

Peer Learning in Higher and Medical Education: A Literature Review

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Received: 31/07/2015

Accepted: 25/08/2015

Published: 25/08/2015

Abstract

Over the last few decades, medical education focused on ways to improve the quality and efficiency of the teaching and learning process. Research has been centered on a variety of instructional strategies such as peer learning (PL) in higher education, as well as medical and graduate medical education. Research for this review was chosen based on Topping's (2005) definition and his inclusion of the different forms of PL. The literature presents evidence of PL that includes the following characteristics: similar degree status, matching course of study and frequently in the same year of their education process. The objective of this review is to explore peer learning as an instructional strategy to improve student learning in graduate medical education. The review explores the concept of PL, its different typologies and the theoretical lens of social constructivism to provide a basis for how PL might work to increase learning outcomes. PL learning outcomes research findings are founded on social and cultural considerations between and among peers. An increased understanding of information such as graduate course content is possible when using PL strategies. Directions for future research based on gaps identified in the literature are discussed.

Keywords: Teaching and learning and peer learning (PL).

Article

Over the last few decades, medical education focused on ways to improve the quality and efficiency of the teaching and learning process. Research has been focused on a variety of instructional strategies such as peer learning (PL) in higher education, as well as medical and graduate medical education (Santee & Garavalia, 2006; Ten Cate & Durning, 2007). Topping (2005) defines PL and its similar types: peer tutoring (PT) and peer assisted learning (PAL) as, "the acquisition of knowledge and skill between learners who have the same level of education" (p. 631). Examples of PL include students who socially and cognitively support each other in the classroom and subsequently experience educational benefits such as increased comprehension (Santee & Garavalia, 2006; Ten Cate & Durning, 2007b; Topping, 1996; Topping, 2005). Several reviews (Santee & Garavalia, 2006; Ten Cate & Durning, 2007b; Topping, 1996; Topping, 2005) show these three benefits: 1. educational benefits for students who practice sharing and learning from clinical experiences; 2. adjusting to and developing coping strategies in new learning environments; and 3. students who improved their ability explain concepts to peers. PL along with PT and PAL explored in the higher education literature (Falchikov &

Blythman, 2001; Whitman & Fife, 1988) as well as for medical learning (Secomb, 2008; Ten Cate & Durning, 2007b). Increased learning has been shown using comparison group design with:

- gross anatomy (Nnodim, 1997; Hendelman & Boss, 1986),
- communication skills (Nestel & Kidd, 2005),
- clinical exams (Field, Burke, McAllister, & Lloyd, 2007),
- undergraduate psychology (Goldschmidand & Goldschmid, 1976),
- resuscitation training (Perkins, Hulme, & Bion, 2002)
- clinical skills (Rye, Wallace, & Bidgood, 1993; Tolsgaard, Gustafsson, Rasmussen, Hoiby, Muller, & Ringsted, 2007),
- calculus (Topping, Watson, Jarvis, & Hill, 1996),
- mathematical economics (Topping, Hill, McKaig, Rogers, Rushiand, & Young, 1996),
- research education (Boud & Lee, 2005).
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Positive learning effects of PL shown in research with randomized controlled design for:

- problem-based learning (Kassab, Abu-Hijleh, Al-Shboul, & Hamdy, 2005)
- clinical skills training (Nikendei, Andreesen, Hoffmann, & Junger, 2009);
- abnormal psychology (Fantuzzo, Dimeff, & Fox, 1989).
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Few reviews of PL (including PT and PAL) methods exist for graduate medical instruction; I could find no literature on the use of PL in anesthesiology (graduate medical) education. The purpose of this literature review is to explore PL, PT and PAL as instructional strategies to increase the benefits of traditional learning in higher education, medical and graduate medical education.

I found few published studies on PL for graduate medical education but two studies did show increased learning benefits for students. Leong, Battistella and Austin (2012) examined the use of PT (another form of PL, explained in nomenclature) as an adjunctive instructional strategy with residents who had different levels of training, rotating in a hemodialysis unit to integrate pharmacy knowledge into pharmacy practice. Leong's et al. (2012) results included four themes: 1. residents were better able to organize and structure their time; 2. learners found the role of teacher increased their learning, 3. opportunities for cognitive and social equivalence and cultural learning and 4. better understanding of the inter-professional team. Lindblad, Howorko, Cashin, Ehlers and Cox (2011) also used pharmacy residents rotating in a medical stroke clinic to examine the use of PAL. Twelve residents with the same level of training were encouraged to provide critical reviews of other peers that included offering different perspectives, questioning, and feedback. Survey data from residents found that time management was improved, and the role of teacher provided greater confidence, autonomy, and better reasoning skills. Both groups of researchers found benefits for increased clinical learning for residents when they interacted with peers (Leong et al., 2011; Lindblad et al., 2011). Limited evidence for use of PL in graduate medical education indicates the need to build the argument for its use in graduate medical education. In order to accomplish this I will address the following questions:

- What value does PL bring to graduate medical education?
- Does PL enhance understanding and benefit learning?
- What are aspects of PL that influence increased learning outcomes?
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Methods

The objective of this review is to explore peer learning as an instructional strategy to improve student learning in graduate medical education by examining the types and benefits of research on PL. The literature review will begin by further exploring the concept of PL and its different typologies. In addition, I will use the theoretical lens of social constructivism to provide a basis for how PL might work. Specifically, Piaget's (1985) and Vygotsky's (1978) work will provide the theoretical foundation for social and cognitive gains that

are socially constructed. For example, this review will examine the structure of PL (i.e. students in the same grade, similar social class or same program of study) and pairing of students to see how this influences learning. Likewise, I will look at PL outcomes based on social and cultural considerations between and among peers. In addition, I will address how increased understanding of information such as graduate course content is possible when using PL strategies. Finally, I will outline directions for future research based on gaps identified in the literature.

Definition, Nomenclature and Typology of Peer Learning

Defining Peer Learning

Topping (2005) defines PL as “the acquisition of knowledge and skill through active helping and supporting, among status equals or matched companions. It involves people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by so doing” (p.631). Topping (2005) also specifies that a clearly defined structure, such as the relationship and level of training between peers and whether roles are static or reciprocal, is necessary to determine what learning outcomes have been achieved. This review will focus on peer learning among students in higher and medical education of the same degree status, similar course of study, frequently in the same year of their education, and students who are in reciprocal roles.

Topping’s (2005) definition of PL is important to this review for a number of reasons. He provides experience and research for the concept of PL that involves all ages, and levels of education that include primary, secondary and higher education (Topping, 1998; Topping & Ehly, 1998; Topping & Wolfendale, 1985). In addition, Topping has studied most forms of PL as well as those concepts related to but not considered PL such as peer assessment, peer mentoring, collaborative learning, paired reading, and parent tutoring. Likewise, he has categorized each form by definition and criteria necessary for replication of his research. Topping has also written or co-authored literature from 1985 to 2010 with school systems in multiple countries (Brozo, Shiel, & Topping, 2007), international learners (Zhou, Jindal-Snape, Topping, & Todman, 2008), and family involvement (Wolfendale & Topping, 1996). He has also looked at social effects of PL (Tolmie, Topping, Christie, Donaldson, Howe, Jessiman, & Thurston, 2010; Topping, 2001), competence and self-efficacy (Lauder, Holland, Roxburgh, Topping, Watson, Johnson, & Behr, 2008) and the challenges (Topping, 2005; Topping, 2010) PL brings to the learning process. From this extensive collection of studies, we can glean that Topping has a clear understanding of the structure of PL necessary to increase learning outcomes. However, there is no widespread agreement in the literature on terminology related to PL, and I will examine this in next section.

Nomenclature and Typology

There are many different names used in the literature on PL such as peer helper, peer tutoring, peer mentoring, peer assessment and peer assisted learning that are distinguished by how they are implemented and their desired learning effects (Topping, 2005). Topping (2005) has researched the concept of PL for the last three decades and uses the umbrella term “peer learning (PL)” to include concepts of peer tutoring, and peer assisted learning. In the past, he explains, PL differentiated the peer helper as a “surrogate teacher” and the learning progressed in a linear fashion. The teacher chose peer helpers because they were some of the best students to fill the surrogate teacher role. The use of “peer helpers” or “peer teachers” proved to be problematic due to different ability levels between peer and helper. This difference resulted in being under-stimulating for the helper and overall lacking in mutual benefits for student and helper. To overcome these concerns, Topping and Ehly (1998) differentiate the peer helper in PL by using the term, “peer assisted learning.” They describe peer assisted learning (PAL) as involving students with matched or equal formal learning who are assisting each other in acquiring knowledge and by doing so, are also learning.

Peer tutoring (PT) is the longest established and most researched form of PL and is often confused with peer mentoring in the literature (Topping, 2005). The different aspects of PT are noted by curriculum content, the role each peer takes as tutor or tutee, and a clear definition how peers interact with each other for which training is usually required. PT can either scaffold interactions with structured activities or structure behaviors between peers to apply with activities. Yet, Topping (2005) cautions: schools often place learners

together and hope that learning occurs; this is not practicing the concept of PT. Bennett, Desforges, Cockburn, and Wilkinson's (1984) research found that when grouping students they often worked as individuals and not through interaction with other students.

Recently, in higher and medical education research, researchers found greater advantages to learning between peers whose capabilities are similar. Topping (2005) describes this model as "learning by teaching" (p. 632) because peers can be both tutor and tutee. For example, in studies that compared learning for students who taught another peer, learners benefited academically more than students who received tutoring. When researchers looked at why this occurred they found that the preparation tutors went through to teach another peer actually increased their learning. In addition, tutors also reinforced their own understanding of concepts because they recognized they would need to help the tutee to understand as well. One-way tutors could reinforce and understand concepts better was by using verbalizations that include explanations and questions (Roscoe & Chi, 2007). Several studies (Bargh & Schul, 1980; King, 1998; Webb, 1989) found that when tutors verbally provide explanations and reasons for how to understand concepts, they improved the organization and accessibility of their own learning.

To accomplish this, Topping (2005) and Falchikov (2002) stress that organizational structures such as learner ability and how roles are assigned, are vital to the implementation of PL. Likewise, Topping (2005) and Falchikov (2002) believe that PL should complement and supplement professional teaching. PL can highlight learners' strengths and influence participation. As students practice cooperation and communication, this helps them better understand concepts presented during discussion (Topping, 2005). One of the most recent developments in the literature about PL places a greater focus on the details of the dimensions and variability of how PL is organized. Therefore, research presented here will examine learning outcomes and organizational structures that include a target, purpose, context and population. Other elements reported in the literature with wide variability are the following:

1. **Curriculum area**-multiple or single curriculum areas or subjects
2. **Objectives**-difference in objectives
3. **Outcomes**-wide range of outcomes or products
4. **Focus**-qualitative, summary or both
5. **Compared**-PL to teacher instruction
6. **Weight**-Determined if PL contributes to student overall grade
7. **Directionality**-of PL, unidirectional, reciprocal or mutual
8. **Contact**-variations in the degree of contact between peers
9. **Year**-of study for each peer
10. **Ability**-within same year of study, peers are matched by different **abilities**
11. **Constellation**-individuals, pairs or groups
12. **Place**-location and times for PL activities
13. **Time**-class time or free time
14. **Requirement**-PL required or voluntary
15. **Reward**-PL that had extrinsic rewards or incentives (Topping, 1996, p. 322; Topping, 1998, p. 251-252; Topping, 2001, p. 634-636)".

In sum, research for this review has been chosen based on Topping's (2005) definition and his inclusion of the different forms of PL. In addition, the literature will present evidence of PL that includes the following characteristics: similar degree status, matching course of study and frequently in the same year of their education process.

Theory of Peer Learning

To understand how PL works, researchers have looked to the social constructivist view of cognitive development (Topping, 2005). Social and cognitive interactions between peers solve problems within the peer's level of difficulty or Zone of Proximal Development (ZPD). As such, PL focuses on the social aspects of learning such as communication skills, and behaviors that influence cognitive outcomes. These skills

signify the cognitive, social, and cultural layers of the complexity of PL (Topping, 2005). In his examination of collaboration, Piaget's (1985) theory of learning and Vygotsky's (1978) Zone of Proximal Development (ZPD) offer a lens that explains how meaning might be constructed in PL. Piaget (1985) found that same age peers could increase the advantages of learning because they were more likely to engage in cognitive conflict, through arguing and debate. Bruner (1996) and Wood, Bruner, and Ross (1976) referred to this notion of cognitive conflict as supported learning or scaffolded exploration. Scaffolding is a process where knowledge is gained in progressive levels of difficulty according to what the learner is capable of understanding (Daniels, Creese, & Norwich, 2000).

Vygotsky's ZPD concept helped to develop Piaget's scaffolding theory by showing that students learned more when they interacted with more advanced learners instead of teachers. The premise of ZPD is not on the individual learning but rather on "socially shared cognition" (Newman & Holzman, 2013 p. 63). Thus, Vygotsky held the idea that learning was an activity conducted through the social sharing of knowledge (Newman & Holzman, 2013). ZPD further explains the process of scaffolding with the distance from what students can learn on their own and learning in collaboration with someone who has different experiences or knowledge. In operationalizing PL, Topping explains how ZPD functions with same-age peers by using the "cognitive other" who has cognitive demands to monitor, detect, diagnose and correct the learning errors of the other peer (Topping, 2005, p. 637).

Similarly, PL has social implications and cultural structures that can influence the learning process. The cultural aspect recognizes the difference between understood knowledge (learned through instruction) and active knowledge owned by those who have different work experiences (Daniels et al., 2000). Boreham, Shea and Mackway-Jones (2000) use the example of hospital emergency teams to illustrate how culture can influence learning. Their research demonstrated that situations in which emergency teams fail to share knowledge could result in serious consequences. Thus, hospital teams whose members work together to distribute information and share different perspectives and expertise form a collective knowledge that leads to better performance of tasks and overcoming difficulties (Boreham et al., 2000). Individuals in this example share a sense of purpose and their role in creating the collective learning process. In addition, the role of peer participates in collective activities such as cooperation and communication that foster an interconnectedness of the group that might not be possible with the individual alone. In a similar way, culture has the potential to allow or disallow a peer's ability to work towards a shared purpose by understanding how hierarchies affect the learning potential of peers (Topping, 2005). Peers who see each other as their social and cognitive equals tend to learn more than they would with a teacher who may impart knowledge instead of creating shared meaning (Argyris, 1992).

Socially, PL that is structured to reduce power relationships prompts better self-esteem, self-confidence and empathy toward other peers (Topping, 2005). A learning environment with less anxiety often leads to higher rates of student self-disclosure of learning gaps (Schunk, 1987; Schunk & Zimmermann, 1994). Thus, opportunities to make mistakes and question existing beliefs are increased (Topping, 2005).

In sum, PL has two approaches that are important when attempting to increase learning in higher and medical education: cognitive, as well as social and cultural. I will next present evidence for how these approaches influence PL strategies to enhance learning.

Cognitive Approach

Many medical schools, colleges and universities now apply the various forms of PL (Falchikov, 2001; Topping, 1996; Whitman, 1988). Research from these disciplines found advantages of PL to be increased cognitive understanding for both the tutor and tutee (King, 1998; Lockspeiser, O'Sullivan, Teherani, & Muller, 2008; Pålsson & Hellström 2013; Secomb, 2007; Ten Cate & Durning, 2007b; Topping, 1996). Researchers believe that the two concepts responsible for this are "learning through teaching" and the development of metacognitive skills.

Learning through Teaching

Studies from education researchers indicate that greater cognitive understanding of ideas may be due to the concept of “learning through teaching.” Research on learning through teaching was evident in both higher education (Boud & Lee, 2005; Lockspeiser et al., 2008; Topping, 1996) as well as medical education (De Volder, 1982; Falchikov & Blythman, 2001; First, Lauerman, Fenton, Herzog, & Snyder, 1992; Lockspeiser, et al., 2008; Seely, Pelletier, Snell, & Trudel, 1999; Topping, 1998; Topping, 1996).

Martin (1996) successfully created and applied the technique he called “Lernen durch Lehren” or “learning through teaching” (Kinney, accessed 4/22/15). His goal was to determine how learning-by-teaching fosters student learning. His findings showed that when learners adopted the role of teacher they played a more active part in the learning and took control of their own learning as well as took responsibility for their students’ learning. Topping (1996) also noted this concept when applying PL and called this “learning by teaching” (p. 323). Topping (1996) expands on the notion that in preparing to teach, the tutor engages in reviewing existing information by reorganizing, simplifying, clarifying and demonstrating the knowledge.

Other research by Lockspeiser et al. (2008) found evidence that tutors and tutees both benefited from learning by teaching. He conducted research with focus groups of first and second year medical students and found that learners valued learning from same-level peers because of the peer teachers’ recent experiences with the learning material and their struggles in medical school. One student remarked, “The thing with peer teaching is that because they’re not experts, they have a better understanding of what the basics are. When you’re an expert like the faculty what you think is basic is no longer basic” (Lockspeiser et al., 2008, p. 6). Peer teachers commented on the experience by saying, “I was motivated to learn at a deeper level because I was more motivated to learn for them than I was for myself.” Another succinctly said, “Teaching MSP has been helpful for my preparation for the boards” (Lockspeiser et al., 2008, p. 11). Yet, Lockspeiser et al. (2008) also noted that PL tutors recognized that the role of teacher was one that they needed to actually prepare for. Other researchers whose data support this need to prepare for teaching include: Escovitz, (1990); Kassab, Abu-Hijleh, Al-Shboul, and Hamdy, (2005); Nestel & Kidd, (2003, 2005).

A number of research studies in medical education have found that when a student assumes the role of peer tutor, the act and preparation for teaching results in increased learning outcomes (Peets, Coderre, Wright, Jenkins, Burak, Leskosky, & McLaughlin, 2009). In a reviewing the medical education literature, Dandavino, Snell, and Wiseman, (2007) found confirmation that teaching as a deliberate practice for peers involves different thinking and procedural skills that prove to be invaluable to the learning process. Specifically, their findings highlighted effective communication and greater understanding of teaching and learning concepts precipitated better learners. Peets et al. (2009) found with survey evidence that when medical students took the role of peer educator in a Gastroenterology/Hematology Course they improved their own knowledge acquisition and retention. Ten Cate and Durning (2007) also found that developing a teaching rotation for medical students led to benefits for both peer learner and peer teacher. In other words, deliberately going through preparation and the process of teaching, led to systematizing and strengthening of information processing for the peer teacher. Weiss and Needham (1998) took a randomized sample of pediatric residents where half of the group was learners and the other half was teachers. Eight weeks later pre-/post- test results showed evidence that those who taught gained significantly more knowledge than controls (learners). In a similar way, Bargh and Shul (1980) initiated a randomized study with two groups of psychology students. One group studied for an exam while another studied a text for 15 minutes and both then taught the material to another student. Peer teachers gained more value from the learning because they were more likely to set personal goals when teaching allows the freedom to develop their personal verbal explanations in order to achieve learning for the other peer (Ten Cate & Durning 2007b).

In sum, increased learning and a deeper understanding of information was found because peers prepare for teaching as well as teach other peers (Dandavino et al., 2007).

Increasing Metacognitive Skills

Another approach to PL was found when peers practiced verbalizing, explaining and questioning towards developing meta-cognitive (knowledge about one's own thinking) skills in medical learning (Falchikov & Blythman, 2001; Ten Cate & Durning, 2007b; Ladyshevsky, Baker, & Jones, 2000) and also higher and university education (Topping, 2005; Downing, Kwong, Chan, Lam, & Downing, 2009; Falchikov & Blythman, 2001).

Cognition is acquiring knowledge by using reasoning, discovery and experiences to solve problems or draw conclusions (Farlex, Inc. accessed 7/14/15). Cognitive understanding could be accomplished by what Dewey (1910) described as someone (facilitator or peer teacher) who provides a disruptive influence in the process of learning. In order to provide a disruptive influence, verbalization, clarification, challenges, making connections, summarizing and posing different views are all necessary to the learning process. Dewey (1910) believed this disruption moved learning to active questioning of concepts instead of passive acceptance of knowledge. Cognition focuses on exploration and discovery to solve problems but metacognition is the awareness of our own thinking or learning process (Downing, Kwong, Chan, Lam, & Downing, 2009; Marchant, 1989). As such, both may be required to facilitate deeper understanding of course material, or concepts. A problem-based learning approach as an instructional strategy increased students' metacognition skills of reflection and analysis of their thoughts (Downing et al., 2009). Downing et al. (2009) research used matched pairs (same level of learning) and a carefully constructed design of a problem based learning environment. They found that metacognitive strategies such as planning, monitoring and analysis of one's own learning process led to appropriate levels of scaffolding and supportive behaviors.

Discussion also plays a central role in this process where the learner is thinking aloud while constructing reason and discourse patterns visible to another learner (King, 1998). For example, Coleman, Brown and Rivkin (1997) explored tools of explanation and summarizing with undergraduate students in an evolutionary biology course. Their results showed positive effects on student learning when peers verbally explained ideas to another peer. Fantuzzo, Riggio, Connelly, and Dimeff (1989) took 100 undergraduate students (70 women and 30 men) enrolled in an abnormal psychology course, and found that when students were paired with their peers during structured didactics, higher test scores and greater satisfaction were evidence of an enhanced learning process. Specifically, when tutors and tutees reviewed course materials and multiple-choice tests, they also provided explanations for incorrect answers indicating that a mutual exchange process between peers can effectively enhance cognitive gains (Fantuzzo et al., 1989).

In the same way, Weinstein and Palmer (1988) assert that when college students understand how learning occurs, they are able to improve their performance. To reach this conclusion, Weinstein (1987) developed a learning and study strategy to measure students' capacity to examine their own processes for thinking about thinking (metacognition). Through repeated research, she found that awareness about and use of learning and studying strategies led to improved learning outcomes (Weinstein 1987; Weinstein & Palmer, 1988; Weinstein & Palmer, 2002).

"Cognition is acquired knowledge, whereas metacognition refers to one's awareness and understanding of that knowledge" (Vadhan & Stander, 1994, p. 307). (Vadhan & Stander, 1994; Allen & Armour-Thomas, 1993). This is also, they believe, very different from ordinary thinking that we might do during the course of our day. Instead, Vadhan, and Stander (1994), Allen, and Armour-Thomas (1993) found that metacognition requires a deliberate awareness and understanding of our thinking process. Thus, when students examine how their minds work, they are able to visualize the process of performing how to remember, learn, and problem solve. This metacognitive skill re-examines established thinking and learning towards a greater cognitive understanding of information.

Choi, Land, and Turgeon's (2005) research for example, found that peers who used a process of adaptive and meaningful questions to one another, would find this to be also instrumental at generating a reflective, reconstruction of the knowledge process. Choi et al. (2005) explain this further as, "when students hear different perspectives and personalized questions, they have to justify their position or revisit their

original understanding” (p. 484). Likewise, these authors explain this process as, “In some ways, this pattern of generating, reflecting upon, and revising explanations may be analogous to self-explaining, in which learners make sense of new information by using prior knowledge and inferences to explain it to themselves” (Chi, 2000, p. 9). King (1998) used a tutoring model called “person-plus” (p. 57) to describe a cognitive partnership that would promote a higher level of thinking towards the construction of new knowledge. In a later study, King (1999) found empirical support for discourse patterns or questions as a way to stimulate learning of complex knowledge construction and problem solving when used between pairs.

In summary, research has found that PL students gain an increased level of knowledge and understanding when taking more time to work with information in preparation for having to teach others. In addition, when learners organize their thoughts and make their reasoning process visible to themselves first (metacognition) and then to others, they understand the learning material better. Metacognition facilitates deeper learning than cognition alone because the learner is able to scaffold their thoughts in a progressive manner, leading to greater cognitive gains. Thus, metacognition and cognition provide strategies that lead to positive learning outcomes of PL because a deeper understanding through knowing how and why we think or make meaning of information are developed in order to teach the information to students. Therefore, PL can enhance understanding and benefit learning for higher and medical education.

Social and Cultural Approach

To understand how PL results in cognitive gains for those who engage in it, we must examine social and cultural structures of the learning process (Head, 2003; Daniels, Creese & Norwich, 2000). More specifically, social and cultural conditions may inhibit or encourage the creation of a ZPD. This may be possible through a hierarchal system, for example, where individuals may only act in the interest of their own needs. In this instance, not only does the learner benefit alone but also there are also fewer cognitive gains for individuals because there are no opportunities for socially constructed knowledge. In light of this, some studies have shown that when there was less competition between students, there was higher self-esteem, self-confidence and empathy in the PT process (Moust & Schmidt, 1994; Schunk, & Zimmerman, 1994).

In the same way, researchers found that when helper and helped (tutor and tutee), participated in reciprocal roles, that there was less social divisiveness due to perceived ability or status and this produced a richer cognitive experience (Fantuzzo et al., 1989; Greenwood et al., 1989). Therefore, when peers are more comfortable with one another and on “equal footing,” they may learn better. While much of the PL research used pairs of tutor and tutee, not all of the evidence shows cognitive gains for both roles. Annis (1983) looked at comparing three randomly differentiated groups of students. The first group read the material and then took the test; the second read the material with the expectation of having to teach it to a peer, and the third also read the material with the expectation of teaching it to a peer but then actually carried this out. Participants were then given a competency test the results of which showed that the group with the highest gain was the third group that read and taught their peers. Likewise, Benware and Deci (1984) also showed positive learning gains and greater depth in conceptual understanding for the group that taught the material, but not for the other group who did no teaching. In light of this evidence, it would seem that each peer must share in the role of tutor (teacher) as well as that of tutee to be able to see an increase in cognitive learning outcomes.

PL research has also shown evidence that in order to gain greater cognition, increased social and communication skills are necessary (Capstick, Fleming & Hurne, 2004; Fantuzzo et al., 1989; Greenwood, Delquadri, & Hall, 1989). PAL was found to benefit students’ social skills such as adjusting to the first year of higher education, as well as improving study skills, and understanding course material (Capstick et al., 2004). Coea, McDougall, and McKeown (1999), found more confidence and better communication between peers in their research results. In an attempt to reduce the dropout and failure rate in the Department of Chemistry, they utilized PAL to accomplish positive learning outcomes using peer assisted study sessions (PASS). Third and fourth year students who trained in leading group study sessions for the benefit of first year students, led the sessions. First year students could expect that participation in PAL would help with problem solving, general advice on note taking, revision and exam techniques and overall their chances of progressing into the next year of study. Researchers found benefits to students for both first year students as well as their leaders.

They used participation rates and exam results of those who contributed in PASS to determine research outcomes indicating the program's success (Coea et al., 1999). Leaders also gained a better understanding of chemistry and in addition, developed skills in communication and group work. Coea et al. (1999) believes that greater confidence may have led to higher participation rates with first year students and while leaders enjoyed better skills in communication, it is not clear from the results if first year students also developed these skills.

Ladyshefsky and Gardner (2008) identified groups of undergraduate physiotherapy students as research subjects in the second half of their clinical fieldwork program. The research goals were to implement reflective practice through blogging. The intent of the blogging was to use "Discussion about the state of one's knowledge that forces novices to explicate their reasoning, which in turn, fosters the development of meta-cognition as it requires students to think about their thinking, and to consider how much they know and do not know" (Ladyshefsky & Gardner 2008, p. 2). Research subjects participated in asynchronous blogging to discuss professional practice and evidence-based practice issues. Each of the blog groups also included students in their final year of clinical fieldwork as well as an academic moderator. Focus groups were used to collect information on the success of the blogs. Focus group evidence showed an increase in learning, building trust, and support for learners on how to integrate theory into practice. The authors identified challenges such as the need for better training among academic advisors, and suggested more guidelines for the blogging process. Results again suggest that to obtain a deeper level of learning, PL can be effective but requires social behaviors that use trust and support between peers.

The social relationship between peers is also a fundamental to increasing cognitive gains in PL (Colvin, 2007; Johnson, Johnson & Smith, 2007; Hart, 1990). Fassett and Warren's (2003) research found that while students interact and form relationships, power and resistance are mutually shared and managed by practicing strategies such as communicative events. Examples of communicative events are sharing information about childhood and school experiences between peers that help give meaning to why learners may respond to situations in a certain manner. In order to manage this fostered relationship learning can be more effective in an informal learning environment (Wadoodi & Crosby, 2002; Boud et al., 1999). Wadoodi and Crosby (2002) found that when learning was friendly, more relaxed and less intimidating, this allowed students to raise areas of concern without feeling foolish to other peers. Peers "understand the difficulties we have with certain topics" (p. 241) was one of the comments cited in research by Wadoodi, and Crosby (2002). The trust is an integral piece to PL because, "communications between peers are less threatening than those that involve supervisors or authorities. Hence, enhanced disclosure, discussion and deeper learning outcomes are possible" (Ladyshefsky & Gardner, 2008, p. 242). From focus group evidence, Ladyshefsky and Gardner (2008) found that blogging was effective for increased learning, building trust, and it supported learners to move theory into practice. In addition, PL students tended to communicate in the subject area more than is usually experienced in learning activities when staff is present. In the same way, peers are also able to comfortably articulate their understanding of information and have it critiqued by peers (Boud, et al., 1999). Johnson, Johnson and Smith's (2007) research showed that when groups consisted of between two to four individuals, students could get to know each other on a personal as well as on a professional level, which leads to interactions that are more meaningful. Thus, PL is effective at increasing cognitive learning when groups of learners are four to two individuals because getting to know one another, builds trust and trust facilitates greater cognitive levels of learning than is possible in larger groups. In summary, small group sizes encourage a comfortable, relaxed learning environment where students can learn more about each other while building trust and sharing information that is instrumental at challenging established knowledge to form new learning.

Collegial relationships such as those found in teams of providers in hospitals also share in deeper learning when practicing with PL. Research evidence found that hospital teams who encouraged relationships with respect and little to no power and resistance, often led to better patient care. For example, Lincoln and McAllister (1993) established empirical evidence for "promotion of collegial relationships between peers" (p. 20). Positive collegial relationships in work relationships are essential in health professions because it encourages cooperation between peers. Hart (1990) noted that this cooperative peer interaction already existed regularly on an unplanned basis but through deliberate practice using PL, could become an extended and

formalized process. This leads to benefits for the group of peer learners as well as improving quality of healthcare and the profession. Hart's (1990) research also found that PL reduced feelings of isolation, facilitated different perspectives on professional issues and individuals were provided with reassurance and support for their ideas. Dowling (1979) and Dowling (1983) looked at the interactions between supervisors, peers and clinicians in a teaching clinic and found that a shared responsibility of for PL led to increased observation and analysis skills. Moreover, their research findings also showed that fostered self-supervisory behaviors, increased problem solving and strategic development were effective at increasing learning in professional peers themselves. As such, relationships that peers form can be a powerful motivator of cognitive gains but they require structure around shared responsibilities, cooperation, trust and support of new ideas.

In summary, a learning culture that encourages less competition between students will foster higher self-esteem, self-confidence and empathy between learners. Likewise, social interactions with minimal social divisiveness will increase social and communication skills. Similarly, PL equality amongst peers with reciprocal roles can nurture a greater learning potential when the social and cultural practices are supportive.

Barriers to Effective Peer Learning

This review has described some of the social, cultural and cognitive complexities of using PL strategies. Some of the barriers researchers found when attempting to apply PL were that they did not know how peers actually felt about their PL experience (Lockspeiser, 2006). In addition, lack of social and cognitive congruence (Weyrich, Schrauth, Kraus, Habermehl, Netzhammer, Zipfel, ... & Nikendei, 2008), degree or level of participation (Lockspeiser, 2006) and peers who emulated poor teaching habits (Allen, 1983; Foot, Shute, Morgan, & Barron, 1990; Robinson et al., 2005) were also viewed as obstacles.

Lockspeiser (2006) noted that while most medical schools are using peer-tutoring programs, we still know little about how peers feel about teaching each other, rather than being taught by faculty. Unless we know more about the impressions, understanding, or capability of peers to engage in the PL process, Lockspeiser (2006) believes, we may find PL strategies to be unsuccessful. As such, Lockspeiser (2006) believed that looking at how peers viewed PL was vital to its success. In a study that used focus group and survey findings to identify and describe participants' views, Lockspeiser (2006) found that when social and cognitive congruence (equality) was present between peers, the result was powerful increases in the learning experience. Although his focus group findings generally revealed positive experiences, some survey ratings averaged between agree or neutral. Lockspeiser (2006) believed this finding correlated to peers with the highest degree of participation tending to rate PL more positively. He summarizes with the point that positive effects of PL are due to the degree of peer participation or social and cognitive congruence.

In a similar way, peer tutors' perceptions of the peer tutor role may influence their choices of teaching behaviors (Allen & Armour-Thomas, 1993; Foot et al., 1990; Robinson, Schofield, Steers-Wentzell, 2005). As such, based on peer tutors' perceptions, they may feel that teaching occurs as knowledge telling instead of information that includes embellishment, reasoning, and challenging.

The level of social and cognitive congruence also influences positive learning outcomes with PL strategies. Weyrich et al., (2008) focus group research revealed that four out of thirteen medical students found peers who exhibited a "pretentious attitude of 'know-it-all'" (p. 13) was not conducive to positive learning outcomes. In sum, all learners may not embrace or be comfortable with the notion of PL.

The success of PL may also depend on the notion of signature pedagogies. Signature pedagogies are the characteristics of teaching and learning that define each profession (Shulman, 2005). Based on Lockspeiser's (2006) focus group and survey results, he found three themes: benefits of the peer-teachers, the learning process for peer-assisted programs, and the peer-teacher/faculty role perceptions that suggest a framework for thinking about how peer assisted instruction works. Lockspeiser (2006) compares these results with Shulman's (2005) ideas of signature pedagogies. As such, Shulman (2005) believes that bedside teaching and clinical rounds, (which serve as the classrooms of medical pedagogy) characterize professional education such as physician training. Examples of physician education rituals consist of case presentations, questions

and answers at bedside, alternative interpretations, diagnosis and treatment plans (Shulman, 2005). Shulman (2005) explains how medicine analyzes, criticizes, accepts or discards information based on these rituals, which eventually develop the expertise of the discipline. More importantly, these characteristics also become traditions that count as lenses for how to think and act like a doctor. Understanding the notion of signature pedagogies reminds us that medical knowledge develops within cultural and social structures of medicine and is vital to understand PL strategies that increase learning.

Discussion

What is the value of peer learning to resident education?

Through the evidence presented here, I have been able to establish that PL strategies result in increased learning than with traditional teaching alone, in higher and medical education. Yet, we have little research to support the use of PL in resident education. Would there be value in graduate medical education by adopting PL strategies? In the next section, I will look at what resident education could gain by using PL strategies.

Physicians who wish to focus on any of the subspecialties of medicine such as obstetrics, pediatrics, or surgery must graduate from a residency program. Residency education is the clinical practice of the specialties, which could mean that when residents begin their education they may be delivering a baby or participating in a surgery for the very first time. In addition, the first year of resident training can be a very stressful time due to treating higher risk patients, increased expectations of faculty and longer hours (Martin, 1986; Cooke, 1985; Wolfe, Jones, 1985). Thus, the first reason students in graduate medical education would benefit from PL are that it could enhance the transition from medical school to providing the specialized care of residency. Ten Cate (2004) and Ten Cate and Durning, (2007) summarize why PL is a key strategy in educating physicians:

An overarching goal of medical education is progressive independence of the learner. While effective teaching is oriented toward the learning process, to foster independence learning may also gradually incorporate elements of teaching. In this model of progressive independence, competence embodies a learner who is capable of bringing everything to the clinical encounter that is needed without formal guidance by a teacher. One potential way to learn to reflect and to teach oneself is by being a teacher for others (Ten Cate et al., 2004; Ten Cate & Durning, 2007 p. 546).

Secondly, PL methods use a social constructivist approach to learning) as the theoretical basis for how to understand and develop learning. Socially constructing knowledge produces increased learning across all levels of education (Vygotsky, 1978; Corden, 2001; Nystrand, 1996) and therefore should be one of the foundations for graduate medical education. Resident education needs more opportunities for learning together with other residents rather than the traditions of teacher-centered education.

Third, Hart's (1990) research in health professions shows that PL reduced feelings of isolation; facilitated different perspectives on professional issues and individuals received more support for their ideas. Thus, residents could receive more social supportive behaviors from peers instead of a segregated learning process. In addition, Boreham's (2000) study of critical incidents in hospital emergency departments argues that professionals who work together towards developing a collective knowledge base, can lead to better patient care. The collective knowledge however depends on the social and cultural structures of the group to rethink surface knowledge to a deeper understanding from thinking, feeling and perceiving (Boreham, 2004). Therefore, a learning environment that is socially and culturally structured to value all individuals' input to the learning process is key both in education but also in hospital teams and operating rooms where people solve healthcare problems together. In sum, residents need social and learning supportive behaviors (learning different strategies and reasoning for problem solving) from their peers to facilitate a deeper understanding of how to care for patients.

The fourth reason resident education would find value in using PL methods is that medical education has used learners as teachers for decades (and maybe even centuries) in instances such as the anatomy lab (that uses teaching assistants in dissection classes) and found unequalled benefits (Ten Cate, 2007; Ocel, Palmer, Wittich, Carmichael, & Pawlina, 2003). Many medical schools apply PL (Moore-West et al., 1990) for both traditional and practical reasons but more importantly to enhance learning outcomes and we need that evidence to show that graduate medical learning would also share these same benefits.

Conclusion

This literature review examines the potential of PL to enhance learning outcomes in higher, medical and graduate medical education. In 2010, the Carnegie Foundation issued the report: *Educating Physicians: A Call for Reform of Medical School and Residency* (Cooke, Irby, & O'Brien, 2010). In response to this call for reform, Irby, Cooke, & O'Brien, (2010) observed that clinical education for doctors relies too heavily on mastery of factual information and then fails to integrate formal knowledge with experiential learning. The educational values of PL is one way to enhance learning for graduate medical education.

PL can provide both social and learning supportive behaviors to learners who might otherwise learn in isolation. Likewise, a deeper understanding of knowledge can be developed when using PL because socially constructed knowledge uses the experiences and knowledge that others bring to the learning environment. Moreover, peers are more likely to disclose learning deficits and challenge existing beliefs with other peers than they are with their professors. Therefore, PL gives social and collegial support to others that may encourage positive learning outcomes.

Peers who teach can increase their own learning because they work with the information longer and in different ways in order to teach it to another peer. Learning through teaching can stimulate a learner's active participation and control of their own learning because they take responsibility for their students' learning. The notion that in preparing to teach, the tutor engages in reviewing existing information by reorganizing, simplifying, clarifying and demonstrating the knowledge in order to teach it to others results in a increased understanding. In sum, PL can facilitate a deeper understanding of information.

The different aspects of PL that influence increased learning outcomes are the social, cultural and cognitive approaches. Socially, PL can be structured to reduce power relationships, which encourages self-esteem, self-confidence and empathy between peers (Topping, 2005). Reduced power relationships can also encourage learning environments with less anxiety that often leads to higher rates of student self-disclosure of learning gaps (Schunk, 1987; Schunk & Zimmermann, 1994). Thus, opportunities to make mistakes and question existing beliefs are increased (Topping, 2005).

Culturally, roles of helper and helped (tutor and tutee) who participated in reciprocal roles, found less social divisiveness due to perceived ability or status and this produced a richer cognitive experience (Fantuzzo et al., 1989; Greenwood et al., 1989). Peers who are more comfortable with one another or on "equal footing," learn better. In addition, increased social and communication skills are necessary (Capstick et al., 2004; Fantuzzo et al., 1989; Greenwood et al., 1989). Researchers found PAL to benefit students with social skills such as adjusting to the first year of education, as well as adopting improved study skills, and understanding of course material (Capstick et al., 2004). Likewise, Coea et al. (1999) also found more confidence and better communication between peers.

The cognitive approach to PL facilitates a greater understanding of knowledge through teaching to learn. Teaching to learn in turn facilitates metacognition or an understanding of how we come to know our own process for acquiring more knowledge. In summary, peers who practiced verbalizing, explaining, questioning and reasoning with other peers saw increased learning benefits.

The final point this literature review argues is to ask if peer learning is necessary to residents' education? I would like to suggest a rhetorical question as a way to answer this. How can graduate medical

education progress without socially constructed development of knowledge, social and cultural support amongst learners, and “creation of meanings that are shared rather than imposed (Head, 2003, p. 48)?

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