, S., McDonough, M., Smith, M., Okaoroafor, N., Jordt, H., & Wenderoth, M. Active learning increases student performance in science, engineering, and mathematics. (2014, June). In *Proceedings of the National Academy of Sciences USA, 111*(23), 8410-8415. https://doi.org/10.1073/pnas.1319030111

Gilakjani, A. (2012). A mismatch between learning styles of learners and teaching styles of the teachers. *Modern Education and Computer Science, 11*, 51-60. https://doi.org/10.5815/ijmecs.2012.11.05

Gholami, M., Moghadam, P. K., Mohammadipoor, F., Tarahi, M. J., Sak, M., Toulabi, T., & Pour, A. H. (2016). Comparing the effects of problem-based learning and the traditional lecture method on critical thinking skills and metacognitive awareness in nursing students in a critical care nursing course. *Nurse Education Today, 45*, 16-21. https://doi.org/10.1016/j.nedt.2016.06.007

Haq, S., Yasmeen, S., Ali, S., & Gallam, F. (2012). Students' learning styles require modified teaching strategies. *Journal of Rawalpindi Medical College, 16*(2), 191-193. Retrieved from: https://www.journalrmc.com/volumes/1394805483.pdf