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Preface

It is a delight to open this issue with some new insights on Houle's conceptualization of self-direction in learning based on historical research conducted in the archival collections at the Syracuse University Library. Fortunately, Cyril Houle saved his research notes from the study that resulted in his classic, *The Inquiring Mind*. Brockett and Donaghy report on their analysis of the folders in the Cyril O. Houle Collection as well as a variety of other sources, providing insights into Houle's early work and the work of Knowles and Tough, two other pioneers in the resurgence of interest in self-direction in learning.

Moving from the past to the leading edge, Kranzow and Hyland address the rapidly expanding area of distance education options in higher education that continuously rely on new technologies as delivery mechanisms. The authors note the temptation to adopt the new technologies without first assessing their impact on the quality of instruction. They examine faculty and student views of using digital tools to enhance self-directed learning and critical thinking, focusing primarily on the use of electronic textbooks (etext) and electronic library resources.

The last two articles in this issue focus on an area of educational preparation that has fostered a great deal of research on self-direction in learning: the preparation of medical professionals. Prompted not only by the urgent and obvious need for physicians to maintain currency in their fields in order to provide the best possible care but also by requirements of their accrediting agencies, medical preparation programs have been implementing curricular innovations designed to enhance the preparation for lifelong, self-directed learning among future medical professionals. Findley and Bulik examine the relationship of self-directed learning readiness to knowledge-based and performance-based measures of success in third-year medical students engaged in an integrated medical curriculum which includes problem-based learning and evidence-based medicine; Piskurich examines ways of overcoming the resistance of time-strapped medical students to methods that foster independent study and lifelong learning, noting the very real problem that faculty will be reluctant to implement the new approaches if their students express their resistance in low faculty evaluations. Although these studies were conducted in medical education settings, their implications will be valuable in any arena in which self-directed learning is being promoted.

In our work in the area of self-directed learning, it is important to learn from the past, carefully observe and experiment in the present, and thoughtfully consider ways of incorporating and adapting new technology to further the development of self-direction in learning and critical thinking. The authors of these articles assist our exploration of these three perspectives.

Lucy M. Guglielmino, Editor

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CONTENTS

SELF-DIRECTED LEARNING: THE HOULE CONNECTION

Ralph G. Brockett and Robert C. Donaghy

This article offers an examination of Cyril Houle's key role in the development of self-directed learning as an area of research. He did this in two ways: (a) through the publication of his classic work, *The Inquiring Mind* and (b) through the influence of two of his doctoral graduates: Allen Tough and Malcolm Knowles. Together, Houle, Tough, and Knowles were central to laying the groundwork for subsequent research on self-directed learning.

Since the early 1970s, self-directed learning (SDL) has emerged as one of the most influential areas of study and practice in adult education. However, little has been written about how this line of scholarship has evolved. One exception is a study by Donaghy (2005) of eight prominent North American self-directed learning scholars. Using qualitative and phenomenological research methods, Donaghy traced the stories of how SDL has been woven into the personal and academic lives of these eight scholars. Hiemstra (as cited in Donaghy, 2005) has suggested it is important to trace the evolution of scholarship in SDL through inquiry into the early writings in this area, focusing on when and from whom these early ideas emerged.

Cyril Houle is frequently credited as having played a pivotal role in bringing self-directed learning (self-education as he frequently called it) to the forefront of scholarship in adult education and learning. Although most of Houle's work was only tangentially linked to SDL, it can be argued that Houle influenced this line of inquiry in at least two ways: (a) through some of his own writings, especially the publication of *The Inquiring Mind* (1961/1993) and (b) through the work of two of his former students: Allen Tough and Malcolm Knowles. The purpose of this article is to examine the early development of self-directed learning as an area of study and practice using Houle as a point of departure. Through primary literature sources, secondary critiques and analyses, archival resources, and insights gained from interview data collected as part of a larger study (Donaghy, 2005), we hope to offer a perspective on how SDL gained a foothold as a vital area of inquiry in adult education. This article is an expansion of an earlier presentation by the first author (Brockett, 2003), with subsequent research by both authors in the Syracuse University

archives, and interview data collected by the second author (Donaghy, 2005) as part of a study on the evolution of scholarship in SDL.

Houle's Contributions to the Literature of Self-Directed Learning

Cyril Houle most likely did not set out to influence the study and practice of self-directed learning. Yet, in looking at his various writings, it is clear that Houle's contributions to this area were substantial. For instance, in his 1964 book, *Continuing Your Education*, which was written "especially for adults . . . who have already established themselves and who now want to fit an organized learning activity into the pattern of their lives" (p. vii), Houle offers a guide with suggestions for helping adults become more effective learners. While there are limited references to self-education or self-directed learning in this book, he does offer a caution at one point by stating that "while adults often teach themselves what they want to know, they may run into real dangers if they rely on this method too consistently" (pp. 32-33).

Four decades ago in the first edition of *The Design of Education* (1972), Houle's classic work on program planning in adult education, he defined adult education as follows:

> Adult education is the process by which men and women (alone, in groups, or in institutional settings) seek to improve themselves or their society by increasing their skill, knowledge, or sensitiveness; or it is any process by which individuals, groups, or institutions try to help men and women improve in these ways. (p. 32)

By including *individuals* and learning *alone* in his definition, Houle implied that self-directed learning should be considered a viable element of adult education. This definition stands in stark contrast to others from that time, most notably Verner (1964) who played down the influence of self-directed learning when he described adult education as a "relationship between an educational agent and a learner in which the agent selects, arranges, and continuously directs" (p. 32) the learning experience. Thus Houle, through his definition, helped to create space for self-directed learning as a legitimate form of adult education, although he did not actually use the term *self-directed learning* at the time.

Another way in which Houle contributed to self-directed learning was in his examination of *external degree* efforts (Houle, 1973), a term that preceded what today falls within the domain of distance education. In this work, Houle addressed issues relative to increasing access to adult learning opportunities by trying to reach potential learners beyond a traditional higher education setting. Although he does not specifically address self-directed learning in this book, the notion of serving adult learners through nontraditional higher education degree programs is similar to the argument that expanding the definition of an adult learner beyond the walls of traditional institutions recognizes a broader, more inclusive view of adult learning. This perspective is borne out in later research by Tough (1971, 1979) and the many scholars who followed in his line of inquiry.

Still another contribution can be found in Houle's (1984) book, *Patterns of Learning*. In this book, which Houle (1992) later referred to as "a series of essays describing how individuals devise patterns of learning for themselves that change as they grow older" (p. 300), he uses biographical sketches to illustrate how adults adopt different patterns of learning. Examples of self-directed learning are found in the stories of Michel de Montaigne and Henry David Thoreau, as well as in a discussion of educational travel, using Florence, Italy, as the illustration.

But Houle's greatest influence on self-directed learning came well before any of these works. In *The Inquiring Mind*, Houle (1961/1993) described the results of a study he conducted through interviews with 22 active adult learners. He categorized these learners in three different ways based how they viewed the "purposes and values of continuing education" (p. 15): goal-oriented, activity-oriented, and learning-oriented. It was the latter of these groups that was of particular interest relative to self-directed learning. The learning-oriented adult was described as an adult who engages in learning purely for "the desire to know" (p. 25). Here, Houle draws parallels to self-directed learning. In the afterword to the 1988 reprinted edition of *The Inquiring Mind*, Houle noted that at the time of the book's publication, "the idea that men and women should assume responsibility for their own learning was tacitly accepted by most people," although the idea of studying this phenomenon was "greeted with apathy or scorn" (1961/1993, p. 89). The idea of self-directed learning, if not the actual term, was in Houle's mind when he conducted his seminal study and this research seems to have helped to *legitimize* self-direction as an area of research inquiry.

Despite the common belief that Houle (1961/1993) did not use actually use the term *self-directed learning* at the time of his original research reported in *The Inquiring Mind*, there is some evidence to the contrary. During separate visits to the Adult Education Collection at the Syracuse University Library, we uncovered information that may show a more direct connection of Houle's work to SDL than had been previously suggested (for example, Brockett & Hiemstra, 1991; Guglielmino, 2002; Guglielmino, Long, & Hiemstra, 2004). Contained among Houle's papers in the Syracuse University archives are notes that were utilized for thematizing the transcripts of participants in *The Inquiring Mind* study. Many of the field notes are typed, while others contain hand-written notes. Because it is difficult to determine who wrote the field notes and when the hand-written comments were added to the typed notes, R. Hiemstra (personal communication with Brockett, May 21, 2003) sent a copy of the information to Houle's son, David, for comment. This correspondence, according to Hiemstra, validated that the notes were actually in Houle's handwriting. However, since it is not possible to determine when these notes were added, it is important to interpret these hand-written comments with some degree of caution. Thus it is possible that these comments were added at a later date from when Houle originally completed the research for *The Inquiring Mind*. The important point, however, is that Houle is in all likelihood the author of the notes.

These notes indicate several points. First, Houle's (n.d.a) index for the audiotapes labels the research as a "study of self-educating people" (p. 1). Second, on some of the coding sheets for the study, the comment "How does the subject view

himself as a self-directed learner?" (Houle, n.d.b, Mr. A, p. 30) is typed at the top of each page. In one quote extracted from the field notes of the interviews, Houle observes, "Mrs. N rather clearly views herself as a self-directed learner" (Houle, n.d.b, Mrs. N, p. 15). In another example, Houle says "Mr. O . . . . does not . . . however, have a fully mature conception of himself as a self-directed learner" (Houle, n.d.b, Mr. O, p. 9). As a third example, Houle says, "Mr. R has a very mature conception of himself as a self-directed learner" (Houle, n.d.b, Mr. R, no page). Finally, Houle (1961/1993) actually interviewed 22 people for his study (p. 84); however, he chose not to include one if the interviewees in his analysis because he believed her "not to be truly self-educating" (Houle, n.d.c, p. 8). These comments provide evidence that Houle was thinking more decisively about the relevance of self-directed learning in *The Inquiring Mind* than previously believed.

Beyond the Inquiring Mind: Self-Planned and Self-Directed Learning

The Inquiring Mind laid a strong foundation for what was to follow. As was mentioned earlier, the second way in which Houle can be linked to SDL is through two of his doctoral graduates from the University of Chicago: Allen Tough and Malcolm Knowles. Although they contributed to self-directed learning in very different ways, Tough and Knowles are generally acknowledged to be the two individuals who set the stage for future work in self-directed learning. The contributions of each are highlighted below.

Allen Tough

Tough's involvement with what he came to describe as *self-planned learning* was directly influenced by his study with Houle. During an interview conducted by Donaghy (2005), Tough stated that he was first introduced to the notion of self-directed learning in a program planning class he took with Houle. According to Tough, this class introduced him to "the concept of a 'learner learning something on his . . . [or] her own'" (Donaghy, 2005, p. 127). Tough acknowledged that this class with Houle was what initially gave him the idea for his dissertation. In describing how Tough came to be involved with self-directed learning, Houle reported that Tough read *The Inquiring Mind* and some of the 22 interview transcripts from the study and that this reinforced "his conviction that an investigator could precisely analyze the self-directed learning actions of an individual" (p. 92). At the same time, however, Tough said that the actual inspiration behind his research on self-planned learning (Donaghy, 2005, p. 129) came from another of his professors, Phillip Jackson, who strongly encouraged him to pursue this study. The point here is that while there is clear evidence of Houle's influence on Tough's thinking, there were other sources of inspiration that may have been at least as strong as Houle's.

Tough subsequently completed his doctoral dissertation on adult self-teachers (Tough, 1966) and, a few years later, his learning projects study (1971, 1979). In an assessment two decades after the publication of *The Adult's Learning Projects*, Kasworm (1992) noted that the shift Tough made from *self-teaching* to *self-planning* actually "incorporates a broader perspective of the adult learner's action and the

learner's use of other resources" (p. 57).

The enthusiasm with which Tough's research was received can be seen in the numerous replications of his approach that were undertaken in the following years. For the most part, these studies confirmed support for Tough's major findings with such samples as mothers with pre-school age children (Coolican, 1973), rural and urban adults (Peters & Gordon, 1974), older adults (Hiemstra, 1975), and a U. S. national sample (Penland, 1978, 1979). These, along with other replication studies, have been reviewed by Tough (1978, 1979) and Brockett and Hiemstra (1991).

Malcolm Knowles

Like Tough, Malcolm Knowles was a student of Houle at the University of Chicago. Unlike Tough, however, Knowles had been considering issues, questions, and practices related to self-directed learning before entering doctoral study with Houle and before Houle conducted his *Inquiring Mind* study. As early as 1950, Knowles made reference to self-direction. In his book, *Informal Adult Education*, Knowles described several assumptions underlying group-centered leadership. The second assumption reads as follows: "*Each individual has a fundamental urge to grow – to achieve greater maturity and self-direction*" (italics in original) (Knowles, 1950, p. 62). He continues by saying it is assumed "that individual growth will take place best in a group that is free from authoritarian control and maturely accepts responsibility for its own direction" (p. 62). While Knowles is writing specifically about group dynamics here, the notion of individual growth through self-direction is central to the assumption.

During the late 1950s, further signs of Knowles' interest in self-directed learning can be found. In an article published in the periodical, *The Church School*, Knowles (1959) stated that an adult is one who has matured "from dependency toward autonomy to the point that at least he makes his own decisions and faces their consequences" (p. 9). He further notes that adults "are more capable [than children] of taking responsibility for planning their own learning experiences and they have more resources from which to contribute to the learning process itself" (p. 10). Knowles goes on to suggest this implies church programs for adults must be "person-centered rather than subject-centered" (p. 10). Also, in a speech given in 1960 to the Council of Liberal Churches, Knowles (1960) discussed the movement from dependency to autonomy in the following way: "One of the central quests of [a person's] life is for increasing self-direction--recognizing that the opposite of dependence in our complicated world may not be independence so much as self-directing interdependence" (p. 5).

Although Knowles was at the University of Chicago several years earlier than Tough, and their time at Chicago did not overlap, the two educators seem to have held each other in high regard relative to their contributions to SDL. For example, during his interview with Tough, Donaghy (2005) reported that Tough gave credit to Knowles for his important contributions to SDL. Similarly, it appears that Tough's learning projects research had an influence on later writing by Knowles on self-direction. In a letter to Tough dated July 27, 1972, Knowles stated,

> I had received a very pleasant sensation from my previous scanning of it [*The Adult's Learning Projects*], but when I really got into it today I found myself feeling really thrilled. It is a magnificent piece of work, and so well written. It greatly deepened my own insights into the nature of self-directed learning and made it more operational for me. (p. 1)

Three years later, Knowles' (1975) own book, *Self-Directed Learning: A Guide for Teachers and Learners,* was published. Because this book is a practical, "how to" guide, Knowles does not use exhaustive citations or quotes. However, he does list references to works by Tough and Houle at the end of several chapters. In addition, he includes a quote from *The Adults' Learning Projects* in one chapter.

The Houle Connection: Its Place in the Literature of Self-Directed Learning

One way to assess the contributions of Houle, Knowles, and Tough is to look at how their works have been utilized by subsequent scholars in the area. Confessore and Confessore (1992) conducted a Delphi survey to determine "the most important published works that, in the panel's judgment, should be read at the outset of one's introduction to the field of adult self-directed learning" (p. 17). They found that the two highest ranked works were *The Adult's Learning Projects* and *The Inquiring Mind*. Knowles' *Self-Directed Learning* ranked fifth while Tough's (1978) article in *Adult Education* ranked eighth.

More recently, two studies using citation analysis (a technique designed to provide quantitative data about authors and publications that have influenced literature in a given area) have provided further information on the lasting influence Houle, Knowles, and Tough have had on the literature of self-directed learning. In the first of these studies, Conner, Carter, Dieffenderfer, and Brockett (2009) analyzed the citation lists for 158 articles published in 18 adult education periodicals between 1980 and 2008. Among these articles, Knowles was the third most frequently cited author, Tough was fourth, and Houle was ninth. Relative to publications, Tough's (1971/1979) *The Adults' Learning Projects* was the most frequently cited publication, while Knowles's *Self-Directed Learning* (1975) and *The Modern Practice of Adult Education* (1970/1980) were second and fourth most cited, respectively. Houle's *The Inquiring Mind* (1961/1993) was the sixth most frequently cited publication. Finally, a 1978 article by Tough that appeared in the journal *Adult Education* (now *Adult Education Quarterly*) tied for fourteenth most cited. Thus, among the 158 articles examined by Conner et al., Houle, Knowles, and Tough authored four out of six and five out of 14 of the most frequently cited publications.

In a second study, using a similar citation analysis design, Kirk, Shih, Smeltzer, Holt, and Brockett (2012) examined the first 13 issues of the *International Journal of Self-Directed Learning*, published between 2004 and 2011. Among the 72 articles published during this period, Knowles tied for third most frequently cited author, Tough was sixth, and Houle was sixteenth. Among the most frequently cited publications, Knowles's *Self-Directed Learning* (1975) was ranked first, *The Adults'*

Learning Projects (Tough, 1971/1979) was third, and Houle's *The Inquiring Mind* (1961/1993) and Knowles's *The Modern Practice of Adult Education* (1970/1980) tied for fifth.

From these two studies, it is clear that the influence of Houle, Knowles, and Tough have remained strong in the literature of self-directed learning through to the present day. The Conner et al. (2009) study covered SDL articles identified in a wide range of periodicals over a 28-year period, while the Kirk et al. (2012) study was more current and limited to a single journal devoted exclusively to self-directed learning. Yet, Houle, Tough, and Knowles, along with four of their key publications, are consistently toward the top of both lists of most frequently cited authors and publications.

A Lasting Legacy

This article serves as a starting point for looking at the evolution of scholarship in self-directed learning by examining the contributions of three seminal figures in this line of inquiry. Future research could broaden this understanding. For example, it would be informative to complete a content analysis of adult education literature from 1900 to 1950, to determine the contributions of other scholars in the area of SDL (Hiemstra, as cited in Donaghy, 2005). Another idea is to "look at the work of Houle [and] Knowles . . . to determine their sources of information" (Donaghy, 2005, p. 186).

In conclusion, it was our intention to show that Cyril Houle, Allen Tough, and Malcolm Knowles each played an important role in the development of self-directed learning research and practice by tracing the intellectual development of these individuals' work. More than 50 years after the publication of *The Inquiring Mind*, much more is known about self-directed learning and self-directed learners, while research and scholarship in this area continues on several fronts today. From the evidence we have presented, it is clear that Cyril Houle played a pivotal role in the establishment of this line of inquiry. Although their direct influence will likely diminish somewhat as new scholars continue to expand the knowledge base, it is clear that the works of Houle, Knowles, and Tough are seminal to the development of SDL as an area of study and practice. Thus, these three scholars, individually and through their connections to one another, provide a lasting legacy.

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FACULTY AND STUDENT VIEWS OF USING DIGITAL TOOLS TO ENHANCE SELF-DIRECTED LEARNING AND CRITICAL THINKING

Nancy Hyland and Jeannine Kranzow

While there is growth in both online courses and the utilization of online resources such as etext and elibrary resources (Rae, 2011; Seaman, 1994; Wieder, 2011), research about how these technologies are impacting education in general and critical thinking and self-direction specifically, is lacking in the research. This preliminary qualitative study examines faculty and student insights into the potential for electronic textbooks (etext) and electronic libraries (elibraries) to contribute to positive learning behaviors.

Overview of the Technological Challenges Facing Higher Education

From online class components to electronic textbooks and libraries, students are moving faster and faster along the information highway. Higher education finds itself in a reciprocal relationship with technology; one in which higher education is both servant and master. Because of the recent downturns in the economy, two-thirds of higher education institutions reported an increased demand for new distance learning offerings in 2009 (Chaney, Chaney, & Eddy, 2010). In Fall 2007 just under 4 million students enrolled in an online course (Roman, Kelsey, & Lin, 2010), and by Fall 2008 that number had jumped to 4.6 million (Chaney et al., 2010). Higher education is in the midst of a technological revolution akin to the industrial revolution but with a speed of change unknown to previous generations (Ehrmann, 1999; Fahmy, 2004). The speed of technology obsolescence places institutions in an inescapable continuum of catch-up over which they have little control (Mallette, 2002). According to the 2010 Horizon Report (Johnson, Levine, Smith, & Stone, 2010), the emerging technologies that will be required to support teaching and learning are mobile computing, electronic books, and visual data analysis. These technologies will not only redefine teaching and learning but will be the

underpinnings for policy changes, access to education, and an expansion of the return-on-investment model (Blimling, 2000; Harpool, 2005).

The Problem

While we see the growth in both online courses and the utilization of online resources such as etext and elibrary resources (Rae, 2011; Seaman, 1994; Wieder, 2011), research about how these technologies are impacting education in general and the development of critical thinking and self-direction specifically is lacking in the research. Bertrand (2010) finds,

> Despite an ever-expanding and rich pool of new applied research areas of information technology to one of its core businesses, i.e., teaching, the academic world has not kept up with researching and investigating the impacts of information technology on itself or on society. (p. 106)

Prensky (2001), Bertrand (2010), and others (Corrin, Lockyer, & Bennett 2010; Salmi, 2002) discuss new models for education as higher education thinks about both globalization and currency. The change for higher education has been most significant in teaching and learning, and the impact of this revolution goes straight to the centrality of the purpose of higher education institutions (Barr & Tagg, 1995). The technology revolution has altered our collective realities and simultaneously the rules that have supported them. It is essential that teaching and learning become equally dynamic and attuned to this changing paradigm (Barr & Tagg, 1995; Bertrand, 2010; Prensky, 2001; Salmi, 2002).

Purpose

Since there is a paucity of research addressing the impact of varied information and communication technologies (ICTs) on student critical thinking and learning in the literature (Bertrand, 2010), the purpose of this preliminary study was to investigate faculty and student perceptions of the use of digital tools, specifically etext and elibraries, to encourage students in their self-directed learning and critical thinking. "The potential for ICT to enhance, extend, and change the role of the teacher can be perceived as an exciting opportunity or a confidence-crushing threat" (Loveless, 1998, p. 1272). The researchers hoped to gather enough data to determine whether or not further studies in this broad but largely unstudied area would be appropriate.

Conceptual Framework

Hanann and Silver (2000) delineate three phases of innovation; one phase driven by the individual who embraces change and seeks to be at the forefront and two phases that are institutionally motivated. In the phase of the individual, it is guided and linked to some desired or expected improvement in teaching and learning.

The second and third phases, which are institutionally motivated, are guided by either the premise of student-centered learning or efficiency. The authors have chosen to frame this research from the latter perspective because an understanding of both the positive and negative impacts of student and faculty engagement with technology is integral to the study. This positions the study to explore not only teaching and learning but also policies that can support successful incorporation of technology.

The ICT literature is grounded in constructivism, as technology lends itself to this way of thinking (Chan Bee, 2007; Loveless, 2000; Overbay, Patterson, Vasu, & Grable, 2010; Wang, 2009). Chan Bee (2007) states, "The constructivists argue that learning is an active process and each individual is capable of constructing new ideas or concepts using their preexisting knowledge when immersed in new experiences" (p. 187). Pedagogically, ICT requires engagement and interaction with learners; therefore, constructivism best frames and orients this study. Traditional pedagogical approaches must be re-engineered to take advantage of the power for learning that is embedded in e-tools. The practice of delivering the same lecture year after year has no place in the new environments of learning. "Such traditional practice faces the danger of breeding a group of students who lack the flexibility to function well or transfer learning to the competitive workplace" (Chan Bee, 2007, p.186).

If we accept that constructivist theory underpins the implementation of e-tools, then the corollary must be that we accept a change in how both learner and teacher perceive their role in the revised teaching and learning paradigm (Kranzow & Hyland, 2009). This new vision will hopefully consist of a technologically-rich learning environment that embraces knowledge construction grounded in critical thinking and self-directed learning supported by a myriad of available e-tools. The initial step in achieving this goal would seem to be an understanding of the current perspective of students and faculty as they interact with various ICTs.

Technology

Technology is often hailed as the solution to all that ails education today (Unwin, 2007). Not only can it make learning more efficient and "greener" (when technology substitutes for paper and hard copy articles and texts), but it potentially allows colleges and universities to enroll more students in online courses, bringing more dollars into often struggling institutions (Hannon & Bretag, 2010). While this incredible potential for ICTs is present, educators must question the unwritten formula that "technology plus students equals progress" (Unwin, 2007, p. 301).

Within the formula, cost becomes a pivotal force in two areas—access and opportunity. College and universities often want to highlight their use of the most current technology and maintain a funding stream with which to purchase constantly appearing newer technologies. In terms of access, expensive technology increases the cost of providing education (Mallette, 2002). Many institutions pass along some of these costs to students (Mallette, 2002), which can limit the potential ability of some students to pay for education. An increase of a few hundred dollars passed along to a student in tuition may ultimately prevent low-income students from enrolling in the programs of their choice.

Institutions have a plethora of choices about which technology products and platforms to purchase. Critical decisions are made here because ultimately, these choices affect the individual student experience on a daily basis as well as the long-term fiscal responsibility of the institution. Items such as networking and telecommunications infrastructures, technical support staff, and repair and maintenance are simply a few of the costs associated with ongoing utilization of technologies (Jones, 2003). Since maintaining existing technologies takes a significant portion of the technology budgets (Mallette, 2002), there is a great responsibility on the part of decision-makers to select the appropriate technologies.

As almost everyone in higher education is aware, technology "has changed the ways libraries function and researchers and scholars conduct research…" (Bertrand, 2010, p. 112). The ability to purchase available databases quickly becomes not only an educational decision, but one of social justice and equity since foregoing access to available resources would prevent an institution's students from learning from the same resources that others learn from.

Self-directed Learning

With the growth of technology in general came the growth in online learning, which has reawakened the interest in self-directed learning (Chou & Chen, 2008). Self-directed learning is grounded in the principles of adult learning and characterized by a shift in the power relationship between learner and faculty, student initiative and self-management, and motivation for learning expressed through the autonomous learner (Brockett & Hiemstra, 1991, Brookfield, 2005; Guglielmino, 2008; Knowles, 1975; Merriam & Caffarella, 1991). In this renegotiation of power, "The students need challenges, support and feedback in their struggle to become self-directed learners and thus require ongoing attention from faculty" (Silen & Uhlin, 2008, p. 462).

Multiple studies in the last decade show a positive relationship between self-directed learning and academic performance in various undergraduate and graduate contexts in both on ground and online environments (Chou & Chen, 2008; Gabrielle, Guglielmino, & Guglielmino, 2006; Long, 1991; Reio, 2004). Corbel's 2003 study (as cited in Chou & Chen, 2008) documented 191 graduate students taking online graduate courses, while Chung's 2001 study documented 177 students in a web-based course (cited in Chou and Chen, 2008). Gabrielle et al. (2006) found that undergraduate students attending a public military academy showed an increase in self-directed learning readiness and noted that "…improved academic performance occurred when carefully designed, technology-mediated supplemental learning was voluntarily accessed in instruction" (p. 31). Based on the results of these studies, it makes sense to use pedagogy that increases the likelihood of increased self-direction, which leads to increased academic performance. Shortly, the authors will propose a model that integrates technology, self-direction, and critical thinking, but the concept of critical thinking must first be discussed in more detail for the model to be understood.

Critical Thinking

Scholars around the world debate the meaning of critical thinking (Mason, 2007). For the purposes of this study and discussion, we have adopted the view of Facione and Facione (2007) that critical thinking "…comes down to reflective decision-making and thoughtful problem-solving about what to do or believe" (p. 40). To make this possible for students, they have to be equipped to deconstruct their assumptions from different vantage points such as journal articles, other professionals, and established theories (Brookfield, 1998). In the current world of burgeoning information, the ability to be an autonomous learner takes on new importance (Beyers, 2009); but so, too, does the role of faculty. Angeli, Valanides and Bonk (2003) investigated communication in web environments and found that "…students' interactions did not involve critical thinking aimed at seriously examining course content. Instead students primarily shared personal experiences amongst themselves…" (p. 40).

Without the guidance of a knowledgeable facilitator, studies indicate that many students (even graduate students) will not be challenged to higher levels of thinking; indeed, they may naively mistake discussions and quantity of information as evidence of critical thinking (Hall, 2005). When student and facilitator collectively commit to viewing digital tools as a conduit to critically evaluating course content, then the potential for ICT's to support and contribute to autonomous, self-directed learning is present (Altinay Aksal, Altinay Gazi, & Isman, 2008; Lesley, 2008). According to Altinay Aksal et al. (2008), "The capacity for self-directed (SDL) is required to implement the reflective judgment process and underlies many of the dispositions needed for critical thinking" (p. 931).

Interdependent Model of Technology/SDL/Critical Thinking

For institutions, the critical factor to be considered is whether or not the use of technology tools ultimately enhances student learning (Loveless, 1998). When used in ways that increase self-directed learning and critical thinking, they are partners in the educational process. Conversely, when they become the students' focus, it seems likely that they are a detriment to student critical thinking and learning.

The authors firmly believe that the traditions of self-directed learning and critical thinking are as important in the digital environment as they were in the traditions of the past. Since technology's arrival in academia, however; it is unclear where the line is drawn between its ability to enhance student learning and its ability to interfere with it. Since technology is likely to continually progress at rapid rates, educators should consider how to integrate ICT into their teaching in ways that take advantage of the technology to increase learning and critical thinking (Facione & Facione, 2007; Prensky, 2003). More important than the presence of technological tools is the method of utilization and context in which they are utilized (Unwin, 2007).

The Model

Ideally, technology is integrated into the learning process and drives the self-directed learning and critical thinking behaviors of the student (see Figure 1). It moves students along an interactive pendulum from one end (receiver of knowledge) to the other (active and engaged learner) and requires them to become more responsible for their own education (Wang, 2009). If technology is present, but does not interface with self-directed learning, critical thinking also suffers; since, as the literature above discussed, critical thinking relies on self-directed learning to reach its full potential.

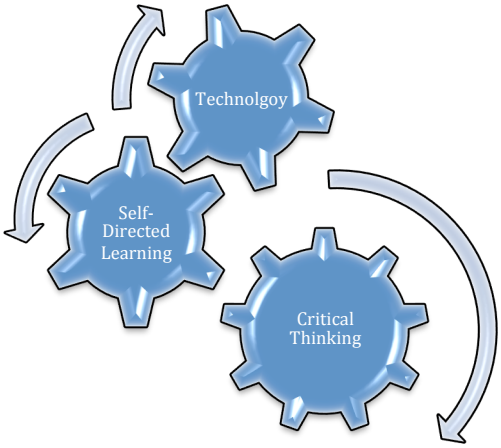

Figure 1. TSC model.

The challenge of establishing a model that accomplishes all three is daunting; but, the authors believe, not impossible. Central to the response is the development of a model of learning that empowers students to be self-directed and accept responsibility for their learning so that they are not servants to the new tools but rather critical thinkers who determine the best use of the technology available and understand its role in their learning (Hall, 2005). A similar journey will be required of faculty.

The need to successfully implement the new educational technologies is, in some institutions, leading to an increased focus on teaching and learning, including provision of incentives for faculty innovators and greater attention to teaching efforts in promotion decisions, thus further changing the culture and mandate of higher education (Hanann, 2005).

Population/Sample

A ready environment in which to test the model for authenticity in the lived experience existed in the classrooms of a private, post-secondary institution. Potential participants were selected purposefully (Patton, 2001); both students and faculty invited to participate in the study were engaged with elibrary and etext during the term, and students and faculty interacted through the university's online platform

to varying degrees. Institutional permission was sought and granted to proceed with the study. Ninety-two graduate educational leadership students from eight classes, with the majority being female attending blended or in-residence (not fully online) courses during the Fall 2010 term signed consent forms and participated in the research. In addition, eight faculty members, including adjunct faculty, also consented and took part in the study.

Instrumentation and Procedures

The student survey was composed of nine questions related to students' experiences with etext and elibraries. Both open- and closed-ended questions were included. Student surveys were handed out during the first month of classes by the departmental administrative assistant. Students were told the survey was optional and that there was no requirement that they complete it. No names were provided by those completing the survey. A student volunteer brought all completed surveys to the researchers after class.

The faculty survey included ten questions designed to gather information on faculty experiences—both with students using new technologies in their classrooms and with having to incorporate the use of new technologies in a meaningful way into their curriculum designs. Again, open- and closed-ended questions were used. Faculty surveys were handed out toward the end of an all-faculty meeting. All faculty were involved in online instruction. Faculty were informed that the purpose of the survey was to capture a snapshot of the current commitment and comfort level of faculty toward the use of technologies in the classroom. They were also told that the survey was optional. At the end of the faculty meeting, all surveys, completed or not, were placed into the collection file.

To ensure anonymity, all responses (student and faculty) were entered into Excel by an administrative assistant. For closed ended-questions that simply asked for a "yes" or "no" answer such as, "Would you feel more comfortable using new tools and technologies for your class if you were given more training in how to use them?" data were analyzed simply for frequency of response. The open-ended questions sought more detailed responses, such as, "If you have ever purchased a hard copy of a text when your course provided a digital or etext in the course shell, why did you do so?" For these questions, data were reviewed, coded, and analyzed for common and recurring themes or categories (Merriam, 2009).

In keeping with the purpose of this preliminary study, an intervention of any type was deemed inappropriate. The researchers simply sought to collect data that would enable us to better understand the reality of what students and faculty are experiencing in the classroom.

Findings and Discussion

Student and faculty feedback were analyzed separately, and both indicated that etext and particularly elibraries offer potential to increase positive learning

behaviors including critical thinking and self-directed learning. Students and faculty identified the potential of the elibraries in the areas of access to information, time management and efficiency, and organization of thoughts and ideas. Etexts, although utilized by some students, were not the preferred method of reading text material for a significant number of students (61%).

Findings also indicate that while etext and elibrary tools can provide students with information and data more than ever before, connections to critical thinking and self-directed learning appear to be missing. Data from surveys show that 79% of students think technology tools have made them better students; yet, when defining what "better" means, students noted the following comments indicating that "better" may not have anything to do with increasing critical thinking, self-direction, and other positive learning behaviors:

- "Students use technology to organize themselves and make better presentations"
- "Technology allows students to be more creative."
- "It allows a student to become more professional and up-to-date."
- "Technology gives a larger tool-chest to pull from."

The student mind-set seems to be that if the student can manage the technology in an efficient manner, then the student is learning. This observation is consistent with the findings of Angeli et al. (2003). While students may be learning at a basic level, mastery of the course content and higher-level critical thinking skills appears to continue to elude many of them. Students on the other end of the continuum clearly delineated that ICTs promoted "access to more data sources; helping to build a more integrated concept" and "help[ed] students become self-directed learners." Given the student feedback, the faculty links to student empowerment and growth appear to be centered around their ability to embrace the non-traditional faculty role identified as the faculty guide (Kranzow & Hyland, 2009), as well as faculty willingness to alter curriculum pedagogy and grow in their own technology skills (Loveless, 2000).

When Technology Distracts

In this preliminary study, evaluation and analysis of the data through the lens of the TSC model indicated that technology did not drive self-directed learning and critical thinking behaviors for this group of students. Student and faculty surveys noted that technology can be too distracting, thus taking away from the learning process. This finding supports Miller, Rainer, and Corley's (2003) technology acceptance model, which suggests that a technology's perceived usefulness and perceived ease of use affects intention to use and ultimately usage behavior. In this study, results indicated that students who perceived the ICTs and newly released technology tools as difficult to navigate found technology to be distracting. While not all students were distracted by etext, some (61%) were distracted to the point that they purchased a hard copy of the text in addition to the digital text. It may be that over time this resistance may diminish or dissipate, but since the transition to etext

took place over a short period of time and with limited notice, many students were seemingly not comfortable relying solely on the etext. Based on student feedback, their comfort level would likely be increased by providing longer lead time prior to adoption of new ICTs. Specifically, when students were asked how much time they wanted prior to a new ICT being utilized in their course, 70% indicated they desired between 4 and 15 weeks (30% wanting 4 weeks, 19.5% wanting 8 weeks, and 22% wanting 15 weeks). Faculty feedback was quite similar in the sense that 87.5% desired between 4 and 15 weeks lead time prior to the adoption of any new ICT (25% wanting 4 weeks, 37.5% wanting 8, and 25% wanting 15 weeks).

When students become focused on the their inability to efficiently co-exist with the technology for their courses, they spend their mental energies and time on tools, which leads to less engagement with their peers, their faculty members, and critical learning behaviors. Similarly, when faculty members become concerned with their ICT familiarity, they become less engaged with curriculum design and less able to function in the faculty guide role (Blimling, 2000, Prensky, 2001).

Importance of Training

A significant factor for alleviating many of the distractions previously discussed and for increasing the opportunity for self-direction is the training component attached to newly released technologies (Salmi, 2002). Regardless, however, of the training strategy adopted, Roman, Kelsey, and Lin (2010) suggest that three fundamental elements should be present: addressing "adult learning principles and practices…" (p. 8); consultations with the trainees prior to developing the program, and ongoing assessment dialogue to determine the effectiveness of the strategy. It is equally important that faculty "…instructors, mentors or e-moderators must be well trained to take full advantage of the affordances of any employed electronic[s]" (Angeli et al., 2003, p. 42).

Faculty who understand the significant responsibility for embracing the digital culture and the importance of training will be able to be responsive to the experience of digital natives who exist in a fast-paced, interactive learning world (Kirkwood & Price, 2005; Prensky, 2001, 2003). The need for training is a common requisite for both students and faculty. "Prior research has found that Perceived Ease of Use and Usefulness [of technology] can be affected by training" (Miller et al., 2010, p. 8). Training must respond simultaneously to two differing cultures: that of the digital native and the digital immigrant (Prensky, 2003). Recognizing that there is a language dissonance between these groups will constitute a key component in designing training activities.

Effective training will include, as Prensky (2003) suggests, "a meta-cognitive approach to instruction" (p. 13). Within this framework learners would be given opportunities to establish their own goals and to assess themselves on the completion of those goals (Prensky, 2003). Training that fails to adopt this responsibility contributes to a culture in which, "…the danger is that technology drives the pedagogy and that it encourages a 'transmission' approach…" (Unwin, 2007, p. 302). To avoid this pedagogical error, higher education reform and training require a different recognition of the underpinnings of ICT (Beyers, 2009; Prensky, 2001,

2003). Street (2010) cautions that underpinnings such as instructional design choices "often influence the level of student engagement" (p. 4) --a reality that meaningful training would want to address. Building on these underpinnings supports the integration of ICT and self-direction from the constructivist viewpoint, leading to positive, autonomous learning behaviors (Lesley, 2008).

Implications

The increased implementation of new technology has changed the scope of professional development required by faculty (Loveless, 1998). For those who have embraced the varying facets of technology, skill acquisition has not been problematic in terms of motivation, but what has been problematic is the time and cost of remaining current. It seems that there are almost monthly updates or releases of new software or hardware, and keeping up with how to infuse the latest ICTs into solid pedagogical practice can be daunting (Salmi, 2002). For the professional who fails to embrace these ongoing challenges, the consequences for both the student and the profession are extreme because this isolation removes the student and the faculty member from the potential to benefit from the rich opportunities within the world of ICT. Faculty must not only know the technology, but they must use it in ways that encourage critical thinking and self-directed learning (Prensky, 2001, 2003). Kirkwood and Price (2005), after examining ICT access and use data spanning five years, confirm:

> …The medium itself is not the most important factor in any educational programme--what really matters is how it is creatively exploited and constructively aligned. The educational benefits that students perceive as gains from using ICT are more significant than the intrinsic characteristics of any particular medium. (p. 272)

Broadband, fiber optics, wireless, satellite, instant communication of all kinds, the social network explosion; virtual platforms; all have become integral to the teaching and learning environment.

> … What higher education institutions need is a climate: (a) that encourages attempts to improve learning and teaching, (b) where pedagogical and curriculum concerns drive technological developments rather than vice versa, [and] (c) where the best about the old way of doing things is adapted to meet new requirements. (Hannan, 2005, p. 975)

Faculty Role

In terms of pedagogy, faculty's pivotal role is to step away from the traditional sage on the stage model and work within the faculty guide model (Kranzow & Hyland, 2009). In the role of faculty guide, they invite students into conversation and push them to think about how they can most effectively be engaged

with technology versus how it can be simply be used (Kirkwood & Price, 2005). Faculty can teach in a way that creates a safe place for discussion about technology and its relevance and importance in the course. Bertrand (2010) speaks to the changing environment that enables students to try to new things:

> Researchers working on the rapidly developing sciences of pedagogy and instructional design are clear that improved learning outcomes take place in a more mentor-like environment that allows the student to experiment, fail, be guided to the right path and subsequently learn to master a subject or process. (p. 111)

In technology professional development, faculty need to be able to utilize the tools with which both they and their students work. Beyond that, they need to consider how to assist students in becoming competent in their use of the technology tools. It is essential that institutions provide ample opportunities to support this professional growth; whether that be through a teaching and learning center, formalized training, or some other mechanism for faculty enhancement. From a curriculum standpoint, faculty members need to determine how to integrate technology into their teaching in such a way that students know how to use the technology and what the technology is intended to do for them. It is their responsibility to clarify for students, at various points in the curriculum, how to effectively engage with etools in order to increase their critical thinking and self-directed learning capacities. Faculty must be cognizant of but not deterred by the fact that, "New technologies diffuse slowly at first until they reach critical mass" (Reese & Levy, 2005, p. 7).

Another facet of concern for faculty in the teaching and learning paradigm should be the social-technological interdependence technology creates, one simultaneously acting on the other and changing the context of learning in subtle and not-so-subtle ways. The impact of this concept can have profound effects on the individual, organizations, and social structures that can manifest themselves in questions of access and social justice (Warschauer, Knobel, & Stone, 2004). When faculty commit to engaging with moving the technology/learning agenda forward, they can have significant impact on student learning and influence on role of the institutions they serve.

Institutional Role

Institutions seeking to effectively use ICTs have many options that can support both faculty members and students. One cost-effective and pedagogically sound recommendation is that faculty members develop professional learning communities to help them better manage ICTs (Unwin, 2007). "A professional learning community perhaps, more than individuals has the potential [to] develop an ontological security. For instance, they can mediate and question the latest initiative or potential of new technologies within their shared underlying theoretical perspectives and stances" (Unwin, 2007, p. 298). In order for faculty learning communities to be effective instruments in this process, institutional administrations

must adopt a culture which supports these efforts for faculty members to work alongside other professionals toward a common goal in a comfortable environment (Lave & Wenger, 1991; Unwin, 2007). These professional learning communities become the catalysts for systemic change, empowering the teaching/learning agenda. They can also serve as resources in developing an institution-wide integrated technology plan (Rose & Cook, 2006).

The availability of teaching and learning centers to assist faculty in their development of curriculum and pedagogies that help students effectively utilize ICTs are another support that campuses can offer. These centers afford faculty the ability to discuss their challenges and desires with professionals who are familiar with curriculum research and best practice.

Student Role

Students in this study identify the strengths of ICTs mainly as "organizational" and "providing efficiencies" or "time management"; it is essential that they embrace the more encompassing ability of the digital tools for developing critical thinking. In doing so, they can begin to perceive elibraries as having the potential for increasing skills such as analysis, evaluation, and synthesis. The acquisition of these skills will lead them to understand that a vast supply of information is not synonymous with critical thinking (Facione & Facione 2007; Prensky, 2003). The capacity to engage with research of this dimension integrates the learner with critical thinking, self-directed learning, and ICTs. As students develop as autonomous learners, they may choose to initiate peer-to-peer support groups, which have the potential to become professional learning communities similar to those described earlier (Unwin, 2007). These groups can provide a forum for discourse that empowers them to perceive and utilize the advantages of digital tools within their larger project, constructing knowledge rather than simply reporting it (Devenish, Dyer, Jefferson, Lord, van Leeuwen, & Fazakerley, 2009).

Concluding Thoughts

While studies on related topics are limited (Bertrand, 2010), the findings here are consistent with some of the other studies that found a lack of critical thinking in technology-rich environments (Angeli et al., 2003; Hall, 2005). The purpose of this preliminary study was to identify the potential need for further research on this topic; the indication that for this population, technology does not drive self-directed learning and critical thinking seems sufficient to support the need. Since faculty members are the conduit between student, technology and self-directed learning, their role is especially critical. "…Real transformation in the learning experience and learning achievement requires a change in pedagogical methods" (Rose & Cook, 2006, p. 21). Data from this study point to the fact that the responsibilities of the faculty role are composed of the three components just discussed – pedagogy, professional development in technology, and curriculum. It is through the infusion of faculty expertise, effort, and concern for student growth that technology tools such as etext and elibraries can be positively integrated into the student experience.

The need for appropriate infusion of new technologies is expected to grow rapidly. Institutional survey results collected by the *Chronicle of Higher Education* (Kaya, 2010) give an indication of where campuses expect to be in regard to etext growth. More than 86% of those surveyed feel that etexts (also referred to as ebooks or electronic textbooks) will increasingly appear on college campuses. Only 4.5 % of classes are currently using this type of technology tool.

While this paper adds to the body of research on the use of elibraries and etext, the results of this study cannot be generalized due to the relatively low number of students and faculty participating; however, the results of this study do point toward areas that are fruitful for future research. Future studies might empirically test the TSC to quantify the relationship between technology, self-directed learning, and critical thinking. In addition, other quantitative and qualitative studies could be conducted with greater numbers of students and faculty. Since this study focused on graduate students, further research in this area might involve undergraduate students and/or students and faculty in fully online learning environments. Finally, data about not only etext and elibraries, but all other forms of technology utilized in the college classroom environment must be explored in relation to their development of self-directed learning and critical thinking. It is the hope of the authors that growth of the research in all areas of educational technology will meet the challenge of ever-expanding ICTs.

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THE RELATIONSHIP OF SELF-DIRECTED LEARNING READINESS TO KNOWLEDGE-BASED AND PERFORMANCE-BASED MEASURES OF SUCCESS IN MEDICAL STUDENTS

Brian W. Findley and Robert J. Bulik

The purpose of this study was to compare the self-directed learning readiness of third-year medical students to the general population mean; and to determine (a) if relationships exist between self-directed learning readiness and other measures of medical school success; and (b) if measures of success in medical school and Self-Directed Learning Readiness Scale (*SDLRS/LPA)* scores are significant in predicting National Board of Medical Examiners Family Medicine Subject Examination (*NBME-FM)* scores. Mean *SDLRS/LPA* score for the 873 participants was 229.06 $\pm$ 23.19, significantly higher than the general population mean ($p < .05$). Correlations were significant for *SDLRS/LPA* scores to *NBME-FM* scores ($r = .073$, $p < .05$), Objective Structured Clinical Exam (*OSCE)* scores ($r = .133$, $p < .01$), and final grade ($r = .138$, $p < .01$). Regression analysis revealed that *SDLRS/LPA*, *OSCE* AVG and preceptor ratings predicted 9.7% of the variance in *NBME-FM,* which was significant ($p < .001$).

The contemporary practice of medicine requires self-efficacy, experience, and the rigorous application of critical thinking skills (Yalcin, Karahan, Karadenizil, & Sahin, 2006). Rapid shifts in the health care system, rapid expansion of knowledge, and the intricacies of reflective practice necessitate that medical practitioners have the ability to be self-directed learners in order to grow as professionals and provide the highest quality of patient care (Ainoda, Onishi, & Yasuda, 2005; Williams, 2004). Constructivist-oriented and based on social-cognitive theory, self-directed learning (SDL) promotes self-efficacy, a necessary attribute in today's complex world (Bradley, Oterholt, Nordheim, & Bjørndal, 2005; Bulik, Burdine, & Shokar, 2007). Moreover, this capacity to identify and address learning needs is highly associated with success as a physician, which may translate directly to patients' health (Bulik, 2003; Yalcin et al., 2006).

Sloan, Donnelly, Schwartz, and Strodel (1995) declare, "Physicians recognize that clinical competence is determined by more than knowledge. Although a sound knowledge base is vital, clinical competence encompasses numerous other domains"

(p. 736). Almost 20 years ago, the UK Medical Council published *Tomorrow's Doctors*, which called for increasing the SDL capacity in medical education (Whittle & Murdoch-Eaton, 2004). More recently, the Accreditation Council for Graduate Medical Education (ACGME) established implementing practice-based learning in medical school as one of its six core competencies. Two of the key components of this approach are directly related to SDL--lifelong learning and self-reflection (ACGME, 2006).

In response to the need for physicians to be self-directed, much of present-day medical training now focuses on clinical competence outcomes based on observable behaviors (Carraccio & Englander, 2000). Some medical schools, such as the University of Texas Medical Branch at Galveston (UTMB), have adopted an Integrated Medical Curriculum (IMC). In the first two years, a physician is assigned to facilitate a group of 6-8 students with a problem-based learning (PBL) strategy where "all courses are interdisciplinary and are based on self-directed, problem-based learning, with supplemental large-group lectures and laboratory sessions" (*UTMB School of Medicine Bulletin*, 2007-2009, p. 14). PBL puts more emphasis on real-world clinical performance rather than rote memorization. During the third and fourth years leading up to their residency, the students participate in clinical rotations with integrated web-based studies (Bulik et al., 2007).

Problem Statement

One of the major tenets of medical education is to cultivate competencies, such as SDL, that will transfer into lifelong, independent learning (Whittle & Murdoch-Eaton, 2001). Harvey, Rothman, and Fecker (2003) state that, "becoming an independent and self-directed lifelong learner is one of the critical outcomes of undergraduate medical education" (p. 1259). While no one criterion can be used to qualify the predicted success of any student, it is helpful to measure students in areas that have been demonstrated to be essential in determining success. Being self-directed has been shown to be a contributing attribute in this profession and, therefore, one that requires investigation. Further, it has been shown that medical school students enter their programs with disparate degrees of SDL readiness.

UTMB at Galveston has adopted an IMC that provides PBL/Evidence-based medicine (EBM) as the main mode to accomplish curricular goals (Bulik, 2003). Previously, a study done with third-year medical students enrolled in this curriculum curriculum (IMC) showed significantly ($p < .01$) higher mean scores (236.6) when compared to the general population (214.0) on Guglielmino's (1978) *Self-Directed Learning Readiness Scale/Learner Preference Assessment (SDLRS/LPA)* (Bulik, 2003). Research has also suggested that medical students educated in a PBL curriculum demonstrated superior clinical reasoning skills, time management skills and clinical information retention (Schwartz, Burgett, Blue, Donnelly, & Sloan, 1997; Schwartz, Donnelly, Nash, & Young, 1992).

Partially due to the fact that the desirable traits of physicians are fostered by SDL, PBL/EBM is becoming more common in medical school curricula. Therefore, the contribution of SDL throughout the medical school experience is worthy of

investigation. Assessment instruments that measure qualities and traits thought to be essential to effective practice should be examined to determine their predictive value. Additionally, curriculum changes explicitly designed to enhance SDL should be investigated to determine if the desired effects are being realized.

Purpose of the Study

The purpose of this study was to investigate (a) the SDL readiness of third-year medical students in comparison to previously reported scores for the general population and (b) the relationship between SDL readiness and knowledge-based and performance-based measures of success in a medical school using an integrated medical curriculum; and (c) to determine if knowledge-based and performance-based measures of success are significant predictors of *SDLRS/LPA* and *NBME-FM* scores.

Four research questions guided the study:

1. Do medical students who have completed the Family Medicine clerkship at UTMB have higher scores on the *SDLRS/LPA* than the general adult population reported by Guglielmino and Guglielmino in 1988 (214.0 $\pm$ 25.59)?
2. Is there a significant correlation between medical students' *SDLRS/LPA* scores and knowledge-based measures of success (*NBME-FM)* scores)?
3. Is there a significant correlation between medical students' *SDLRS/LPA* scores and performance-based measures of success (*OSCE* scores, preceptor rating scores)?
4. Is there a significant correlation between medical students' *SDLRS/LPA* scores and the combination of knowledge-based and performance-based measures of success (final grade)?
5. Are knowledge-based and performance-based measures of success (*OSCE* and preceptor ratings scores) and *SDLRS/LPA* scores significant in predicting *NBME-FM* scores?

Conceptual Framework

Integrated Medical Curriculum

According to the Association of American Medical Colleges (1998) the process of improving the quality of medical education curriculum is continuous. Medicine must always be responsive to "evolving societal needs, practice patterns and scientific developments" (Association of American Medical Colleges, p. 9). While part of the shift in mode of training may be due to technological advances, much of the impetus for these changes is due to increased knowledge of how learning best occurs. Lujan and DiCarlo (2006) note that the quantity of undergraduate science education has no effect on medical students' academic success. However, the variance in these studies may make it problematic to accurately assess the results. Low retention rates of basic science, anatomy and biochemistry information prior to medical school graduation have led those involved in curricular decision-making to

rethink their strategies (Lujan & DiCarlo, 2006). As a consequence, the philosophy that "teachers should reduce the total amount of factual information students are expected to memorize, reduce our use of the passive lecture format, and devote much more effort to helping students become active, independent learners and problem solvers" (Lujan & DiCarlo, 2006, p. 17), is now prevalent in medical education.

Two closely related methods identified to facilitate the development of self-directed learning are problem-based learning (PBL), and evidence-based medicine (EBM) curricula (Williams, 2004). These forms of self-instruction have increased substantially over the past 15 years. In fact, 94% of medical schools reported using self-instruction in their curricula in 1998-99 (Albanese, 2000).

PBL, which is grounded in cognitive psychology, was introduced in the late 1970's (Tärnvik, 2007) by Barrows and Tamblyn at McMaster University in Canada (Trevena, 2007). PBL instructors present to small groups scenarios or phenomena that require further clarification (Tärnvik, 2007). Students then "identify issues raised by specific problems to help develop an understanding of underlying concepts and principles" (Norman & Schmidt, 1992, p. 557). The objectives of this learning strategy are vital knowledge acquisition, transfer of knowledge in clinical settings, and SDL (Musal, Gursel, Taskiran, Ozan, & Tuna, 2004). At the core of PBL is the opportunity for students to learn contextually. Researchers have argued that learning in the context of how the information will be used translates into students being better able to apply the information than they would be if they had learned it in a competitively-graded, lecture-based environment. Contextual learning is paramount in transferability of medical skills (Albanese, 2000).

While PBL has detractors (Colliver, 2000) who claim all medical education is clinically contextual, PBL is based on information-processing theory which involves activating prior knowledge, encoding specificity, and knowledge elaboration (Albanese, 2000; Schmidt, Vermeulen, & Van Der Molen, 2006). In 1998, Champagain et al. conducted a research study with 26 medical students engaged in a PBL curriculum. Even though the sample size was small and caution should be used in interpreting the results, they perceived that PBL facilitated the development of SDL.

Evidence-based medicine, whose origins date back to mid-19th century Paris, is defined as "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996, p. 71)." Bradley et al. (2005) identify five steps to the EBM process: "formulating clinically important questions, efficient gathering of clinical evidence (research), critical appraisal (assessment) of evidence, applying evidence to practice, evaluating own practice" (p. 150). Following these guidelines, medical school students are commonly presented case studies that require them to analyze the case and develop suitable questions; locate, synthesize and critically interpret information; and apply the findings in order to best treat the patient (Bradley et al.; Yalcin et al., 2006). In this philosophy, skilled practitioners (and those training to be) are challenged to apply their own clinical knowledge with the best existing external evidence in order to more effectively treat patients (Sackett et al., 1996).

Based on available research, the cognitive advantages of PBL/EBM are an increase in honing SDL skills that transfer to professional practice, motivation (Schmidt et al., 2006), scientific thinking, promoting deeper understanding (Yalcin et al., 2006), better knowledge acquisition (Bradley et al., 2005; Schmidt et al.), critical appraisal skills, learner autonomy (Bradley et al.), and problem solving (Schmidt et al.; Yalcin et al.). The interpersonal advantages of PBL/EBM include improved professional collaboration, (Schmidt et al., 2006; Yalcin et al., 2006), conflict resolution (Yalcin et al.), retention, better patient communication, teamwork, expertise in running meetings, helping colleagues' confidence, ability to work and plan efficiently (Schmidt et al.) and improved attitudes (Bradley et al., 2005). Further, PBL enhances enjoyment of school by both student and instructor when compared to traditional curriculum (Albanese, 2000), and they affiliate better, as well (Abraham, Upadbya, & Ramnarayan, 2005; Albanese, 2000). In fact, PBL graduates were more likely to, "spend more time in direct patient care, bill for more psychotherapy services per month, have an academic appointment, enter family medicine and be in group practice" (Albanese, p. 736).

Self-Directed Learning in the Medical Field

In a study involving three U.S. medical schools (n=941), the *SDLRS/LPA* was found to be a reliable, gender-fair assessment. The mean score for the medical students was 235, placing them in the above-average range of *SDLRS/LPA* scores for the general population (Guglielmino, Mazmanian, Guglielmino, Hoban, & Pololi, 2002).

Previous research conducted with 182 UTMB third-year medical students revealed a mean *SDLRS/LPA* score of 235.81, which is higher than the mean score of 227.7 of a 5,000-subject meta-analysis of college students and professionals (McCune, Guglielmino, & Garcia, 1990), and significantly ($p < .05$) higher than the mean of the general population (214) (Shokar, Shokar, Romero, & Bulik, 2002). Self-directed modes have been identified as the most effective approach to improving physician performance and patient care outcomes (Candy, 1995; Davis, O'Brien, et al., 1999; Davis, Thompson, Oxman, & Haynes, 1999; Horn et al., 1997; Mamary & Charles, 2003).

Methodology

The subjects for this study were 873 third-year medical school students from UTMB between 2003 and 2007. Demographic and ethnic information was unavailable. The study examined a variety of assessments linked to the students in order to explore the stated research questions.

Assessments

Final grade. A formula equation is used to take into account variability in faculty observation (*OSCE* AVG), evaluation (preceptor AVG) and *NBME-FM* scores. Scale scores between one and five are assigned (i.e., 3 = 75) and faculty-determined weights are used to determine students' final grade.

National Board of Medical Examiners-*Family Medicine Subject Examination*. The NBME provides subject tests in the basic and clinical sciences for the purpose of assessing educational achievement (NBME, 2011). The *NBME-FM* consists of 100 questions, most of which are single-best answer (*a* through *e*) based on lengthy patient-based scenarios. The exam focuses on "normal growth and development and general principles of care throughout the lifespan," (Examination Focus section) and "diagnosis and initial management of common life-threatening and debilitating diseases" (Examination Focus section).

Objective Structured Clinical Exam. Knowledge-based examinations have limits and they often fail to measure qualities in a physician that patients value the most (humanistic behavior, real-world performance, and the ability to learn when not under examination scenarios) (Dornan et al., 2004). The *OSCE* was developed by Harden, Stevenson, Downie and Wilson (1975) at the University of Dundee in Scotland to allow for a more complete evaluation of student clinical performance. The *OSCE* is 27-item 5-point Likert scale standard evaluation form covering student performance during an observed patient encounter, laboratory requests, an oral presentation and a question/answer period (Appel, Friedman, Fazio, Kimmel, & Whelan, 2002). Students rotate through a number of stations within a set time period while faculty members evaluate their skills (Harden et al., 1975). It has been shown to be a valid measurement tool with high levels of face, content and construct validity (Appel et al., 2002). Since students are placed in clinically relevant simulations where they are directly observed and assessed (Karani, Leipzig, Callahan, & Thomas, 2004), the examination is viewed as "a measure of clinical competence that focuses on outcomes via observable behaviors" (Carraccio & Englander, 2000, p. 736). The *OSCE* is constructed most often as a result of blueprinting the course objectives into the stations to assure learning outcomes and objectives are met (Malloy, Perkowski, Callaway, & Speer, 1998).

Preceptor ratings. Each student is assigned to one primary preceptor – a faculty member who works closely with the student and is able to evaluate that student's ability. If a student spends sufficient time with multiple preceptors, up to three may be able to evaluate the student. Each preceptor completes a clerkship evaluation form, a 10-item standard evaluation form used to rate student performance for the one-month clinical experience. Students are assessed in history-taking skills, physical examination skills, communication skills, problem-solving skills and professionalism. The advantage of this type of evaluation it is a measure of practical competence, rated by experienced preceptors; the disadvantages are the extraneous variables introduced by personality and subjectivity.

Self-Directed Learning Readiness Scale/Learning Preference Assessment. The SDLRS/LPA was developed by Guglielmino (1978) and is the most commonly used quantitative tool to measure an individual's current readiness for managing his or her own learning. Based on the results of a three-round Delphi study with a panel of 13 experts, this 58-item, 5-point Likert-scale questionnaire measures the attitudes, skills and characteristics that encompass the learner's state of readiness for self-directed learning. Validity and reliability have been well-established (Delahaye & Choy, 2000).

Data Collection and Analysis

This was a retrospective study using archived data from a 3-year period. The *SDLRS/LPA* was administered to students under the direction of an Associate Professor in the Office of Educational Development during the third year of their medical preparation. *SDLRS/LPA* data collection was supervised by a senior investigator and approved by the IRB of UTMB. *NBME-FM* scores, two *OSCE* scores and the average of the two scores (*OSCE* 1, *OSCE* 2, *OSCE* AVG), preceptor ratings (between one and three) and the preceptor ratings average (Preceptor 1, Preceptor 2, Preceptor 3, Preceptor AVG), and final grades were made available to the same investigator.

Quantitative data analysis was employed to determine if relationships exist between *SDLRS/LPA* scores and knowledge-based scores (*NMBE-FM*), performance-based scores (*OSCE* and preceptor scores) and the combination of knowledge-based and performance-based scores (final grade). The group mean on the *SDLRS/LPA* was compared to the mean score of 214.0 $\pm$ 25.59 for general adult learners.

Correlation analysis was employed to determine the relative relationship of *SDLRS/LPA* scores with measurements of medical school success (*NBME-FM* scores, *OSCE* scores, preceptor rating scores, and final grade). These measures of success represent knowledge-based and performance-based measures and a combination of knowledge-based and performance-based measures. Regression analysis was employed to determine if knowledge-based and performance-based measures of success (*OSCE* scores, preceptor ratings scores, final grade) and *SDLRS/LPA* scores were significant predictors of *NBME-FM* scores.

Findings

Mean Scores

The mean sample score on the *SDLRS/LPA* was 229.06 $\pm$ 23.19 (n = 873). The range was 173 with a minimum of 113 and a maximum of 286. Twenty-two students fell at or below the 10th percentile (183), while 184 students scored above the 90th percentile (249). The mean sample score on the *NBME-FM* was 71.58 $\pm$ 7.60. Students were assessed on two faculty-based *OSCEs* (*OSCE* 1 and *OSCE* 2). Those scores, along with the average of the two scores (*OSCE* AVG), are represented here. The mean sample scores on the *OSCE* were: *OSCE* 1, 87.69 $\pm$ 5.50; *OSCE 2*, 88.41 $\pm$ 5.30. The mean sample score for the *OSCE* AVG was 88.05 $\pm$ 4.31. Students are assigned to between one and three preceptors who complete assessments for their one-month clinical experience. The mean score on the preceptor 1 rating was 93.23 $\pm$ 3.06 (n = 873). The mean score on the preceptor 2 rating was 92.47 $\pm$ 3.83 (n = 161). The mean score on the preceptor 3 rating was 92.31 $\pm$ 2.88 (n = 42). The mean score on the average preceptor rating was 93.22 $\pm$ 2.98. Figure 5 shows the frequency distribution of scores. A final reported student grade is computed based on a formula equation to take into account variability in faculty observation and evaluation in the *OSCE*, preceptor rating and *NBME-FM*. The mean score on the final grade was 85.16 $\pm$ 5.36.

Research Question 1

Do medical students who have completed the FM clerkship have higher scores on the SDLRS/LPA than the general adult population reported by Guglielmino and Guglielmino in 1988 (214.0 $\pm$ 25.59)?

The mean *SDLRS/LPA* score was 229.06 $\pm$ 23.19, which places the sample in the top 31% of those tested (Guglielmino & Guglielmino, 1991).

Research Question 2

Is there a significant correlation between medical students' SDLRS/LPA scores and knowledge-based measures of success (NBME scores)?

The Pearson *r* correlation showed a significant ($p < 0.05$) relationship between *SDLRS/LPA* scores and *NBME-FM* scores, but the relationship was negligible ($r = .073$).

Research Question 3

Is there a significant correlation between medical students' SDLRS/LPA scores and performance-based measures of success (OSCE scores, preceptor rating scores)?

The Pearson *r* correlation showed significant ($p < 0.01$) relationships between *SDLRS/LPA* and *OSCE* 1 ($r = .109$, $p = .001$), *OSCE* 2 ($r = .103$, $p = .002$), and *OSCE* AVG ($r = .133$, $p = .000$). Correlation analysis also showed significant ($p < 0.05$) correlations between *SDLRS/LPA* scores and preceptor rating 2 ($r = .168$, $p = .034$), and preceptor rating 3 ($r = .305$, $p = 0.05$). While these correlations show statistical significance, they should be interpreted with caution since the effect size, in most cases, indicates a small effect. No significant correlation existed between *SDLRS/LPA* scores and preceptor rating 1 ($r = .041$, $p = .223$) or preceptor rating average ($r = .066$, $p = 0.50$).

Research Question 4

Is there a significant correlation between medical students' SDLRS/LPA scores and the combination of knowledge-based and performance-based measures of success (final grade)?

Correlation analysis showed significant ($p < 0.01$) correlations between *SDLRS/LPA* scores and final grade ($r = .138$). While this correlation is significant, it should be interpreted with caution since the effect size is small.

Research Question 5

Are knowledge-based and performance-based measures of success (*OSCE* and preceptor ratings scores) and *SDLRS/LPA* scores significant in predicting *NBME-FM* scores?

Regression analysis was performed to determine the nature of the relationship between the variables. The regression equation used *NBME-FM* scores as the criterion variable and *SDLRS/LPA* scores, *OSC* AVG, and preceptor ratings as variables for predictors. The final grade was purposely not included in this analysis

since *NBME-FM* scores were calculated into that score and it would confound the results due to collinearity.

Significant ($p < .01$) correlations were found between the criterion variable (*NBME-FM*) and two of the predictor variables (*OSCE* AVG, preceptor rating). The correlation between *NBME-FM* and *SDLRS/LPA* was significant at the $p < .05$ level. All predictor variables were significantly correlated with each other. Correlations between *OSCE* AVG and preceptor rating and *SDLRS/LPA* and *OSCE* were significant at $p < .01$. The correlation between *SDLRS/LPA* and preceptor rating was significant at $p < .05$. The total model predicted 9.7% of the variation in *NBME-FM,* which was significant at the $p < .01$ level. Only *OSCE* AVG contributed significantly ($p < .001$) to the model having all other variables present.

Conclusions, Discussion And Recommendations

Conclusions and Discussion

While research has been conducted on the SDL readiness of physicians, little research has addressed the relationship SDL readiness has with both knowledge-based and performance-based measures of medical school success. As a result, this study sought to explore those relationships by examining third-year medical students' levels of readiness for SDL and other measures typical of third-year students.

SDLRS levels of medical students. The results of this study support previous findings that medical students' mean levels of SDL readiness are higher than the general population (Guglielmino & Guglielmino, 1991). It would appear that this field attracts internally-motivated self-directed learners rather than externally-motivated teacher-centered learners as Bradley et al. (2005) describe. High levels of SDL are requisite to those who practice medicine in order to grow as professionals and provide the highest quality of patient care (Ainoda et al., 2005; Williams, 2004). Research has indicated that those preparing to become physicians are highly self-directed (Pilling-Cormick & Bulik, 1999; Shokar et al., 2002).

In this study, third-year medical students' readiness for SDL was 229.19 $\pm$ 23.49, falling into the above average range. The mean was significantly ($p < .05$) higher than the mean of the general adult population mean of 214.0 $\pm$ 25.59 (Guglielmino & Guglielmino, 1988). Several previous studies have measured populations that scored higher than the medical students in this study: for example, a small group of exemplary school principals recognized at the state level (Guglielmino & Hillard, 2007), top US female executives (Guglielmino, 1996), top U. S. entrepreneurs (Guglielmino & Klatt, 1994), medical supervisors and managers (Muller, 2007), and YMCA directors (Zsiga, 2007). The mean in this study was lower than the mean of 234.68 reported for 941 students from three U.S. medical schools (Guglielmino et al., 2002), where curricular methods were not identified. The mean in this study was slightly higher than the mean of a meta-analysis of a sample of more than 3,000 professionals and graduate students with a variety of majors (McCune et al., 1990).

In a previous smaller study with 182 third-year medical students at UTMB (Shokar et al., 2002), the *SDLRS/LPA* mean score of 235.81 $\pm$ 19.99 was also

significantly ($p < .01$) higher than the general adult population. Therefore, these findings remain consistent for third-year students at this medical school within this curriculum.

Students in this study were engaged in an IMC, which might be expected to increase levels of SDL. Whether students' level of SDL increased in this study due to the fact they were engaged in an IMC, while probable, is not measurable; *SDLRS* data from the prior years was not available. In addition, it is important to note that many variables besides the IMC curriculum could explain the high *SDLRS/LPA* scores. Certainly, one of the limitations of interpreting this data is that medical students' levels of SDL are already above average and that they would be likely to thrive in any curriculum format. Any attempt to measure improvement may be hindered by a ceiling effect, as was noted by Caffarella and Caffarella (1986) in a study of graduate students.

SDLRS/LPA scores and NBME-FM. Significant relationships existed between *SDLRS/LPA* scores and *NBME-FM* scores ($r = .071$, $p < .05$). However, this was a weak association. The *NBME-FM*, based on extensive patient-based scenarios, is the capstone standardized examination taken by third-year students.

SDLRS/LPA scores and OSCE. Significant relationships existed between *SDLRS/LPA* and *OSCE* 1 scores ($r = .102$, $p < .0\ 1$), and *OSCE* 2 ($r = .101$, $p < .01$). Similarly, Bulik (2003) found significant ($p < 0.05$) correlations between *SDLRS/LPA* and *OSCE* in a Medical Ambulatory Clerkship ($r = 0.136$).

SDLRS/LPA scores and preceptor ratings. Significant relationships existed between *SDLRS/LPA* and preceptor rating 2 ($r = .168$, $p = .034$), and preceptor rating 3 ($r = .205$, $p < 0.05$). However, no significant relationship existed between *SDLRS/LPA* scores and preceptor rating 1 or preceptor rating average. This finding is puzzling, as a previous study with 182 third-year medical students at the same university (Shokar et al., 2002), significant ($p < .01$) correlations were reported between *SDLRS/LPA* and preceptor ratings in the family medicine clerkship ($r = .251$) and multidisciplinary ambulatory clerkship ($r = .242$) (Shokar et al., 2002). No correlations were found between *SDLRS/LPA* and *OSCE* in that study (Shokar et al., 2002). Bulik's study of 560 third-year students also demonstrated significant ($p < 0.01$) correlations with *SDLRS/LPA* and preceptor rating scores in both a Family Medicine clerkship ($r = 0.118$) and Medical Ambulatory clerkship ($r = 0.190$). The variation in results may be due to the fact that preceptor ratings can be influenced by individual personalities, rating tendencies, and other factors.

SDLRS/LPA scores and final grade. The correlation between *SDLRS/LPA* and final grade ($r = .133$, $p = .001$) was also significant, but a weak association existed. In a previous study with 182 third-year medical students at the same university (Shokar et al., 2002), significant ($p < .05$) correlations existed between *SDLRS/LPA* and final grade in a multidisciplinary ambulatory clerkship final grade ($r = .173$). Bulik (2003) also found significant correlations between *SDLRS/LPA* and final grade in a Family Medicine Clerkship ($r = 0.092$, $p < 0.05$) and Medical Ambulatory Clerkship ($r = 0.187$, $p < 0.01$).

While the relationships of *SDLRS/LPA* scores of medical students in this study with knowledge-based and performance-based examinations were modest, they

mirror the relationships that have appeared consistently across a number of studies and indicate a tendency for medical students with higher levels of SDL to perform better in medical preparation programs. Although correlation coefficients in this study were small, they were all positive and many measures reached statistical significance. It is also important to recognize that developing lifelong, self-directed learners is substantially different from developing individuals who can perform well on tests in an academic setting. A vital question to explore would be whether the students' SDLRS/LPA scores rose during the course of their medical preparation program; however, data for this comparison was not available for this study.

The *SDLRS/LPA* contributes to the holistic assessment of those preparing for the medical profession. The assessment of medical knowledge and the ability to apply it are, of course, critical; however, the newer standards for medical education have also addressed the importance of promoting self-directed learning readiness in physician preparation programs. The *SDLRS/LPA* adds an important dimension to the assessment of medical students, addressing the emphasis on ensuring that physician preparation programs produce practitioners who are likely to be continuing, lifelong learners.

Limitations

Since this study took place at a one large medical school, findings and conclusions must be considered localized to that university and not generalizable to all medical students. Also, since the NBME-FM is a component of the final grade, the same variable is acting, at least partly, as both an independent and a dependent variable. Additionally, there is a potential attenuation of the correlation between *NBME-FM* and performance measures due to the restricted variance of the *NBME-FM*. The *SDLRS/LPA* scores may be truncated as well. It must also be assumed that all students answered the *SDLRS/LPA* truthfully and that variables not investigated were equal across the sample.

Another limitation is that there may be undue bias in the student population towards preferring to learn in a self-directed manner. White (2007) has shown that some medical students choose PBL curricula based on their individual learning preference. Therefore, this preference may differentiate characteristics in these students from other medical school populations.

Summary

One of the major tenets of medical education is to cultivate competencies, such as SDL, that will transfer into lifelong independent learning (Whittle & Murdoch-Eaton, 2001). Accordingly, Harvey et al. (2003) state that, "becoming an independent and self-directed lifelong learner is one of the critical outcomes of undergraduate medical education" (p. 1259). Bulik (2003) agrees, stating "Success in medical school is strongly related to the ability to direct and regulate one's own learning experience" (p. 76).

The positive relationships of the *SDLRS/LPA* scores of medical students in this study with knowledge-based and performance-based practical examinations were modest, but they indicate a tendency for medical students with higher levels of readiness for self-directed learning to perform better in medical preparation programs. These results reflect relationships that have appeared consistently across a number of other studies. The *SDLRS/LPA* adds an important dimension to the assessment of medical students, addressing the emphasis on ensuring that physician preparation programs produce practitioners who not only possess current medical knowledge and the ability to apply it, but are also likely to continue to seek out new knowledge and techniques as the practice of medicine rapidly changes over their careers.

The constant proliferation of new information has made maintaining currency with best practices for standards of care an even greater component of a physician's job. In fact, it has been estimated that the half-life of biomedical knowledge is 7-10 years (Rugh, Goggins, & Hatch, 2009). According to Friedman et al. (2005), "the exponential growth of biomedical knowledge and shortening half-life of any single item of knowledge both suggest that modern medicine will increasingly depend on external knowledge to support practice and reduce errors" (p. 334). It is evident that physicians will be increasingly reliant on self-directed learning in order to maintain proper levels of care.

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FOSTERING SELF-DIRECTED LEARNING IN MEDICAL SCHOOL: WHEN CURRICULAR INNOVATION IS NOT ENOUGH

Janet F. Piskurich

Medical students are poised to enter a constantly changing field. Although medical school education standards specify inclusion of independent study to foster lifelong learning skills, first-year medical students may pressure faculty to provide necessary knowledge in strict lecture format, especially early in their programs. This paper reports on two different interventions that were used to help support students' autonomy and their acceptance of self-directed learning during this transitional period in two very different medical school curricula. Medical students' perceptions of sessions that fostered independent study were improved by interventions that allowed students to provide input into the facilitation or implementation of these sessions.

Advances in scientific information and technology are proliferating at an accelerating pace, requiring that physicians continually acquire new knowledge and skills. In 1984, the *Physicians for the Twenty-first Century: Report of the Project Panel on General Professional Education of the Physician and College Preparation for Medicine* (Association of American Medical Colleges [AAMC]) emphasized that a medical education should prepare students to learn throughout their professional lives. It stressed preparation of students for active, self-directed learning, recommending that medical schools evaluate students' abilities to learn independently and provide opportunities for development of the skills that support independent learning. Again in the 1990's, a seminal report on assessing medical education change stated, "…Faculty members' first goal should be to foster their students' lifelong learning by helping them to develop their learning skills" (AAMC, 1993, p. S33). Standards for medical school accreditation now specify that medical education programs must include opportunities for independent study to foster lifelong learning skills (Liaison Committee on Medical Education [LCME], 2010). In response, most medical schools now have as an institutional goal that students must demonstrate

skills necessary for lifelong learning, and their curricula now incorporate learning strategies that depart from traditional lecture-based approaches.

One nontraditional pedagogy, *problem-based learning*, emerged early as a method for development of self-direction and lifelong learning skills in medical students (Neville, 2009). While many medical schools use blended approaches incorporating various aspects of this instructional pedagogy, problem-based learning has been the sole basis of the curriculum at Mercer University School of Medicine for over twenty-five years (Donner & Brickley, 1993). Here, first and second-year medical students learn both basic science and clinical concepts in a student-centered, self-directed learning environment. The curriculum is organized into thirteen courses taught in an interdisciplinary approach in which learning is linked to a unique set of clinical cases for each course. Groups of seven to eight students meet in three-hour sessions, three times a week, with a basic scientist or physician faculty member as learning facilitator. During these formal group meetings, students read cases aloud and identify specific learning issues required to fully understand each case. Outside of formal sessions, students prepare independently (using textbooks, journal articles and Web-based materials) for discussions at upcoming formal sessions addressing both learning issues and clinical cases.

While self-directed learning skills are fostered by problem-based learning, certain deficiencies in clinical reasoning have been described for medical school problem-based learning curricula (Anderson, Reder, & Simon, 1996; Holyoak, 1985). Problem-based learning emphasizes a hypothetical-deductive reasoning process that differs from the intuitive diagnostic reasoning processes used by expert physicians. It also promotes learning in which basic science knowledge is tightly tied to specific clinical cases and may be difficult to transfer to a new situation. Students in such programs have identified significant gaps in their understanding of certain concepts, felt their knowledge level was weaker than that of students in traditional programs, and expressed need for greater interaction with experts (Tufts & Higgins-Opitz, 2009; Watmough, O'Sullivan, & Taylor, 2010).

Another curricular innovation that is being introduced into medical schools to improve diagnostic reasoning skills of medical students as well as their retention and transfer of knowledge is *clinical-presentation-based curricula,* an attempt to avoid the drawback of having basic science knowledge tied to specific clinical cases (Mandin, Jones, Woloschuk, & Harasym, 1997). In this approach, diagnostic schemes that serve as scaffolds for gap-free integration of basic science and clinical knowledge are provided. These schemes are used to promote more inductive diagnostic reasoning processes as used by experts, and exposure to experts is maximized. Paul L. Foster School of Medicine of the Texas Tech University Health Sciences Center at El Paso is now entering the fourth year of implementation of such a curriculum (Akins, Arana, McMahon, & Piskurich, 2010). Although traditional lectures by experts are still used, it is an important goal that students should demonstrate lifelong learning skills; therefore, faculty members incorporate learning strategies that encourage the use and development of students' self-directed learning skills. Both independent learning projects and self-taught learning modules are employed. An approach commonly used by faculty is team-based learning, where

students prepare out of class for in-class tests and application exercises. These sessions are designed to contain all the traditional elements of team-based learning, including readiness assurance tests and application exercises (Michaelson, Watson, Cragin, & Fink, 1982).

Initial resistance of some learners to self-directed learning is well-recognized. The transition can represent an intimidating change in educational approach for individuals without previous self-directed learning experience (Long, 1994). It has been shown that medical students, who have normally excelled in a teacher-centered college environment, value the familiar teacher-directed approach rather than self-directed, independent learning (Ho & Tani, 2007). Resistance by medical students as the responsibility for their learning is shifted from the teacher to the student has also been noted in publications aimed at preparing medical students for problem-based learning (Woods, 1994). In both problem-based and clinical presentation-based curricula, faculty are encouraged to serve as learning facilitators and provide students with opportunities for self-directed learning; however, resistance of learners to accept responsibility for their learning occurs in both programs, especially early in the first year. Since excellent evaluations by their students are essential components of the medical educator portfolios required of faculty for tenure and/or promotion (Fresco & Nasser, 2001; Simpson et al., 2007), faculty are likely to perceive learner resistance as a formidable barrier to teaching-learning transactions that foster self-directed learning.

This paper describes interventions that helped overcome students' resistance and improved students' perceptions of faculty using teaching-learning transactions that encouraged self-directed learning in two very different medical schools, one with a problem-based learning curriculum and the other with a clinical presentation-based curriculum.

Methods

Problem-based Learning Curriculum

Intervention. Essential elements of the problem-based learning curriculum are described above. During the four years spanned by this study, the average class size was 50 medical students. The one-minute paper is an in-class writing activity that takes a minute or less to complete where students respond to a question posed by the instructor (Cross & Angelo, 1988). It enables students to reflect on the instruction and provides instructors with useful anonymous student feedback. The intervention in the problem-based learning curriculum consisted of two one-minute papers, performed at the first session, after group members introduced themselves but before they started the first case. The first question posed was: "Name one thing a good group member does?" Pieces of paper were handed out on which students were asked to write their response. All papers were collected into a bag. The bag was then passed around and students were asked to draw out a paper and read it aloud while the facilitator made a list of the responses. This process was repeated for the second one-minute paper, for which the question posed was: "Name one thing a good faculty learning facilitator does?" Reflection by students at this first session was private

while each composed their response. Facilitators were encouraged to set aside time during the last formal group session of each week to discuss students' perceptions of the learning process within the group. To initiate discussion, the facilitator provided the list of responses gathered during the first session. Group members were encouraged to collectively reflect and discuss how the group and learning process was working.

Survey instrument. Students' scores and comments from the level-one evaluation survey (Kirkpatrick & Kirkpatrick, 2006) were examined for the six-week "Host Defense" course that occurs early in the curriculum. This survey measures students' attitudes toward the course and learning facilitator. A Likert questionnaire item asks students to rate the facilitator's ability as *excellent, satisfactory, marginal,* or *inadequate*, and students are asked to provide additional comments. Comparisons were made between a year when there was no intervention and three successive years when an intervention was used.

Clinical Presentation-based Curriculum

Intervention. The intervention consisted of a student survey using an audience response system. The survey question, which described team-based learning in layman's terms for the students, was: "Our next session (based on the self-taught learning module) will be interactive and composed of clinical vignettes with audience response questions that you can use to formatively assess your knowledge. How would you prefer to answer the questions during this session?" The possible responses were: "By consensus of your assigned small group" (consistent with team-based learning) or "Individually" (inconsistent with team-based learning). Students' responses to the survey were collected anonymously, and the collective results were shared with the class. For the year when there was no intervention, the class was not surveyed and students were not given any chance to provide input.

Assessment. Students' scores and comments on end-of-unit level-one evaluations were examined for the six-week long "Introduction to Health and Disease" course that occurs early in the first year. Comparisons were made between a year when conventional team-based learning was used with no intervention (medical school class size was 39 students) and the following year when conventional team-based learning and an intervention were used (medical school class size was 62 students).

Results

Problem-Based Learning Curriculum

The intervention used for the problem-based learning curriculum provided opportunity for students' input into roles of both learners and learning facilitator. "Comes prepared," "teaches," and "learns from others" were the most common responses for the question addressing the learners' role ("Name one thing a good group member does?"). The most common responses for the question addressing the role of the facilitator ("Name one thing a good faculty learning facilitator does?") were "guides," "listens," "encourages," and "questions." Without intervention, 92%

of students ranked the qualifications of the learning facilitator as inadequate or marginal, and 86% commented that they had not received enough instructional content or direction in their learning. With intervention, 95% of students ranked facilitator qualifications as excellent or satisfactory. Only 5% ranked the facilitator as inadequate or marginal. Comments from students experiencing the intervention indicated they felt the facilitator had "acted as a guide to learning resources," "assisted students with self assessment," provided "encouragement and feedback" on their strengths and weaknesses, "regularly asked for students' input and suggestions," and "lived up to expectations."

Clinical Presentation-Based Curriculum

The intervention used for the clinical presentation-based curriculum allowed students to decide how sessions based on self-taught modules would be implemented. The decision was split with 50% wanting to submit question answers individually (inconsistent with team-based learning) and 50% wanting to submit only consensus answers for their assigned small group (consistent with team-based learning). Since two similar sessions based on self-taught modules were scheduled, it was possible for every student to have his or her preference for one of the two sessions. The first was run as a conventional team-based learning session, where students' answers to clinical vignette-based application exercise questions were submitted as a consensus response for their assigned small group. During the second session each student submitted individual responses to the questions (inconsistent with team-based learning). Scores for level-one evaluation items related to the self-taught modules for the two groups (with and without intervention) are shown in Table 1.

Table 1. *Students' Responses on Level-One Evaluation Surveys With and Without Intervention in the Clinical-based Medical Curriculum*

Survey Item:	% Agree (- intervention)	% Agree (+ intervention)
Faculty member adequately addressed objectives	42	100
Faculty member presents material in organized fashion	25	94
Faculty member encourages me to think actively about material	42	100

Students' comments for the year when there was no intervention indicated that they believed "Team-based learning sessions fail miserably"; there should be "no more team-based learning sessions"; "Self-taught classes can be tricky"; and that they would have ranked the teacher higher if they were not "expected to find all the information on our own." Students' comments for the year when there was intervention indicated that they thought the teacher "encouraged us to learn," "encouraged feedback," and was "well organized"; and that they "knew what to expect" and "enjoyed the questions in class."

Discussion

Medical students will enter a rapidly changing field; therefore, developing skills for independent, lifelong learning is an important goal of medical education. Since students selected for admission may have been successful in situations dominated by didactic instruction, they may be highly resistant to self-directed learning (Long, 1994; Albers, 2009). Especially during their first year, students may reward faculty who use a directive lecture approach with higher scores on teaching evaluations. Since faculty evaluation data is commonly used for administrative decisions regarding faculty tenure and advancement (Fresco & Nasser, 2001; Simpson et al., 2007), student pressure can be a formidable barrier to faculty wishing to utilize teaching-learning transactions that foster self-directed learning. This paper has described two interventions used to overcome students' resistance and improve perceptions of faculty in two different curricular approaches.

The two types of interventions seem almost as different as the curricula themselves, yet both yielded very favorable results. In the problem-based learning curriculum, the intervention afforded students the opportunity to reflect upon and list the characteristics of good group members and learning facilitators. Students listed preparation, an independent task in this curriculum, as an important factor for good group members. The commonest response related to the facilitator's role was that the facilitator should act as a guide who listens, encourages, and provides questions as formative feedback. Without the intervention, students expressed dissatisfaction with the facilitator, indicating that he or she should have been more directive and provided more instructional content. With the intervention, students expressed satisfaction with the learning facilitator, reflecting their greater understanding of the facilitator's role.

In the clinical-presentation-based curriculum, the intervention gave students the opportunity to decide how responses would be submitted during sessions based on self-taught modules. Although half of the students chose to submit responses as a team during the intervention year (consistent with team-based learning), over half of the students during the non-intervention year scored the teacher unfavorably, with many posting comments that they were dissatisfied with team-based learning. It is possible that the polling allowed the class to recognize that half of its members actually preferred the session to be team-based. Revealing the result allowed students to realize that not every student disliked team-based sessions and that every student would have their preference for submitting responses for one of the two sessions.

The common thread for the interventions was transfer to the learners of some control for how formal learning sessions would be conducted. Transfer of control to learners is consistent with Malcolm Knowles' self-concept theory for adult learners (Knowles, Holton, & Swanson, 2005). Adult learners need to be responsible for educational decisions and involved in the planning and evaluation of their instruction. It is also consistent with techniques used to overcome resistance to self-directed learning in technical training where, as in medical schools, freedom in learning is constrained by requirements dictated by licensing examinations (Blackwood, 1994).

Both interventions enabled students to provide input that was then incorporated by the learning facilitator. Learners were given opportunity to provide open-ended input or were at least given choices with options. Teaching-learning transactions that supported self-directed learning were negotiated with learners rather than prescribed by the learning facilitator.

Conclusions and Implications

Although medical school education standards now specify that curricula must be designed to include independent study to foster lifelong learning skills, first-year medical students may pressure faculty to provide necessary knowledge in strict lecture format, especially during the first semester of their study. In this study, which examined interventions used to support learner autonomy and acceptance during this transition period in two very different medical school curricula, medical students' perceptions of early learning experiences designed to foster self-directed learning appear to be improved by interventions that allow students' input into how teaching-learning transactions are facilitated or implemented. Interventions that provided the opportunities for learner input into the role of the learning facilitator and for discussion of the learners' role, as was done in the problem-based curriculum; or solicited learners' input on the way sessions would be implemented (as in the clinical presentation-based curriculum) helped overcome students' resistance and had a positive impact on students' evaluations of faculty.

While the results of this study must be interpreted with caution, since only two medical schools were involved and the numbers were relatively small, further research on ways of overcoming resistance to curricular approaches that place more responsibility on the learner appears to be merited.

With the rising use of online educational media, there is a recent push, even in medical schools that have employed very traditional teacher-based instruction, to "flip" the medical school classroom (Prober & Heath, 2012). In the "flipped classroom" approach, students would review didactic materials in advance so that class time can be utilized solely to discuss patient-based cases and problems. While this approach is also aimed at assisting medical students to become self-directed, lifelong learners in preparation for their future careers as physicians, a fear is that the transition from teacher-based instruction to "flipped classrooms" will be difficult and will be accompanied by resistance for students inexperienced in self-directed learning. One suggestion for further research would be to test the intervention model for improving medical students' perspectives of "flipped classrooms" and of the faculty that use this approach. Based on the results of this study, the anticipated resistance may be counteracted by allowing the students to have at least some minimal control over how these learning sessions are conducted.

The mandate for preparing medical students for lifelong, self-directed learning is here to stay. If we can document ways to assist students to understand the need for the move away from traditional didactic approaches and to have some voice in how the alternative curricular approaches are designed, their resistance is likely to

decrease; and faculty will be more likely to effectively implement the curricular innovations that support the development of self-direction in learning.

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