TITLE: Which Learning Activities Enhance Physical Therapist Practice? Part 2: Systematic Review of Qualitative Studies and Thematic Synthesis

RUNNING HEAD: PTs' Lived Experience of Learning Activities

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Objective. Post-professional physical therapy expertise requires career-long participation in learning activities. Understanding physical therapists' lived experience of learning activities provides novel insight into how best to enhance physical therapist practice from the perspective of the learner. The purpose of this study was to explore qualified physical therapists' experiences, beliefs, and perspectives with regard to learning activities and professional development.

Methods. Eight databases were searched for studies published from inception through December 2018. Study selection included mixed-methods and qualitative studies exploring physical therapists' experiences, perspectives, beliefs and attitudes. Thematic synthesis was performed, and the GRADE-Confidence in the Evidence from Reviews of Qualitative research (CERQual) was used to assess the level of confidence in the findings. Forty-one studies with 719 participants were included.

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Results. The key findings include physical therapists' perceptions that worthwhile post professional learning requires more than attendance at professional development courses. Physical therapists perceived that worthwhile learning requires connection with others and being "taken out of ones' comfort zone." Sufficient time and accessible, trustworthy resources were also valued.

Conclusions. Moderate- to low-level evidence suggests that the choice of professional development activities and education design for qualified physical therapists should consider the inclusion of connected activities, activities that take participants out of comfort zones, time to practice, and trustworthy resources that are easily accessible. Future research should evaluate the effectiveness of learning activities encompassing these factors, prioritizing those that minimize the barriers of time and distance.

Impact. This study adds to the profession's understanding of physical therapists' lived experience of learning activities, providing novel insight into how best to enhance physical therapist practice from the perspective of the learner.

Following graduation from a physical therapy entry-level program, a commitment to ongoing career-long learning is essential for the development of clinical expertise.[1] Researchers and registration boards have identified a wide range of formal and informal learning activities appropriate for the continuing professional development (CPD) of physical therapists.[2-5] Knowing the relative impact and physical therapists' perspectives of these learning activities would enable efficient and effective physical therapist learning, inform post-professional education design and guide the allocation of professional development resources.

In medical education, there have been calls for greater use of deliberate practice with feedback to develop expertise[6,7] with suggestions that clinicians need be adaptive learners to be able to thrive in a complex, unpredictable healthcare environment.[8] The "Master Adaptive Learner" concept has been proposed, which is based on current learning research.[8] This concept encourages the mastery of four phases of learning for clinical practice: planning, learning, assessment and adjustment. Determining

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whether deliberate practice and the master adaptive learner concept are applicable to physical

therapists requires an exploration of the current quantitative and qualitative evidence on learning.

The current quantitative evidence supports the use of the master adaptive learner concept and

deliberate practice to develop expertise in physical therapists. In examining the impact of physical

therapist CPD on therapist related outcomes (Part A of this systematic review), learning activities with

active components appear to be most effective at changing physical therapist behaviour.[9] Also, the

inclusion of mentored patient interactions appears to be required for a professional development

course to improve patient outcomes.[9] While quantitative data examining impact from the Quantitative

(Part A) review[9] and other previous reviews related to health professional learning[2,9] could be used to

guide post-professional physical therapist learning activities, the findings should not be the only

evidence considered. Learning has been defined as "a process that leads to change, which occurs as a

result of experience and increases the potential for improved performance and future learning."[10] As

learning is a result of how learners interpret and respond to experiences,[10] the possible perspectives

and experiences of the physical therapist learner also needs to be considered. Qualitative research

captures the experiences and perspectives of learners vital to the individualised nature of learning,[11]

hence should be used to guide learning activity decisions. Only one previous systematic review has

considered qualitative research when exploring health professional learning.[12] This review reported

that certain learning activities were perceived by allied health professionals to improve reflective

thinking, sustain positive attitudes and beliefs, and enhance learning. Unfortunately, rigorous

qualitative methods, such thematic synthesis[13] or thematic analysis,[14] were not used to synthesize the

primary research findings or to determine the level of confidence in the findings.[15] Further, learning is

contextual, and this review examined allied health professionals as a group of professions, not

allowing for physical therapist specific professional development recommendations to be made.

Thus, the purpose of this Qualitative (Part B) review was to explore the experiences, attitudes and

beliefs of physical therapists with regards to the different learning activities. This provides deeper

insights into the findings from the Quantitative (Part A) review findings[9] which addressed the

question "Which learning activities enhance physical therapy practice?"

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[H1] Methods

This systematic review is the second in a 2-part series based on a published protocol,[2] and registered on the International Prospective Register of Systematic Reviews (PROSPERO CRD CRD42016050157). The following is an outline of the methods used for the qualitative component of the review (Part B), with rationale for amendments.

[H2] Data sources and searches

Details of data sources and searches are detailed in the protocol paper[2] and in Part A of this systematic review.[9] In brief, Ovid MEDLINE, EMBASE, AMED, CINAHL, PsycINFO, PEDro, Cochrane library and ERIC were searched to December 2018. The search strategy used the concepts of (1) physical therapist (2) learning activities and (3) physical therapist or patient outcomes. An example of the full search is provided in Supplementary Appendix 1.

[H2] Study selection

Detailed study selection criteria were described previously.[2,9] Briefly, studies were eligible if published in peer reviewed journals or were higher degree dissertations (Doctorate or Master's research theses), and in English. Qualitative studies were included in this systematic review (part B), with quantitative studies included in a separate systematic review.[9] The reviews have been presented separately due to larger than expected number of eligible studies, and to ensure that reporting was of sufficient detail to adhere to qualitative systematic review guidelines.[16]

For qualitative systematic review inclusion, studies needed to have qualified physical therapists as the participant learner, and formal or informal learning activities as the education intervention. Included studies explored experiences, attitudes or beliefs of physical therapist learners.

[H2] Data Extraction and Risk of Bias Assessment

Study characteristics extracted included authors, year, study design, participant characteristics, funding sources, geographic location, setting, timeframe, education intervention, data collection method, and results. Data was extracted (E.L.) then verified independently by a second researcher (M.C).

Risk of bias was assessed by two independent reviewers (E.L. and M.C.) using the Quality Assessment or Qualitative Research Reports (QAQRR) scale, which has been used in an educationally focussed peer reviewed systematic review.[17] Disagreements were resolved through discussion, with a third reviewer (F.B.) making the final decision when required.

[H2] Data Synthesis and Analysis

After verbatim data extraction of the papers' findings into an excel spreadsheet, a three step thematic synthesis approach was implemented,[13] incorporating the principles of thematic analysis.[18] First, line-by-line coding of text relevant to the review question was completed. Both the primary study author interpretations and participant quotations were coded. Second, the codes were organised to formulate descriptive themes. Finally, the descriptive themes were used to generate analytical themes and subthemes.

The codes and themes were developed using an iterative and inductive process. Initially, two researchers (EL and FB) independently coded eight (20%) papers. The researchers met to discuss similarities and differences in coding, and came to a consensus regarding the initial codes. E.L. then coded the remaining data.

On coding completion, codes were grouped together into descriptive themes by one researcher (E.L.). The research team (L.C. and F.B) then revised and made suggestions on how the descriptive thematic framework could be altered. These themes were based the authors knowledge of educational theory, the review topic, the previous quantitative review results and the content of the emerging codes. A final summary of the descriptive themes and codes was then used to identify analytical themes and their relationships by E.L. These were then discussed and refined during meetings with other members of the research team (L.C. and F.B.). Diagrams and mind maps were used as part of the

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analytical themes development. Examples of the initial mind maps linking codes to initial descriptive and analytical themes are provided in Supplementary Appendices 2 and 3. One example of a descriptive theme was 'learning can be hard' which was linked to 17 codes. This descriptive theme and related codes formed part of the basis for the analytical theme development which resulted in the eventual theme of 'taken out of comfort zone'. One researcher (E.L) checked the themes against each other and the original dataset[18] to ensure that they were a true representation of the data.

The GRADE-Confidence in the Evidence from Reviews of Qualitative research (CERQual) approach was used to rate the overall level of confidence for each of the review's findings and theme.[19] The CERQual was designed to support the systematic and transparent assessment of this level of confidence with consideration of four components. These components are the methodological limitations, relevance, coherence and adequacy of data. After consideration of each component, the overall level of confidence for each theme was rated as either, high, moderate, low or very low.[19] E.L completed the CERQual appraisal process of review findings in an excel spreadsheet which was then verified by FB.

[H2]ROLE OF THE FUNDING SOURCE: The funder played no role in the design, conduct, or reporting of this study.

[H1] Results

[H2] Identification of studies

Figure 1 illustrates the process of identification of studies for inclusion. Forty-one qualitative studies were included.

[H2] Description of included studies

Table 1 presents a summary of included studies. In total, 719 participants were included across the studies, which were conducted across 13 countries. Thirty-three studies used qualitative research methods only, while eight studies used a mixed methods design. Data collection involved individual

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interviews,[20-41] field notes,[20,42,43], surveys[29,30,37,39,40,43-46], focus groups[28,43,47-49] and written self-reflections.[20,21,29,46,50]

Learning activities completed by participants included university courses,[22,35,36,45,49] online mentoring,[43,51] professional development courses or workshops,[23,24,27,44,47,48,52-55] online courses,[32,37,46,56,57] peer review,[38] peer assessment,[28,30] mentoring,[23,25,40,44] supervision[29,39], inservice program,[58] clinical guidance,[42] audit and feedback[27] and community of practice.[31] The focus of these learning activities varied, and included the practice areas of musculoskeletal,[22,23,27-32,35,36,47-49,51,52,55,57,58] cardiopulmonary,[49] paediatric,[37,43,56] neurological,[42] women's health,[59] balance[53] and human immunosufficiency virus.[40] Some studies did not explore a specific learning activity, instead explored post-professional learning of physical therapists as a general overarching concept.[20,21,26,34,41,50]

[H2] Risk of bias assessment

A summary of the risk of bias assessment across the studies is presented in Table 2. The agreement between researchers was good (82.26 observed agreements: Kappa = 0.635, 95% confidence interval 0.586, 0.685). Five studies had a score under 10, 35 had a score between 10 and 20, and one had a score greater than 20. The most common poorly scored criteria were 'participants informed about researchers backgrounds' (two studies met criteria), 'independent analysis of collapsed data' (seven studies met the criteria) and 'contrary items were not looked for' (10 studies met the criteria). For other key risk of bias areas, describing protocol steps clearly was fulfilled in 28 studies, data collector characteristics were reported in 14 studies and analysis procedures were able to be replicated in 32 studies.

[H2]Summary of Thematic Synthesis

Overall, physical therapists perceived that worthwhile learning needed more than attendance at professional development courses. Worthwhile learning was perceived to require connection, as well as being taken out of one's comfort zone, with adequate time and access to high quality resources. These themes were inter-related, with individual data extracts supporting multiple themes (Fig. 2). A

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summary of the themes, key findings, and the level of confidence based on CERQual assessment is presented in Table 3 and Supplementary Appendix 4**.**

[H2] Theme: More than attending professional development

Physical therapists acknowledged that worthwhile learning requires more than attending a short duration professional development course. Concerns were raised about their ability to ensure clinical improvement.[21,35] Further, there was a perception that courses were often narrow in their focus, did not assist with integration of information into clinical practice, lacked applicability to work context and failed to provide follow up guidance.[21,35,49,57]

[H2] Theme: Connection

Physical therapists perceived that they require connection with others to make learning worthwhile. This connection was experienced in two ways, through role modelling, and interaction.

[H3] Role modelling

Physical therapists believed that role modelling through observing others with patients and seeing how they approached clinical situations enhanced their learning, and influenced their problem solving and behaviour.[20,25,30,35,56] Role modelling included observation of therapist/patient interactions via video recordings,[28,56] observation of peers,[28,30] observation of work mentors and collegues,[20,25] and observation of physical therapists with more expertise.[42,56] Observation of clinicians with expertise by video or face-to-face clinical encounters was reported to enhance learning,[37,42,56] with the provision of similar information in the written form being viewed as ineffective.[42,56] Working in an environment where the opportunity to see others attempting to improve and learn was also reported as positively influencing physical therapists motivation to learn.[20,56]

[H3] Interaction

Physical therapists perceived that formal and informal interaction with others with similar,[20,21,24,25,28-34,38-41,43,46,50,51,53,55,60] higher[20,23-25,29,33-36,39,40,42-44,47,48,51,53,58,60] or lower levels[20] of expertise enhanced

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learning. While role modelling was observational in nature, interaction included discussions and direction.

Physical therapists believed there were many benefits to interactions with others. Listening to how others with different perspectives and experiences approached patient encounters was seen as a valuable learning experience.[24,31,34,39,40,46,47,51,55] Articulating thought processes during discussions with peers or in response to questioning, facilitated critical self-awareness of strengths and gaps in knowledge, reasoning and skills.[20,24,25,30,43,51,60] This self-awareness was also enhanced through receiving constructive feedback on performance by experts or peers.[20,28,30,32,33,36] The absence of feedback provision was perceived to contribute to a poorer learning experience.[59]

Interactive learning experiences were perceived to provide networking opportunities,[40] increase accountability,[55] and reduce learning workload.[31] They provided problem solving support when implementing something new,[33] and resulted in increased confidence to attempt new ways of working.[34] They were thought to contribute to feelings of confidence, enjoyment, motivation, inspiration and of being supported.[25,31,33,34,40,51]

Early career physical therapists reported work dissatisfaction when this supportive interaction was absent.[34,60]

Reported barriers to interaction included geographical isolation, lack of workplace support and time constraints.[23,26,39,43,51] Technology was reported to successfully overcome these barriers. Examples were online mentoring[51] and online communities of practice.[31,55]

[H2] **Theme: Taken out of comfort zone.**

Physical therapists indicated that being taken out of their comfort zone was valuable for learning, even when this was perceived to be unpleasant at the time.[36,38] For some, this was experienced informally through exposure to new and challenging workplace situations.[20,34,41,50,60] Others reported benefit when taken out of their comfort zone during formally structured activities, such as being

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observed and provided with feedback either during role play or an actual clinical encounter.[22,24,26-28,30-33,36,38,43,59]

Being taken out the comfort zone was perceived as anxiety provoking and overwhelming by some physical therapists, and not contributing to their learning.[28,34,38] For example, physical therapists reported not contributing to group discussions due to fear of being exposed or judged by others.[41] Similar fears were reported when their clinical performance was observed.[28,30,36] Rather than rising to the occasion, some thought their performance would be poorer as a result of being observed.[28,30,38]

Physical therapists reported being more prepared to be taken out of their comfort zone in certain circumstances. These included the structured conditions of peer assessment,[30] a safe setting where mistakes were allowed,[28] a non-judgemental environment[24,31] and when interactive support was provided in new workplace settings.[34] The provision of supportive positive and constructive feedback also appeared to improve the experience.[36]

[H2] **Theme: Time**

Physical therapists valued time to participate in connected learning activities. These included, time to practice under supervision,[21,41,42,53] time to collaborate,[28,30] protected learning time at work[26,31,47] and time to be mentored.[39,40,51] Lack of time was perceived as a barrier to learning and participation in learning activities.[23,29,31,39-41,48,55,59]

With a connected learning activity such as peer assessment, additional time was suggested to be required so that participants would feel safe enough to fully engage in the activity.[28] Time was also a perceived barrier to implementing what had been learnt into clinical practice.[23,27,33,45,53]

[H2] **Theme: Accessible Trustworthy Resources**

Physical therapists perceived a need for trustworthy, evidence based resources which were easily accessible and compiled with peers through a community of practice,[31] or by respected experts.[37,56]

[H1] **Discussion**

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Five inter-related themes related to the lived experience of physical therapists completing professional development were created from 41 qualitative studies providing rich insights into the perspectives of physical therapists. These insights provide foundational guidance to inform the design and implementation of professional development decisions of physical therapists, educators, professional bodies, managers, and researchers. The theme that worthwhile learning required more than simply attending a professional development course aligns with the World Confederation for Physical Therapy guidelines for the conduct of professional development courses.[61] These guidelines recommend that courses should facilitate active learning engagement rather than merely disseminating knowledge. The other themes, along with triangulation to the quantitative review findings, can be considered as design principles for physical therapy professional development. Integration of these principles into professional development design may foster active engagement in learning, and as such, should be used to assist developers.

The findings from the quantitative and qualitative components of this review support master adaptive learner concept for the development of adaptive expertise. Adaptive expertise is where clinicians have the skills to learn from experience with unfamiliar and unpredictable contexts.[8] Each of the themes in this study can be linked components to master adaptive learner concept, and highlight the components of this concept which are important for physical therapist expertise development.

Physical therapists' perceived that being taken out of their comfort zone was beneficial for learning. This is consistent with research in expertise development that emphasizes the importance of deliberate practice.[7] In deliberate practice, the learner practices aspects outside their area of expertise or comfort, in conjunction with targeted feedback on performance.[7] This is an important part of the planning and assessment phases of the master adaptive learner, as it assists the learner to identify their knowledge or performance deficit and their progress towards addressing this deficit.[8] This finding is supported by Part A of this review which found that professional development courses that included feedback were effective at changing physiotherapy behaviour.[9] Hence targeted feedback should be considered when designing learning activities. However, care is required, as feedback on performance was perceived by some to be anxiety provoking and detrimental to learning. This variable perception on feedback

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has been reported previously and led to evidence-informed feedback guidelines to maximise the beneficial effects, while minimizing the potential negative effects, of feedback on health professional learning.[62] These guidelines suggest that learning from feedback requires a non-judgemental, supportive environment which fosters a sense of safety. This is supported by the current review that highlighted that a safe environment was perceived as important when embarking on learning activities that required physical therapists to step out of their comfort zone.

Opportunities for connection should also be considered when designing learning activities. Physical therapists perceived that connection through role modelling and interaction with others enhanced learning experiences. The perceived benefit of role model observation in the clinical environment is consistent with findings from research in other health professionals which demonstrates that health professionals perceive role modelling as positively influencing communication.[63,64] Learning through role modelling is thought to occur through imitation where-by role modelling of desirable behaviors can have a positive influence on the learner. However, there is a concern that learners may imitate undesirable aspects of the model's performance.[65,66] Hence, reflection on the role model's performance has been recommended to minimise the risk of imitation of less desirable behaviours.[66]

The perceived benefits of role modelling is also consistent with research identifying the importance of clearly communicating a desired learned behaviour or 'success criteria'.[67] In the classroom, this 'success criteria' can be demonstrated as a worked example and has been recommended as a strategy to promote metacognition.[10] In the clinical context, a worked example could be a role-model interaction between a physical therapist and patient. Meta-analyses have found that clearly communicating 'success criteria' has an effect size of 0.54 for positively impacting learning in the classroom setting.[67] However, whether role modelling in the clinical setting has a measurable positive effect on physical therapists' learning has yet to be determined and is worthy of further research. Role modelling is not included in the master adaptive learner model,[8] and this is a possible limitation in the application of this model in its purest form to physical therapists. Physical therapy clinical practice is complex, requiring the integration of clinical knowledge, data collection skill, cognition and meta-cognition to appropriately assess and collaboratively implement management plans with patients.[68]

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Role modelling may assist the development of the required meta-cognition through stimulating reflection on clinical practice and facilitating the connection of knowledge to clinical decisions. Hence role modelling should be incorporated into the master adaptive learner model. Role modelling may be important in the planning phase, as learners become aware of areas requiring development. They may also be useful in the learning phase, so that the learner knows the clinical performance they are aiming for.

Physical therapists' perception that worthwhile learning requires interaction with others is also consistent with the quantitative review findings of this systematic review (Part A).[9] Here, learning activities with interactive components, such as peer assessment and mentoring, were found to be effective at improving physical therapist knowledge and patient outcomes.[9] This is an important finding and should be taken into account when designing learning activities. However, effectiveness can depend on who the learner is interacting with, the structure of the learning experience, the learning content, the learner's workplace context and the characteristics of the individual learner.[67] There are dangers of reinforcing errors if interactive learning with peers is encouraged without adequate structure or ensuring that surface knowledge has been consolidated.[67] In the unstructured, time pressured, informal workplace environment, this is a real possibility. Hence, steps should be taken to ensure that physical therapist learners have adequate support to optimise the learning that occurs through these interactions. These supports include ensuring they have accurate surface knowledge and guidance from a knowledgeable mentor. External feedback has been identified as important to assist in the development of adaptive learning skills, as self-assessment by clinicians is not accurate.[69] The master adaptive learner should seek external feedback and not assume that their self-assessment through reflection is sufficient information on their performance. This is consistent with the master adaptive learner concept, where self-assessment is combined with external feedback.[69] The master adaptive learner still completes self-assessment which is critical for self-regulated learning,[69] however they need to acknowledge that self-assessment can be inaccurate and therefore seek out external feedback to identify gaps in their clinical performance.

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Peer assessment is an example of how peer interaction can be formally supported to minimise error reinforcement. During peer assessment, learners participate in role play and provide each other feedback on their performance. They also receive evidence based clinical guidelines and specific feedback and guidance from a knowledgeable coach, which together may prevent the potential reinforcement of errors from the learner interaction.[30] Part A of this review found that peer assessment enhanced physical therapist knowledge[9] however the effect on clinical behaviour and patient outcomes has yet to be evaluated.

The results from the quantitative and qualitative components of this review indicate that physical therapists do not work in a vacuum with time needed in the workplace to engage in worthwhile learning interactions with other clinicians. This finding is supported by a previous narrative review of professional development.[3] Our review adds to this work with the time perceived to be required with connection, so that role modelling and interaction with other physical therapists can occur. This time barrier may be overcome through the use of online learning activities which were found to be equally effective as face-to-face courses for improving physical therapists' knowledge. Importantly, physical therapists in the studies in this review valued connected learning online through recorded role-modelling interactions, communities of practice and mentoring. Online learning should not be seen as an inferior substitute to face-to-face connected learning, as meaningful active learning has been reported by physical therapists to occur. Future research should evaluate the effectiveness of interactive online activities such as e-mentoring and communities of practice, as they are yet to be evaluated in a randomised controlled trial.

The importance of reflection is highlighted in the master adaptive learner model[69] and may explain why learning activities with active components are more effective[9] and valued by physical therapists. The use of reflection is a common critical element present in the themes of connection, taken out of comfort zone and time. Physical therapists being taken out of their comfort zone, either through work duties or structured learning activities, stimulates reflection. Reflection is also an important aspect of learning through role modelling. Observing a role model at work, with comparison to what the learner might do, is a reflective exercise requiring the use of meta-cognition. Similarly, interaction with

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others where learners articulate thoughts, receive feedback on performance or provide feedback to others requires the use of meta-cognitive processes as they reflect on their own or other persons performance. Hence, the value that physical therapists place on being taken out of their comfort zone and connection may be due to facilitation of meta-cognition and reflection, which are essential for adaptive expertise.[69]

There are a number of recommendations that can be made for current CPD design for physical therapists based on this review. The quantitative (Part A) and qualitative (Part B) evidence indicates that CPD learning activities should not involve the knowledge dissemination in isolation. For maximal effectiveness, learning activities need to take participants out of their comfort zone, offer opportunities for interaction, incorporate role modelling and provide feedback on their performance. Examples of these active components are peer assessment and mentored patient interactions. Care should be taken when designing these activities to ensure participants are willing to take themselves out of their comfort zone, as some learners perceive this as anxiety provoking. These activities need to be supported by trustworthy, accessible resources. If employers and physical therapists wish to develop expertise then they must find time to incorporate these activities in the workplace as well as during structured learning activities.

[H2] Strengths

This comprehensive review of the literature provides a deep understanding of the principles and features of effective physical therapist professional development. The use of CERQual provides transparency, so that the reader may independently determine their own confidence in the reviews' findings, adding to the credibility the thematic synthesis. The triangulation of the quantitative and qualitative data provides insights of value for those who allocate resources towards physical therapist post-professional education.

[H2] Limitations

The main limitation of this review was the inclusion of studies which collected data via questionnaires or surveys with open ended questions. A narrow and incomplete perspective may have been provided

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from this data collection method which should be considered when interpreting the results. While this is a limitation, these studies were included, as they provided additional learner quotes and author perspectives which strengthened the richness and depth of the thematic synthesis which is important for reviews of qualitative studies.[70]

[H2] Conclusion:

The Qualitative (Part A) review [9] found that the learning activities effective at improving behaviour and patient outcomes incorporated the findings identified from the thematic synthesis of the Qualitative (Part B) review. These active learning activities involved feedback on performance and mentored patient interactions and are consistent with the themes of connection and being taken out of the comfort zone. Both connection and being taken out of the comfort zone require time commitment from the learners to complete the activities. However, the geographic, workplace and time barriers identified in the thematic synthesis suggests that these activities may not be widely available to many physical therapists. Hence the final theme of accessible, trustworthy resources is important to consider. This theme suggests that technology could be used to provide these evidenced based connected and out of comfort zone learning opportunities to more physical therapists.

Future research is required which evaluates the effectiveness of learning activities that dedicate sufficient time to connected learning activities which take physical therapists out of their comfort zones. Of particular importance is research evaluating the effectiveness of online connected activities such as online mentoring and communities of practice, as these have the potential to overcome the geographical and time learning barriers that some physical therapists experience.

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Systematic Review Registration

This review is the first in a 2-part series based on a published protocol and was registered on the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42016050157).

Disclosures and Presentations

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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Table 1: Summary of Included Studies

Study (Country)	Sample Size	Target Patient Group	Education Intervention	Data Collection Method
Ajjawi and Higgs,[20] 2008 (Australia)	12	N/A	Not specific	Written exercises, semi-structured interviews and work observation
Austin and Graber,[21] 2007 (USA)	23	N/A	Not specific	Semi-structured interviews, field journals
Banks et al,[58] 2013 (United Kingdom)	23	Musculoskeletal	Structured bespoke in-service program.	Semi-structured questionnaire
Black et al,[60] 2010 (USA)	11	N/A	Not specific	Semi-structured interviews, reflective journals, academic/clinical education records and resumes
Camden et al,[56] 2015 (Canada)	50	Paediatric neurological	Online module	Questionnaires
Carlfjord et al,[47] 2018 (Sweden)	16	Shoulder pain	Course	Focus groups
Constantine and Carpenter,[22] 2012 (United Kingdom)	7	Musculoskeletal	University course	Semi-structured phone interviews
Cunningham et al,[23] 2018 (Kenya)	27	Musculoskeletal	Course, mentoring	Semi-structured interviews
Dahlgren et al,[24] 2000 (Sweden)	3	N/A	Balint group training	Semi-structured interviews
Dall et al,[59] 2017 (United Kingdom)	6	Woman's health	Observation and practical training	Focus groups
Dunleavy et al,[44] 2018 (Rwanda)	168	Multiple areas	Course, mentoring and feedback	Survey
Ezzat and Maly,[25] 2012 (Canada)	14	N/A	Mentor provision	Semi-structured face-to-face interviews
Graham et al,[45] 2011 (USA)	103	N/A	University course	Online survey
Gunn and Goding,[26] 2009 (United Kingdom)	11	N/A	General	One-to-one semi-structured interviews
Hayward et al,[50] 2013 (USA)	11	N/A	Not specific	Semi-structured interviews, reflective journals, participant observation

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Lawford et al,[27] 2018 (Australia)	8	Osteoarthritis lower extremity	Course, audit, feedback	Semi-structured interviews
Maas et al,[28] 2017 (Netherlands)	64	n/a	Peer assessment	Focus groups and one-to-one in-depth interviews
Maas et al,[30] 2015 (Netherlands)	49	Low back pain	Peer assessment	Questionnaire and semi-structured interviews
Mattsson and Mattsson,[29] 1994 (Sweden)	4	Pain	Supervision	Questionnaire, participant diary, semi-structured interview of superintendent of the physical therapy department (the employer)
McCreesh et al,[31] 2016 (Ireland)	12	Shoulder pain	Community of practice	Semi-structured interviews
Monaghan et al,[52] 2018, (United Kingdom)	10	Low back pain	Course	Focus groups
Mowder-Tinney,[53] 2009 (USA)	40	Balance	One day course	Open ended interviews
Nessen et al,[32] 2014 (Sweden)	12	Rheumatoid arthritis	Feedback, online forums	Semi-structured interviews
Nielsen et al,[33] 2014 (Australia)	8	Osteoarthritis lower extremity	Course, mentoring and feedback	Telephone interviews
Normann et al,[42] 2014 (Norway)	9	Neurological	Clinical guidance	Interviews, non-participating observations
Norris,[48] 2008 (United Kingdom)	6	Low back pain	Course	Focus groups
Pettersson et al,[34] 2015 (Sweden)	12	N/A	General	Face-to-face interviews.
Petty et al,[35] 2011a (United Kingdom)	11	Musculoskeletal	University course	Semi-structured interviews
Petty et al,[36] 2011b (United Kingdom)	11	Musculoskeletal	University course	Semi-structured interviews
Richmond et al,[57] 2016 (England)	8	Low back pain	Online course	Semi-structured interviews
Rivard et al,[37] 2015 (Canada)	50	Paediatric neurological	Online	Questionnaires and interviews
Rolland et al,[38] 2010	7	N/A	Peer review	semi-structured interviews

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(New Zealand)				
Schreiber et al,[54] 2009 (USA)	21	N/A	One day workshop	Semi-structured interviews
Sellars,[39] 2004 (United Kingdom)	130	N/A	Supervision	Surveys, interviews
Sjodahl et al,[46] 2013 (Sweden)	5	N/A	Online courses (inquiry based)	Written-self reflections and course evaluation surveys
Solomon et al,[40] 2011 (Canada)	5	HIV	Mentoring	Focus groups and interviews
Stathopoulos and Harrison,[49] 2003 (United Kingdom)	5	Musculoskeletal, cardiothoracic	Masters university course	Focus groups
Stewart and Carpenter,[43] 2009 (British Columbia)	2	Paediatric	E-mentoring	Questionnaire, field notes and group meeting
Tilson et al,[55] 2014 (USA)	18	Low back pain	Course, guided group work, expert feedback	Semi-structured interviews and focus groups
Titchen,[41] 1987 (United Kingdom)	40	N/A	N/A	Non-structured interviews
Westervelt et al,[51] 2018 (USA, New Zealand, Australia)	11	Musculoskeletal	Online mentoring	Surveys and focus groups

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Table 2: Risk of Bias of Included Studies Using Quality Assessment or Qualitative Research Reports (QAQRR) Scale

Study	Item[a]																								Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Ajjawi and Higgs,[20] 2008	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y			Y				Y	Y	Y	Y	Y	17
Austin and Graber,[21] 2007	Y	Y	Y		Y	Y		Y	Y	Y		Y			Y	Y			Y		Y	Y	Y	Y	16
Banks et al,[58] 2013	Y				Y	Y			Y	Y		Y									Y			Y	8
Black et al,[60] 2010	Y	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y		Y	Y		Y	Y	Y	Y	Y	Y	Y	20
Camden et al,[56] 2015	Y	Y	Y	Y	Y	Y	Y		Y			Y	Y			Y					Y	Y	Y	Y	15
Carlfjord et al,[47] 2018	Y						Y	Y	Y	Y	Y	Y				Y	Y		Y			Y	Y	Y	13
Constantine and Carpenter,[22] 2012	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y		Y			Y	Y	Y	19
Cunningham et al,[23] 2018	Y	Y	Y			Y	Y		Y	Y	Y	Y										Y	Y	Y	12
Dahlgren et al,[24] 2000	Y	Y	Y	Y			Y		Y			Y				Y	Y	Y	Y			Y	Y	Y	14
Dall et al,[59] 2017												Y										Y	Y		3
Dunleavy et al,[44] 2018		Y				Y			Y												Y			Y	5
Ezzat and Maly,[25] 2012	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y			Y			Y			Y	Y	Y	16
Graham et al,[45] 2011	Y		Y		Y	Y			Y			Y			Y	Y	Y		Y		Y	Y	Y	Y	14
Gunn and Goding,[26] 2009	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y						Y	Y	Y	17
Hayward et al,[50] 2013	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y				Y	Y				Y	Y	Y	Y	17
Lawford et al,[27] 2018	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y			Y	Y		Y			Y	Y	Y	18
Maas et al,[30] 2015	Y		Y		Y		Y		Y	Y	Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	17
Maas et al,[28] 2017	Y		Y				Y		Y	Y	Y	Y	Y		Y	Y	Y		Y			Y	Y	Y	16
Mattsson and Mattsson,[29] 1994	Y				Y																Y	Y	Y	Y	6
McCreesh et al,[31] 2016	Y	Y	Y	Y	Y	Y	Y		Y	Y		Y				Y	Y		Y		Y	Y	Y	Y	17
Monaghan et al,[52] 2018	Y	Y	Y	Y	Y		Y	Y	Y	Y		Y	Y			Y						Y	Y	Y	15
Mowder-Tinney,[53] 2009	Y	Y	Y		Y				Y	Y	Y	Y			Y							Y	Y	Y	12
Nessen et al,[32] 2014	Y		Y		Y		Y		Y	Y	Y	Y	Y		Y	Y			Y			Y	Y	Y	15
Nielsen et al,[33] 2014	Y		Y		Y		Y		Y	Y		Y				Y	Y					Y	Y	Y	12
Normann et al,[42] 2014	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y		Y	Y	Y	20

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Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Norris,[48] 2008	Y		Y						Y													Y	Y	Y	6
Pettersson et al,[34] 2015	Y	Y	Y	Y	Y				Y	Y	Y	Y			Y	Y			Y			Y	Y		14
Petty et al,[35] 2011a	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y			Y	Y	Y	19
Petty et al,[36] 2011b	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y		Y	Y			Y			Y	Y	Y	18
Richmond et al,[57] 2016	Y	Y	Y				Y	Y	Y	Y	Y	Y				Y	Y			Y	Y	Y	Y	Y	16
Rivard et al,[37] 2015	Y		Y		Y	Y	Y		Y	Y	Y	Y				Y						Y	Y	Y	13
Rolland et al,[38] 2010	Y		Y	Y	Y	Y	Y		Y	Y		Y				Y						Y	Y	Y	13
Schreiber et al,[54] 2009	Y						Y		Y	Y		Y				Y	Y		Y		Y	Y	Y	Y	12
Sellars,[39] 2004	Y	Y	Y	Y			Y		Y	Y	Y	Y				Y					Y	Y	Y	Y	14
Sjodahl et al,[46] 2013	Y		Y		Y	Y	Y	Y	Y	Y		Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	18
Solomon et al,[40] 2011	Y		Y	Y	Y				Y	Y		Y				Y						Y	Y	Y	11
Stathopoulos and Harrison,[49] 2003	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y			Y	Y	Y	Y	Y			Y	Y		18
Stewart and Carpenter,[43] 2009	Y	Y	Y	Y	Y	Y			Y	Y		Y	Y		Y	Y						Y	Y	Y	15
Tilson et al,[55] 2014	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	22
Titchen,[41] 1987	Y						Y		Y	Y	Y	Y									Y	Y	Y	Y	10
Westervelt et al,[51] 2018	Y	Y					Y		Y	Y		Y									Y	Y	Y	Y	10
TOTAL	39	25	33	21	28	18	26	16	39	34	22	38	14	2	12	32	16	7	18	10	23	39	39	33	

[a]1 = research question/aim; 2 = theoretical framework for analysis; 3 = study design explanation; 4 = study design justification; 5 = description of steps; 6 = confirmation of participant data; 7 = consent gained; 8 = participants able to give opinions freely; 9 = method of participant recruitment;

10 = sampling strategy description; 11 = sampling strategy justification; 12 = data collection methods; 13 = data collector characteristics;

14 = participants informed about researcher's backgrounds; 15 = data checking system reported; 16 = analysis procedures able to be replicated;

17 = independent analysis of raw data; 18 = independent analysis of collapsed data; 19 = consensus achieved and described; 20 = contrary observations were looked for; 21 = triangulation of findings described; 22 = results primary findings addressed aims; 23 = discussion findings related to aims;

24 = strengths/limitations; Y = yes.

Table 3: CERQual Summary of Qualitative Findings[a]

Summary of Review Findings	Studies Contributing to the Review Finding	Cerqual Assessment of Confidence in the Evidence	Explanation of Cerqual Assessment
Not just attendance	Austin and Graber,[21] 2007, Black et al,[60] 2010, Gunn	Moderate confidence	Moderate concerns with methodological

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	and Goding,[26] 2009, Petty et al,[35] 2011a, Richmond et al,[57] 2016, Stathopoulos and Harrison,[49] 2003		limitations and adequacy. Minor concerns with coherence and adequacy. No concerns with relevance.
Connected:	Ajjawi and Higgs,[20] 2008, Austin and Graber,[21] 2007, Black et al,[60] 2010, Camden et al,[56] 2015, Carlfjord et al,[47] 2018, Cunningham et al,[23] 2018, Dahlgren et al,[24] 2000, Dall et al,[59] 2017, Dunleavy et al,[44] 2018, Ezzat and Maly,[25] 2012, Gunn and Goding,[26] 2009, Hayward et al,[50] 2013, Maas et al,[30] 2015, Maas et al,[28] 2017, Mattsson and Mattsson,[29] 1994, McCreesh et al,[31] 2016, Monaghan et al,[52] 2018, Mowder-Tinney,[53] 2009, Nielsen et al,[33] 2014, Normann et al,[42] 2014, Norris,[48] 2008, Pettersson et al,[34] 2015, Petty et al,[35] 2011a, Petty et al,[36] 2011b, Rivard et al,[37] 2015, Rolland et al,[38] 2010, Schreiber et al,[54] 2009, Sellars,[39] 2004, Sjodahl et al,[46] 2013, Solomon et al,[40] 2011, Stewart and Carpenter,[43] 2009, Tilson et al,[55] 2014, Westervelt et al,[51] 2018	Moderate confidence	Moderate concerns about methodological limitations (8 severe concerns), no or very minor concerns regarding coherence, relevance and adequacy. Data from 34 studies from 12 different countries.
Out of comfort zone	Ajjawi and Higgs,[20] 2008, Black et al,[60] 2010, Constantine and Carpenter,[22] 2012, Dahlgren et al,[24] 2000, Gunn and Goding,[26] 2009, Hayward et al,[50] 2013, Lawford et al,[27] 2018, Maas et al,[30] 2015, Maas et al,[28] 2017, Mattsson and Mattsson,[29] 1994, McCreesh et al,[31] 2016, Nielsen et al,[33] 2014, Nessen et al,[32] 2014, Pettersson et al,[34] 2015, Petty et al,[36] 2011b, Rolland et al,[38] 2010, Sellars,[39] 2004, Stewart and Carpenter,[43] 2009, Titchen,[41] 1987	Moderate confidence	Moderate methodological limitation concerns (3 studies with severe concerns), minor concerns with coherence and adequacy (Vast majority of studies clearly support findings and sufficiently rich.), no or very minor concerns about relevance.
Time	Austin and Graber,[21] 2007, Camden et al,[56] 2015, Carlfjord et al,[47] 2018 Cunningham et al,[23] 2018, Dall et al,[59] 2017, Graham et al,[45] 2011, Gunn and Goding,[26] 2009, Lawford et al,[27] 2018, Maas et al,[30] 2015, Maas et al,[28] 2017, Mattsson and Mattsson,[29] 1994, McCreesh et al,[31] 2016, Monaghan et al,[52] 2018, Mowder-Tinney,[53] 2009, Nielsen et al,[33] 2014, Nessen et al,[32] 2014, Normann et al,[42] 2014, Norris,[48] 2008,	Moderate confidence	Moderate concerns about methodological limitations (6 severe concerns), minor concerns with coherence due to 5 studies with unclear support, no or very minor concerns with relevance and adequacy.

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	Rivard et al,[37] 2015, Sellars,[39] 2004, Sjodahl et al,[46] 2013, Solomon et al,[40] 2011, Tilson et al,[55] 2014, Titchen,[41] 1987, Westervelt et al,[51] 2018		
Accessible trustworthy resources	Camden et al,[56] 2015, McCreesh et al,[31] 2016, Rivard et al,[37] 2015, Monaghan et al,[52] 2018,	Low confidence	Moderate concerns about methodological limitations, minor concerns about coherence due to 1 studies with unclear support and only 3 clearly supporting the finding, moderate concerns about the adequacy due to 4 studies with thin/superficial data and only two with rich data.

[a]Objective: to explore which learning activities enhance physical therapy practice from the physical therapist's perspective.

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Table 4: Supporting Quotes

Theme	Supporting Quotes
More than attending professional development	*"The problem of courses is you can sit at the back… and get your certificate at the end, but does it mean you are a better skilled practitioner."[26(p211)]* *"For me, personally, the information can go in but it's not assimilated and there needs to be that tie. I think doing it all in a weekend and expecting you to go home and assimilate it when the people aren't around to maybe ask questions, and it's just too much."[21(p221)]*
Connection	**Role Modelling** *"…it makes you envision what you would perhaps like your life to be like, and seeing [what] someone else is doing, that makes it easier."[25(p80)]* *"It is really helpful to actually see [the approaches] in practice on the videos. I just could not get a great understanding of how to put them in practice from reading about them."[56(p203)]* *"When you re in a place where there is just such a strong professional approach that this is the way it's done, you just go 'I have to just conform to this and I m going to pick up my game because my level of skill isn't at the level of what is happening in the place that I'm working.'"[20(p145)]* **Interaction** *"The supervisor could explain constructively where, why and how to look for the difficulties, how to approach the problem and to control the type and quality of treatment given."[29(p116)]* *"To help someone else learn to problem solve you need to have got that very much together yourself and as you are doing that process of teaching them to problem solve about a problem you continue to learn quite a lot yourself as well."[20(p142)]* *"Receiving peer feedback clearly revealed my strengths and weaknesses. I immediately understood what I needed to work on. And because my strengths were noticed, it was easier to face my weaknesses."[30(p8)]* *"It certainly was more enjoyable than sitting down reading articles on your own and I think that's kind of an important kind of factor of the Community of Practice, that it is a community as opposed to you sitting at home doing it all yourself and it does break the workload."[31(p5)]*

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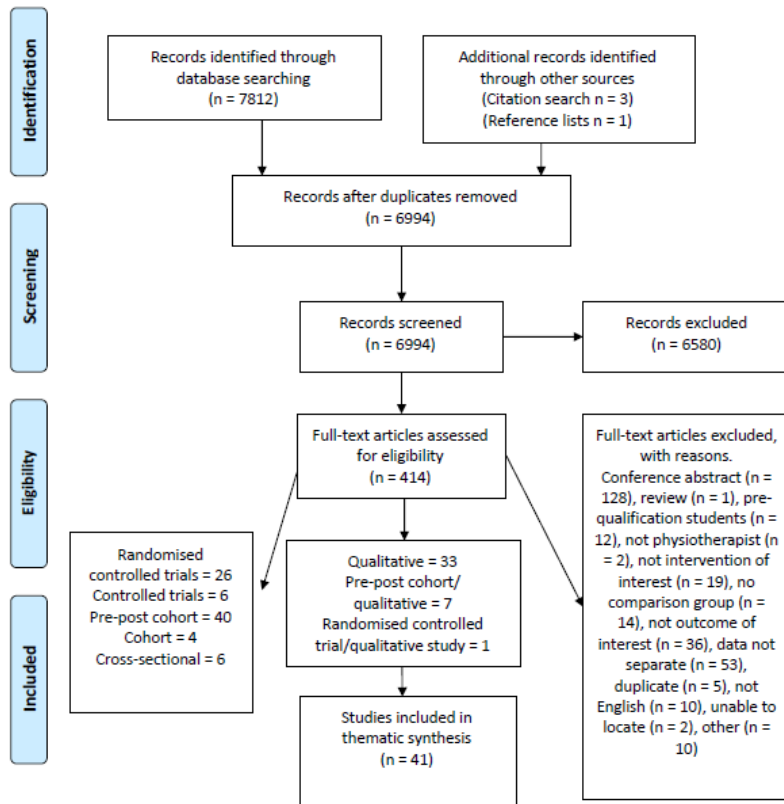|	
	"It's been an ever-changing environment in our clinic and not having a whole lot of resources to fall back on or be able to ask certain people questions that may have had experience in that particular area. It's been kind of tough figuring out stuff on my own and kind of going from there…. At that point in time, you do kind of wish you had a mentor to fall back on."[60(p1764)] *"I thought it was very accessible. I loved that we had the teleconferences because I'm coming from (distant site). There was always no issue with me using the teleconference you know rather than being there in person and I thought they worked really, really well."*[31(p4)]
Taken out of comfort zone	*"Working at a large teaching hospital really challenges you because … you're going to see it all ... being exposed to some really difficult clinical situations really does help develop your clinical reasoning skills."*[20(p141)] *"And a role play, even if I think it's the worst thing I know . . . . Yes, I think it's very uncomfortable and cannot be myself, even so I can see certain weaknesses in myself . . . . Those things I have thought about afterwards. So I think that has been great."* [32(p649)] *"I found the placements really, really helpful and even though it was very, very difficult, it was probably the most positive thing to come out of the course. In my practice, I'm still using aspects of the clinical reasoning and the key criteria that I learnt on placement and use it in my undergraduate and postgraduate teaching."*[36(p222)]
Time	*"Particularly in the treating clinic, it's very hard to give yourself some time to think about reflecting, thinking about what you did right and wrong with patients…And a mentorship… having clear structured time to sit down and reflect…(is) beneficial."*[51(p174)] *"I think it (critical appraisal of peer performance) needs time to develop. I think it will come by doing it a number of times (…). You need to feel safe enough to trust."*[28(p5)] *"In theory, it's a great idea. In practice, you don't have time to do it properly."*[33(p203)]
Accessible, trustworthy resources	*"Having someone/organization who has done all the background work at gathering/ organizing/structuring the information in such a useable way is a huge facilitator for providing evidence-based services to children."*[56(p205)]

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Figure Captions:

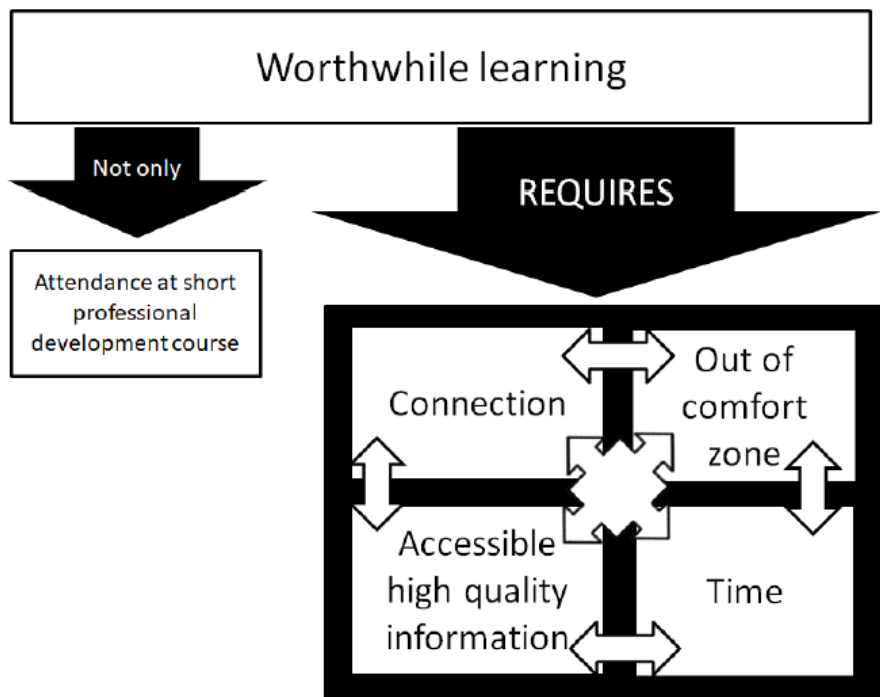**Figure 1: PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart.**

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Figure 2.