MEDICAL STUDENTS' PERCEPTIONS OF LIFELONG LEARNING

AT INDIANA UNIVERSITY SCHOOL OF MEDICINE

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Submitted to the faculty of the University Graduate School

in partial fulfillment of the requirements

for the degree

Doctor of Philosophy

in the School of Library and Information Science

Indiana University

December, 2007

Accepted by the Graduate Faculty, Indiana University, in partial fulfillment of the

requirements for the degree of Doctor of Philosophy

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Dedication

This work is dedicated to my husband, Zacharie Brahmi, whose faith in me, at times, far surpassed my own and who would not let me give up, however discouraged I became. His singular determination and support were beyond the call and inspired me to continue what became a long and fulfilling journey. I also dedicate this work to my children, Dalia and Tarik Brahmi, who have been unrelenting supporters of my goals and achievements.

Acknowledgements

This work would not have been completed without the unfailing support and feedback of my committee members, Drs. Debora (Ralf) Shaw, Verna Pungitore, Katherine Schilling, and Nancy Chism. Dr. Danny Callison, part of my earlier committee, was also very supportive.

I especially want to thank Ralf for the patience and willingness to stand by me all these years, despite several false starts and stops. To Verna, I am very grateful for her willingness to continue on my committee; despite her retirement from IU SLIS; she has given generously of her time. As for Kathy, as a new member of the IUPUI SLIS faculty, she enthusiastically embraced her role as a committee member, replacing Danny Callison, who was called to other duties. To Nancy Chism, whose plate was very full as both a teacher and an administrator when I asked for her participation, she has been extremely supportive.

In addition, I want to thank all the medical students who participated in this study and gave up their coveted study time to spend it with me. I thank them for their candor, insights, and generosity in sharing their stories with me.

Special thanks go to Arlene Merkel and Mary Kennedy for their help with logistical matters and their support throughout this process.

Frances A. Brahmi

Problem: This study explored medical students' perceptions of Lifelong Learning (LLL) at Indiana University School of Medicine (IUSM). The IUSM was selected because it has been in the forefront of the competency-based curriculum movement since 1999, a trend for which IUSM is now a leader among undergraduate medical education (years 1-4 of medical school). This study addressed the following issues: 1) definition of LLL, 2) LLL development, 3) LLL attitudes and behaviors, 4) role models, and 5) LLL and technology. **Methods**: Semi-structured interviews were conducted at the IUSM. Methods used to select students included random number tables and snowballing techniques. **Results**: Results focused on three areas: 1) what characterized LLL practices and attitudes of medical students, 2) how these practices and attitudes differed across the four years of medical school, and 3) how medical students use technology to help them cope with information overload. Most often, differences between students' perceptions of LLL correlated to whether they were preclinical (first- and second-year) or clinical (third- and fourth-year) students. Preclinical students spoke more generally about LLL and its role in their education, whereas clinical students related LLL to the practice of medicine and patient care. Although most students agreed that LLL began as an innate curiosity and that childhood influences were significant in their development of LLL, role models at all stages of their education were deemed extremely important. Medical students' characterized the Internet as a quick and easy way to access much information but

were keenly aware of its limitations, in terms of lack of peer review and reliability.

Specific sources were discussed by the students. **Conclusions**: Implications for

information fluency, medical and information science educators are discussed.

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I. INTRODUCTION AND PROBLEM STATEMENT

A. Introduction

Lifelong learning (LLL) competency is one of the most fundamental competencies for medical practice. Above and beyond the clinical knowledge and skills acquired, medical students must learn how to continue learning efficiently and effectively to become and remain effective physicians. Discussions of lifelong learning are pervasive in the medical and information literature but definitions and characteristics remain incomplete. How medical students become lifelong learners has been of interest to this researcher for some time. The goal of this study is to explore how medical students perceive their development as lifelong learners in terms of their attitudes, skills, and behaviors.

Lifelong learning has been referred to as lifelong education, "learning to learn" (Mentkowski & Doherty, 1984, p. 5; Mentkowski, 1988, p.115), "learning over the lifespan" (Titmus, 1999, p. 343), "free choice learning, " (Falk & Dierking, 2002, p. 6), "self-directed learning, " "self-sustaining learning" (Banta, 1993, p. 16), "learning without boundaries" (Edwards & Usher, 2001, p. 276), or even "information literacy" (Saranto & Hovenga, 2004, p. 504). Edwards and Usher (2001, p. 276) refer to the "spreading epidemic of lifelong learning," recognizing the "boundlessness" of its potential influence. In their article, entitled "Lifelong Learning: The Postmodern Condition of Education," Edwards and Usher argue that LLL contributes to "performativity and a loss of mastery" (p. 273). At the same time, they argue that LLL is simply the new metaphor for learning. Mentkowski (1988) identifies three student outcomes as focused components of self-sustained learning: 1) taking responsibility

for learning, 2) making relationships between abilities and their use, and 3) using different ways of learning (as cited in Banta, 1993, p.16). Does LLL symbolize simply the learner-centered movement, with its emphasis on the active, independent learner, responsible for his or her learning? Stronach and Maclure (1997) characterize knowledge as having certain "unruliness" (as cited by Edwards & Usher, 2001, p. 275) and LLL as a way to deal with the problems this entails. According to LaBlance and Fagan (1994, p. 32), "lifelong learning, like taxes and death, is a fact of life." Discussions of LLL are pervasive in the education literature and occur often in other fields, including information science.

LLL has been defined, characterized, lauded (General Professional Education of the Physician Report, Association of American Medical Colleges' Medical School Objectives Project, The Institute for Improving Medical Education, Accreditation Council for Graduate Medical Education; see Appendix 1) and its assumptions have sometimes been questioned (Schmidt, 2000).

LLL has been touted as the modern equivalent of "learning" as a consequence of exponential growth of information (Wets et al., p.249). The growth of knowledge is particularly evident in the sciences and medicine. In medicine, it has been said that half of what one learns will be outdated by the time one enters practice, and that knowing which half is the key. LLL is also viewed as an ongoing learning process that begins at birth and ends only with death: from cradle to grave. How does LLL relate to medical education, which is seen as a progression from undergraduate, to residency, to fellowship, to continuing medical education (CME) (Johnson et al., 2000)?

The focus of this study is to explore LLL within undergraduate medical education. "Undergraduate" medical education consists of four years of post-baccalaureate study, usually divided into two years of basic sciences and two years of clinical studies. For the purposes of this study, self-directed learning (SDL), active learning, and independent learning are being considered synonymous and part of the larger movement toward learner-centered education. In terms of national medical organizations, the Association of American Medical Colleges (AAMC), the Accreditation Council for Graduate Medical Education (ACGME), the Institute for Improving Medical Education (IIME), and the Liaison Committee on Medical Education (LCME) have issued statements on LLL and medical education. These are described briefly in Appendix 1. This focus places formal continuing medical education beyond the scope of this study as CME is usually designed for residents, fellows, and physicians (AMA website). Evidence-based medicine (EBM), a current trend in medical education, will be considered as part of LLL but only as one of several components.

B. Definition of terms

Terms and concepts related to this study and used frequently in medical and general education include: competency-based curriculum (CBC), evidence-based medicine (EBM), learner-centered learning, lifelong learning (LLL), problem-based learning (PBL), team-based learning (TBL), and reflective learning. A basic familiarization with these approaches to learning is essential for understanding LLL; and are briefly defined here.

Competency-based Curriculum (CBC) assumes that "learning to become a professional is a progression through stages and competency represents the point along this path where the learner understands the foundations of his/her skills and has internalized appropriate professional values to work independently in normal settings and manage his/her own continued growth "(Org, 2002, online).

Among competencies essential for training competent physicians, lifelong learning is usually prominent. Hojat (2003, p. 434) defines lifelong learning as "a concept involving a set of *self-initiated activities* (behavioral aspect) and *information-seeking skills* (capabilities) that are activated in individuals with a sustained *motivation* (predisposition) to learn and the ability to recognize their own *learning needs* (cognitive aspect)."

Evidence-based medicine (EBM) is an approach to patient care focusing on three concepts: clinical expertise, research evidence, and patient preferences (Sackett et al., 2000). EBM encompasses clinical state and circumstances, patient preferences and actions, and research evidence, with clinical expertise integrating the other three components (Haynes et al., 2002, p. A11). Briefly, EBM involves the physician taking into account and applying the best evidence (as found in the research literature and as defined by an evidence hierarchy) to his or her patient. In addition, the learner-centered movement motivates learners to identify their own knowledge gaps, fill them, and keep track of learning gains. Teachers facilitate this process, increasing students' motivation to learn and to continue to learn (IIME Glossary, 2004, online).

Problem-based Learning (PBL), in medical education, is conducted in small groups with a facilitator, addressing a pre-determined problem that "contains triggers designed to evoke objectives or concepts which are used to set the agenda for individual or group investigation and learning after the initial session" (IIME Glossary, 2004, online). Students then do independent research. Subsequent group meetings permit students to monitor their achievements and to set further learning goals as required. Students in PBL courses have been found to place more emphasis on "meaning" (understanding) than "reproduction" (memorization) and engage in more self-directed learning (IIME Glossary, 2004, online).

Team-based Learning (TBL), a related instructional mode, tends to combine the advantages of lecture-based learning (LBL) and PBL. TBL incorporates the emphasis on content acquisition from LBL and the collaborative approach of PBL. TBL tends to be more directive than PBL and requires pre-class preparation on the students' part (Michaelsen et al., 2002). PBL is done exclusively in small groups: in TBL, however, students come to class having independently completed an assignment and are directed to discuss specific aspects of the assignment in small groups. Subsequently each small group shares its findings with the rest of the class. As a consequence, TBL uses fewer human and classroom resources, a clear advantage in an economically challenged academic environment. All these approaches lead to increased expectations of students' participation in and responsibility for their education.

Both problem-based learning and team-based learning have roots in the learner-centered movement. All these approaches are aimed at enhancing LLL, a

complex set of attitudes, behaviors, and skills that are developed over a lifetime. The researcher characterizes LLL as the ability to identify information gaps, determine the best ways to fill those gaps, reconcile conflicting data, synthesize and integrate the data, and continuously reassess the process; the attitude of open-mindedness to uncertainty and possibilities; and behavior that reflects this mindset.

C. Problem statement

The purpose of this study is to improve understanding of medical students' views of LLL through structured interviews. By asking medical students to describe their information-seeking behavior, its context(s), skills, and the technology employed, a new perspective on what constitutes LLL may become apparent. For example, do students use text only? Or as Brown argues, in his evolving nature of literacy, have digital students "developed their own vernacular, a screen language for their digital culture" (Brown, 2001, online)? Do medical students include images, sound, or other media in their sources and resources for information? Will their language reflect "discovery-based learning" (Brown, 2001, online)? As users of non-print, electronic services such as instant messaging, chat rooms, email, portable digital audio players, and computer games, have medical students internalized the use of these technologies into their medical education? How have they developed these skills? Daley suggests that an expanded concept of literacy (beyond text) includes the "multimedia language of the screen" (Daley, 2003, online). As students describe the skills, behaviors, and attitudes that they consider important to becoming a lifelong learner, the researcher seeks to understand more about the challenges they face or have faced in this preparation and what has facilitated their

development as lifelong learners. Do they agree with assertions in the literature that lifelong learning is a worthy goal? Have they thought about it consciously or do they just assume that, by virtue of graduating from medical school, they will have become lifelong learners? How do medical students frame their learning?

New users of the Web typically use it only for specific, limited purposes such as making airline or hotel reservations; the Web later becomes a part of life for many users (Haythornthwaite, 2001; Selwyn et al., 2005, online). Have these digital technologies become a part of medical students' approach to learning? Brown (2002, online, p. 61) discusses several "digital divides": between "today's digital student and yesterday's analog professor"; between generations that use instant messaging and those that do not; between information and knowledge. Brown (p. 54) makes the distinction: "Knowledge is information that has been internalized and integrated into our frameworks," information thus becomes actionable knowledge. He sees the Internet as the "first medium…that has the technological tools to support multiple forms of intelligence" (p. 63) and challenges educators to discover ways of incorporating these tools into the learner-centered paradigm.

Lifelong learners in medicine face the ultimate challenge: finding what they want, judging whether to believe it, and keeping an open mind on evaluating information that could alter their points of view (Brown, 2002, online, p. 62). This is precisely what a physician does when diagnosing a patient's health problem. The "differential diagnosis", as this process is called, analyzes what is known about a patient's situation, what other information is needed, how the pieces fit together, and-- as new data are obtained--how these data may alter what is known and what

is actionable at any given moment. The impact of the Internet on patient care has made "just-in-time" information available at the point of care. Physicians can retrieve, store, share, and manipulate patient-specific and general medical information efficiently and effectively (Kim & Lehman, 2003, p. 433). Telemedicine has brought the expertise of specialists in large urban areas to rural and distant practitioners. The electronic medical record has made multiple and simultaneous accesses possible, potentially eliminating the unnecessary duplication of laboratory and radiological tests and alerting practitioners to potential drug reactions and interactions. Overall, such technological advances have led to new thinking about information-seeking and learning strategies for future physicians. How medical students think about and articulate their LLL needs has not been explored fully within the emerging electronic learning environment. Knowing how medical students cope with information overload and learn within the digital environment may enlighten current approaches to teaching information-seeking strategies.

No studies have focused on how medical students themselves define LLL and whether they feel they are developing as lifelong learners. Focus groups have been used at Indiana University School of Medicine to ask students to characterize their medical education experience (Bell, Griffin, Greene, & Brokaw, 2004). The literature contains numerous studies on how clinicians think, make clinical decisions, and practice (Slotnick, 2001; Slotnick et al., 2002). Fewer studies have been conducted with medical students per se, investigating how their views, behaviors, and practices may differ from those of practicing clinicians. However, Peterson (2004) has argued that previous studies on the use of online information resources by practicing

clinicians have found little correlation with medical students' information practices. Peterson has observed that medical students more readily embraced the digital age and used resources very differently from their professional mentors and faculty. Additionally, Wilson et al. (2004) demonstrated that perceptions of medical students, of physicians, and of the public differed significantly. Medical student perceptions changed during acculturation to the medical profession: "First-year medical students were more likely than fourth-year students and fourth-year students more likely than physicians to perceive unfair treatment (Wilson et al., 2004, p. 715). This suggests those medical students' perceptions of themselves as lifelong learners are likely to change as they develop professionally.

D. Research questions

In this study, the following research questions were addressed:

1. What characterizes lifelong learning practices and attitudes of undergraduate medical students?

2. How do lifelong learning practices and attitudes differ across the four years of undergraduate medical education?

3. How do undergraduate medical students use technology to help them cope with the information they encounter?

E. Significance

This study contributes to the overall literature on LLL from a perspective that has received little attention. The findings are of interest in the development of policy, practice, and theory. Indiana University School of Medicine's (IUSM) size (second largest in the U.S.) and status as a leader in competency-based curriculum make it a

logical place to conduct this study. It is expected that other medical schools will also be interested in how LLL competency is understood and assessed by IUSM students.

Policy. The Accreditation Council for Graduate Medical Education (ACGME) is the governing body of graduate medical education in the United States, accrediting teaching hospitals and residency training programs. ACGME currently requires residency programs to support six major competencies in graduate medical education; the Association of American Medical Colleges (AAMC) encourages undergraduate medical education to follow suit.

Undergraduate and graduate medical education programs thus form a progression. LLL is a major component in all national and international criteria for the ideal graduate. The ACGME's core of competencies for (graduate level) residency programs recommends that medical schools focus on undergraduate competencies to prepare their students better for these residency requirements. As a result, medical educators and students devote much time and energy to a set of competencies that include LLL. Among ACGME's six competencies, LLL is evidenced in three areas: Patient Care, Medical Knowledge, and Practice-based Learning and Improvement. According to ACGME residents must be able to:

- Make informed decisions about diagnostic and therapeutic interventions based on patient information and preferences, up-to-date scientific evidence, and clinical judgment.

- Use information technology to support patient care decisions and patient education.

- Demonstrate an investigatory and analytic thinking approach to clinical situations.

- Know and apply the basic and clinically supportive sciences which are appropriate to their discipline.

- Locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems.

- Obtain and use information about their own population of patients and the larger population from which their patients are drawn.

- Apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness.

- Use information technology to manage information, access on-line medical information; and support their own education (Accreditation Council for Graduate Medical Education. Outcome Project, online).

Practice. Given the global movement toward learner-centered learning and self-directed learning, understanding how medical students conceptualize LLL, its manifestations, its usefulness, its definition, and how it might be measured will provide new evidence for medical educators to consider. Do students buy into this concept? If not, why not? How do they see their own development in terms of LLL skills, behaviors, and attitudes? This study provides information to address these questions.

In addition to the requirements established by national and international organizations, medical students face with an ever-growing knowledge base that may be accessed and managed using a variety of hardware and software. In addition to the traditional MEDLINE database, physicians-in-training now have access to the Cochrane Collaboration databases, UpToDate, Info Poems, and a host of other pre-filtered information packages. These attempts to fill the gap between the medical student's own knowledge and the vast store of information that is available.

Theory. In her seminal essay on "training for uncertainty," Fox describes the three basic types of uncertainty that medical students face:

> The first results from incomplete or imperfect mastery of available knowledge. No one can have at his command all skills and all knowledge of the lore of medicine. The second depends upon limitations in current medical knowledge. There are innumerable questions to which no physician, however well trained, can yet provide answers. A third source of uncertainty derives from the first two. This consists of difficulty in distinguishing between personal ignorance or ineptitude and the limitations of present medical knowledge (Fox, 1957, p.9 as cited in Fox, 1980, p. 5).

The challenge of dealing with uncertainty remains central to the educational process as evidenced by a recent call for papers by the AAMC's Institute for Improving Medical Education:

> Biomedical facts and reductionist reasoning are not sufficient to equip physicians to deal with today's clinical problems in the context

of the human experience. The ability to apply values and ethics and to acknowledge uncertainty in caring for patients stands as a parallel requirement for today's physicians (Cooper & Tauber, 2004).

Medical students' views on lifelong learning and their coping with the uncertainty inherent in applying medical information to specific patients may contribute to a deeper understanding of learning and developmental theory, may reinforce or extend existing theory, or may form the basis of emerging theory.

II. LITERATURE REVIEW

Currently, MEDLINE contains over 18 million articles from over 4, 800 journals (U.S. National Library of Medicine, 2005, online). Over 400, 000 new articles have been added to MEDLINE each year since 1993 (Wets et al., 2003, p. 249) Interestingly, MEDLINE does not include LLL as a Medical Subject Heading (MeSH). Rather, it indexes LLL material primarily under "Learning, Professional Competence, Clinical Competence," and "Education, Continuing, Medical." However, in CINHAL, the major nursing and allied health bibliographic database, Lifelong Learning is a thesaurus heading, which is defined as "personal intellectual and/or professional development through the life span…. [And] may include but is not limited to EDUCATION, CONTINUING" (CINAHL scope note for LLL). "Self-Directed Learning" is a separate heading used for "independent learning" (CINAHL scope note). The volume of information, coupled with its half life of fewer than five years, challenges physicians to stay abreast of current best practices. As a result, numerous attempts have been made to filter information, including work by commercial organizations that provide products such as UpToDate, MD Consult, and Biovista. In addition, the evidence-based medicine (EBM) movement has emphasized quality filtering with such products as *EBM Reviews* and the numerous *Cochrane Collaboration* databases (Sackett et al., 2000).

Numerous authors have viewed medical education is viewed by as a progression (Johnson et al., 2002; Slotnick, 1990, 2001; Schmidt, 1990; 2000; Slotnick, Norman, & Boshuizen 1990; Slotnick, Mejicano, Passin & Bailey, 2002). The AAMC has produced reports (Medical School Objectives Program (MSOP) I &

II), that support this perspective. Johnson et al. (FOPE II, 2002) speak for pediatric education in describing the progression: "Medical education is properly viewed as a continuum, from medical school through residency, fellowship, and continuing education, with variations both in the content and the level at which that content is taught" (p. 1175). According to others, key features of LLL include "personal motivation, recognition of needs that prompts an active search for knowledge, and information-seeking skills" (Knowles, 1975, p.18; Bligh, 1993).

A. Context and situation as they affect LLL

What settings are appropriate for LLL? As Lundmark (2002, p. 325) points out, "Information and experiences available in all three major learning settings (schools, workplace, and free-choice venues) work synergistically to reinforce and contextualize what is learned." Just as learning styles vary among learners, so do the environments in which they learn best. Learning through both formal and informal means is reinforcing. Learner-teacher, teacher-learner, and peer-to-peer learning are all important. Ballou (1999) found that for "advanced professionals," interactivity between colleagues was one of the most valued activities during the fellowship experience he and his colleagues described.

Lifelong learning (LLL) is defined differently in different contexts. Medical education is a career-long process beginning with medical school, extending into residency, and continuing through years of medical practice. Support of lifelong learning with information technology requires more than computer literacy (Saranto & Hovenga, 2004). Other requirements include cognizance of the broad range of medical information resources and their relative values for particular needs, the

know-how to use them, and the motivation to use them routinely. At the national level, the AAMC proposed the Medical School Objective Project (MSOP) to look more closely at the needs of the physician in the 21st century. According to MSOP (1998), in order to provide a foundation for lifelong learning, the successful graduate should be able to:

- demonstrate knowledge of the information resources available to support lifelong learning

- retrieve, filter, evaluate, and reconcile information

- exhibit good "information habits"

The MSOP guidelines included critical physician skills described as the "capacity to recognize and accept limitations in one's knowledge and ability" and to understand "the need to engage in lifelong learning to stay abreast of relevant scientific advances" (MSOP, January 1998). MSOP focused on physician attributes; the Institute for Improving Medical Education (IIME), together with the AAMC, looked at the system necessary to create the ideal described in the MSOP. An ad hoc committee of ten U.S. medical school deans' review of the educational system recommended strategies for change, presented in "Educating Doctors to Provide High Quality Medical Care" (July 2004). Among its priorities were the needs to "employ educational technologies that enhance learning" and to "promote the acquisition of skills necessary for self-directed learning" (p. 8).

Making the paradigm shift from discipline-defined curriculum to competency-based curriculum (CBC) has been a boon to the implementation of LLL at several medical schools. At the undergraduate medical level, the CBC has been

implemented at six medical schools as of 2007 (Brown University, Indiana

University, Loyola University, Southern Illinois, University of Maryland, and

University of Miami). At the graduate level, the Accreditation Council for the

Graduate Medical Education (ACGME) has proposed a competency-based

curriculum for residency programs with six competencies, namely, 1) patient care, 2)

medical knowledge, 3) practice-based learning and improvement, 4) interpersonal

and communication skills, 5) professionalism, and 6) systems-based practice: this

list is closely related to the nine competencies in place at the Indiana University

School of Medicine (IUSM).

ACGME defined its third competency, "practice-based learning and

improvement" as the ability of physicians "to investigate and evaluate their patient

care practices, appraise and assimilate scientific evidence, and improve their patient

care practices." The Association of American Medical Colleges supported the shift

to a competency-based curriculum for undergraduate medical education. At both the

undergraduate and graduate levels, major components of LLL have included both

self-assessment and the ability to fill gaps in one's knowledge and practice.

Pediatrics has extended the shift to the certification process; one step "is

demonstrating a commitment to life-long learning through the Knowledge Self-

Assessment and Decision Skills Self-Assessment" (Carraccio, 2004, p. 256). It

appears likely that these parallel developments, from undergraduate, to graduate, to

physician education will eventually coalesce. The key here is pairing leadership in

undergraduate and graduate education to ensure that outcome competencies from

medical school match expected incoming competencies for residency training (Corraccio, 2004, p. 256).

B. Student development theories and LLL

Student development theories (Evans et al., 1998, pp. 10-11) have included psychosocial, cognitive-structural, and typology theories. Although Evans et al. (1998, p.12) maintained that "Paradigms guide both theory and research," McEwen (1996) argues that theory develops as "a result of shifting paradigms" (pp.147-163). A paradigm, according to Guba (1990, p.17), is a "basic set of beliefs that guides action." For the purposes of this study, psychosocial and cognitive-structural theories are discussed. Typology theories, although helpful for designing educational materials, are "not truly developmental in that they do not consist of stages through which individuals progress" (Evans et al., 1998, p. 204).

Psychosocial theories (identity models)

Psychosocial theories address the "content" of development and are helpful in understanding important life issues that individuals face in defining themselves and their relationships with others at various times in their lives. (Evans, 1998, pp.32-33). Several psychosocial theories are worthy of discussion as they relate to LLL, specifically those of Knowles, Chickering, and Grow as well as transition models.

Knowles' theory of andragogy

According to Knowles, prior to 1970, interpreters of learning theories had been unsuccessful in organizing them in any comprehensive way (1998, p. 22). The theory of andragogy, introduced in the 1960s by Knowles, is probably the "best known concept in adult education" (St Clair, 2002). Knowles' theory of andragogy is

to adult learning what pedagogy is to non-adult learning (Knowles, 1998). Knowles'

arguments have been considered at times all of the following: a theory, a method,

and a set of assumptions. Knowles' (1980 & 1998; Atherton, 2003; St. Clair, 2002)

assumptions are predicated on the following:

- Adults move from dependency to self-directedness and are internally
  motivated to learn (learner self-concept).

- Adults draw upon their reservoir of experience to enhance their learning (role
  of learner's experience).

- Adults are ready to learn something when it will help them cope with real
  problems or situations (orientation to learn).

- Adults need to know why they need to learn something before learning it
  (need to know).

According to Knowles (1980; 1984), two conceptions predominate in self-

directed learning: 1) adults teaching themselves about a particular subject in

independent study courses and 2) personal autonomy, what Candy (1991) called

"autodidaxy, " which involves taking ownership of learning, determining its goals and

purposes. These concepts may overlap or they may also be independent. Does

Knowles' theory still apply? According to St. Clair (2002, online), as a set of

assumptions, it is still useful: "In the future andragogy will maintain its role as a

necessary component of the field's shared knowledge, but it is highly unlikely to be

viewed as sufficient to explain or shape the education of adults."

Chickering's Seven Vectors

Chickering's classic view of general undergraduate student development includes seven vectors (Chickering & Reisser, 1993, pp. 38-39):

1. developing competence

2. managing emotions

3. moving through autonomy toward independence

4. developing mature interpersonal relationships

5. establishing identity

6. developing purpose

7. developing integrity

Vectors 3, 4, 5, 6, and 7 seem particularly appropriate to the discussion of medical students' development because, as graduate students, they are likely to be further along the development sequence.

Grow's Stages in Learning Autonomy

Grow (1991) describes self-directed learning as a four stage process, where teacher and learner share the responsibility for learning until the learner becomes completely self-directed, "able and willing to take responsibility for their learning, direction, and productivity" (p. 134). The learner, according to Grow, evolves from being "dependent" and needing a teacher to be an authority figure, to being "interested" and needing a motivator, to being "involved" and needing a facilitator, to being "self-directed" and needing a consultant. Grow saw learning as situational and held that the teacher needs to adapt teaching styles accordingly to the student's stage of development to avoid a "mismatch" between learner stages and teacher styles (p. 137).

Transition Models

Schlossberg's Transition Theory *(1995)* involved an individual's ability to deal with transitions, namely, the "4 Ss": 1) situation, 2) self, 3) support, and 4) strategies (Evans et al., p.115). Transitions were defined as "events or nonevents resulting in changed relationships, routines, assumption or roles." Individual meaning is based on type, context, and impact. The transition process involved "reactions over time" and a "moving in, moving through, and moving out" (Schlossberg, Waters, & Goodman's Transition Model, 1995). Egan's model (1982) involved "exploration, understanding, and coping."

Cognitive structural student development theories

Psychosocial theories focus on stages of development, cognitive theories, however, described "changes in thinking and evolving frames of reference that structure values, beliefs, and assumptions" (Chickering & Reisser, 1993, p. 2). Among cognitive structural theories, **Erikson's** (1959) stage theory and Marcia's theory of identity development (1966) helped to lay the foundation for Perry's Theory of Intellectual and Ethical Development (1968). Perry's theory referred to the progression of development consisting of nine "positions." Perry's choice of the term "positions" was central to his theory because positions do not imply duration (as opposed to "stages") and were in keeping with his idea that students viewed the world from a particular place on a journey, an intellectual "Pilgrim's Progress" (Perry, 1985, online). Perry (1981) delineated nine positions, which included four major concepts: duality, multiplicity, relativism, and commitment. Interestingly, Perry

viewed these positions as static and argued that development occurred during the transitions between them.

Baxter-Magolda (1992) proposed a four stage model of learning development based on her research with undergraduates at Miami University. The stages were:

1. absolute knowing (includes two patterns: receiving knowledge and mastering knowledge)

2. transitional knowing (interpersonal knowing and impersonal knowing)

3. independent knowing (interindividual and individual: knowledge is uncertain)

4. contextual knowing

Importantly, Baxter-Magolda (1992, p. 287) stated that dialogue "brings together students and teachers in the process of making meaning". She saw parallels with other young adults in three areas: "development and emergence of voice, changing relationships with authority, and evolving relationships with peers" (1992, p. 196).

Stage 4 of Baxter-Magolda's Epistemological Reflection Model (1992) is particularly significant to the study of LLL. Contextual knowing, the final stage of the model, "involves the belief that the legitimacy of knowledge claims is determined contextually: The individual still constructs a point of view, but the perspective now requires supporting evidence" (1992, p. 188). This relates to the EBM approach now being emphasized in medical education (Sackett et al., 2002). In spite of its significance and relevance to LLL, Baxter-Magolda's research has limited utility because the sample was limited to 101 University of Miami undergraduate students (50 men and 51 women), who were primarily white (3 were non-white). McEwen (1994) pointed out that the study did not pay sufficient attention to gender patterns

among the four general ways of knowing. However, Baxter-Magolda did demonstrate that, at the contextual knowing stage, previously gender-related patterns converge. Like Baxter-Magolda's model, King and Kitchener's (1994) Reflective Judgment Model (RJM) of intellectual development was developed from interviews with student subjects (p.74).

Developmental approaches to understanding learning as espoused by Erikson, Piaget, and Knowles have come into question for their "one size fits all" view of student development. Another approach focused more on how individuals learn within specific environments. Sanford (2006) was one of the first to study student development as a function of "person-environment interaction." Conditions for learning, according to Sanford, included readiness, challenge, and support: "The amount of challenge a person can tolerate is a function of the amount of support available (Sanford, 2006, pp. 1-27). This contextual approach to learning (Falk & Dierking, 2002) reflected a more integrated view of development and learning.

Most of the psychosocial and cognitive structural theories discussed above came from the traditional perspective. The constructionist view, however, holds that human development is more comprehensive than linear. Allen questioned the assumptions of traditionalists. She contended that development: may follow multiple paths, consisted of themes and patterns rather than stages, was both intrinsically and extrinsically triggered, included cohort patterns, and needed to be studied holistically because "aspects of development are interconnected" (Evans et al., 1998, p. 285-286).

Although these student development theories were based on studies of undergraduates, it is reasonable to expect that at their highest levels these theories may also apply to graduate and medical students

C. Medical professionalism and LLL

LLL is a core component of professionalism. According to Gordon (2003, p. 341), "altruism, accountability, duty, integrity, respect for others, and lifelong learning are qualities that have been identified as central to medical professionalism." National medical education organizations (such as IIME, AAMC, and ACGME) consider LLL one of characteristics of being a professional. Swick's (2000) definition of medical professionalism includes nine behaviors. Among them is that "physicians demonstrate a continuing commitment to excellence" (p. 615). According to Swick, "excellence is internally focused" and derives from a physician's "commitment to expand his or her knowledge to keep abreast of the rapid changes in biomedical science and clinical practice….A commitment to excellence makes life-long learning fundamental to professionalism" (p. 615). Similarly, the Medical School Objective Project (MSOP) states that a physician should have "the capacity to recognize and accept limitations in one's knowledge and clinical skills, and a commitment to continuously improve one's knowledge and ability" (MSOP, 1998, online). Self-directed learning becomes a salient characteristic of the professional and one of a physician's core professional responsibilities (AAMC, MSOP, 1998; Nelson, 1998). LLL is inherent in medical education and practice. Attempts to assess LLL preparedness among physicians and medical students have used a variety of

scales, notably the Jefferson Scale of Physician Lifelong Learning (Hojat et al.,

2003) and the Self-Directed Learning Readiness Scale (Guglielmino, 1977).

D. LLL and medical education within the electronic culture

How lifelong learners develop in an electronic environment is not clear. Although

reflective learning has been an educational model since the early 1980s (Schon,

1983, 1987), the field of medicine has come to it more recently (Snadden et al.,

1996; Lichstein & Young, 1996). Frankford et al. (2000, p. 709) urged practice

organizations (groups of physicians who practice together) to institutionalize

"reflective practice," noting that "the resulting 'institutions of reflective practice' would

link individual reflection with processes of collegial reflection to enhance and sustain

lifelong learning."

Education technology has played a significant role in the development of the

digital physician (Satava, 1994): Medical practice has progressed from direct online

access to MEDLINE in 1980s (via Grateful Med and other end-user products) to full-

text online journals and textbooks, to handheld devices that now track clinical

encounters, patient data, and drug/therapy reminders. The technology has had a

profound effect on medical education, as Moberg and Whitcomb predicted in 1999.

The ubiquitous cell phone turned camera-pager-PDA has had a significant impact on

the medical community in spite of complications arising from Health Insurance

Portability and Accountability Act (HIPAA) guidelines concerning privacy and

confidentiality (Centers for Disease Control and Prevention, 2003, online).

A recent online discussion among EBM-librarians on the relative value of

Goggle and MEDLINE in locating medical information has underscored yet another

issue. In 2002, Google began indexing a significant portion of PubMed, NLM's MEDLINE. The option of searching MEDLINE via Google appeals to many users as a metasearch approach that is quick, easy, and fruitful (Sadeh, 2004). What Tennant (2004) called the "Google lesson," was that presentation of results is more important than the number of the results. Thus, quality and completeness of retrieval become lower priorities.

Put another way, will the convenience that technology provides in improved access and portability (to point of care) of pre-filtered information encourage "best practices" for physicians-in-training and the development of their own critical thinking skills and lifelong learning strategies? Will the primary literature be abandoned in favor of secondary sources? If information is not available in full-text online, will it be ignored? Or, as Campbell (2006, p. 18) suggests, will it become "kind of second-rate" because of its inaccessibility online? These questions can be daunting as educators face an ever-growing body of knowledge and physicians face ever-briefer contact with their patients.

Where does this leave the physician-in-training? As information continues to grow and become more portable and shareable, and as open access decreases the digital divide between developed and developing cultures, Brown suggests the term "hyperexponential" (Brown, 2002, online, p. 51) to describe the ever-increasing virtual communities which become possible. In such an environment, how will the future physician fare? What tools will she/he need to navigate, store, retrieve, manage, reconcile, and transform available data into actionable knowledge? The changes in readily available gigabyte storage devices, such as pocket drives, have

made floppy disks, zip disks, and CDs of just a few years ago seem clumsy and

obsolete, underscoring the need to adapt quickly to changing environments. Forsee

(2005, online) refers to this trend as the "The Law of Mobility," which states the

"value of any product or service increases exponentially with mobility." Additionally,

the combination of two other forces, Moore's and Metcalfe's Laws, have driven the

technological revolution. Moore's Law states that computer processing power

doubles every 18 to 24 months while remaining at the same price point; Metcalfe's

Law states that the value of any network increases exponentially as its number of

users. The Internet in general and Google in particular have been prime examples of

these forces at work. A vivid example of the changes brought about by Internet

access is the treatment of Parkinson's disease. An effective treatment for

Parkinson's was discovered around 3000 BC in India but it did not come to light in

Europe until thousands of years later (Gallien, 2006, online). The failure was one of

information transfer:

> The failure in this story is not in the physicians and scientists who worked for
>
> generations to understand and treat this disease; they set exemplary
>
> standards in scientific theory. The failure was in the transfer of information,
>
> and this is a theme that has been played out many times in the history of
>
> science and medicine. Often, the problem is not that the information does not
>
> exist, but that the information is not known to exist (Gallien, 2006, online).

Summary of literature review

Medical education is complex. Its complexity lies in the practice of medicine,

which is both an art and a science. The nature and vastness of medical information

has required physicians-in-training to update and refine their information skills,

behaviors, and attitudes continually. Relevant theories for understanding student

development can help clarify how this is accomplished.

III. RESEARCH METHODS

A. Study setting and population

The study setting is the Indiana University School of Medicine (IUSM), the second largest school of medicine in the United States. IUSM is the only medical school in the state of Indiana. The school's competency-based curriculum, which was implemented in 1999 and whose first students graduated in 2003, makes it an appropriate setting for this study because one of its nine competencies is Lifelong Learning. The more than 1, 100 medical students include first- and second-year students at nine campuses, half of whom are located outside of Indianapolis at Centers for Medical Education (eight satellite campuses where basic medical sciences are taught). Third- and fourth-year students come to Indianapolis to do their clinical rotations. Students rotate through the various clinical services where they gain hands-on experience in patient care.

B. Student recruitment and sampling

Several recommendations for determining sample size have been described (Bauer & Aarts, 2000; Lincoln & Guba, 1985; Burawoy, 1998). No target number of interviews was determined at the outset. Initially, ten students from each year were invited to participate. Interviews were conducted with those who accepted the invitation until strong patterns were established. The minimum expected sample was five students from each of the four years of medical school (see Appendix 5).

The researcher randomly selected medical students from a list of students provided by the IUSM Medical Student Academic Affairs office and emailed them invitations. This was done to avoid giving the impression that students were hand-picked or that volunteering for this interview might have an effect on their relationship with the researcher in any other professional capacity; the researcher interacts with students during classes and in school committee work. This approach was expected to provide sufficient variation among participants. When insufficient numbers of students responded, the researcher used snowball sampling (Creswell, 1998; Patton, 2002). This technique is used for developing a research sample by having current study participants recruit other participants from among their acquaintances. See Appendix 3 for the email message that was used to invite participants.

Confidentiality

Students were identified only by an alpha-numeric code; the interviews were conducted in a neutral setting, study or conference room, lasted approximately one hour, and were audio-recorded. Interviews were conducted on a one-on-one basis to preserve confidentiality and privacy. No one other than the student and researcher was present. The transcriber and second coder received no identification data for the students except for their alpha-numeric code. Recorded interviews were destroyed once they were transcribed and had been reviewed by the students.

Demographics

The following demographic data were collected about each research participant: age, gender, year in medical school, ethnicity, campus where first two

years were completed, degree(s) earned, special degree programs such as

MD/PhD or MD/MBA, first in family to go to college or medical school, and parental

educational level. The 2004 entering class at IUSM was 46% female and 54% male.

The 2007 entering class was 45% female and 55% male (IUSM, 2007, online). The

sample in this study included ten men (56%) and eight women (44%), mirroring

closely the school demographics. The IUSM reports 13% of the 2004 entering class

and 26% of the 2007 entering class were from underrepresented ethnicities. For the

2007 data, twenty students did not respond to the ethnicity question on their

application. The sample in this study included four minority students, or 22%.

Researcher's personal stance and possible biases

The researcher has been active in the development and implementation of lifelong

learning competencies into the Indiana University School of Medicine curriculum.

She has been an advocate of its significance in the development and maintenance

of effective physicians. She also has an appointment in the School of Medicine as

Lifelong Learning Competency Director. Her views favor lifelong learning's relevance

and importance in the medical curriculum. The researcher was also curious to

discover if students view themselves as lifelong learners and if so, how they planned

to remain lifelong learners. To address the researcher's viewpoint, debriefing with

colleagues and research committee members was done to ascertain whether the

interpretations she was making appeared reasonable to uninvolved others. The

researcher maintained a reflective journal during data collection and analysis and

has summarized her thoughts on how her bias influenced the research (section

III.C.2 Semi-structured interviews). Other approaches to trustworthiness are also discussed in that same section.

1. Case study

According to Creswell (1998), the case study is one of five traditions of qualitative inquiry. It involves detailed, in-depth data collection about a phenomenon of interest. It is thus an appropriate method for this inquiry, where the emphasis is on developing a detailed understanding of LLL from the medical student's perspective. The case study method provides specific strengths to the researcher in allowing exploration of complex issues in context and the flexibility of adapting questions as new insights emerge. More importantly, it allows participants to tell their own stories: how they create meaning from their experiences. It is this "meaning-making" (Bailey & Tilley, 2002, p. 574) that the researcher sought to understand.

2. Unit of analysis

The school was the unit of analysis, allowing comparisons among students, within the same year, and between and across the years.

C. Data collection methods

1. Interview guide

The researcher developed an interview guide consisting of four main parts that investigated students' experiences with LLL 1) prior to medical school, 2) during medical school, 3) beyond medical school, and 4) how LLL related to other relevant concepts such as coping with information overload and use of technology. See Appendix 4 for interview questions.

2. Semi-structured interviews

Semi-structured interviews were employed to maintain the topic of interest at the forefront. Additionally, open-ended questions were used to provide students an opportunity to tell their stories. Charon (2004, p. 862) referred to such stories as "tellings." Because the concept of narrative is central to the practice of medicine, patients' stories blend with laboratory results and the physician's clinical experience to create a broader story. The goal was to make explicit the student's "taken-for-granted understandings" (Rubin & Rubin, 1995, p. 8).

Katz (2001) recommends using "how" rather than "why" questions to determine the reasoning for students' choices because "why" questions can be intimidating. Active interviewing (Holstein & Gubrium, 1995, p. 4) is another method for eliciting rich responses; students become "constructors of knowledge in collaboration with the interviewers." The researcher followed these practices. Pilot interviews with three students were conducted to determine if the questions were clear to the students and whether they were phrased appropriately for each student's year in school.

Two forms of member checking were used. During the interview, the researcher restated and summarized the information received to help clarify questions and assure that participants' views were represented accurately. Following data collection, participants were encouraged to review the interview transcripts for accuracy and to provide additional comments (Kuzel & Like, 1991). Those that responded stated that the transcripts were accurate.

3. Maintaining a journal

The researcher maintained a written journal during the interviews to note student responses (verbal and non-verbal) to particular questions, recording which worked well, which did not elicit useful responses, and for what reasons. This journal was kept throughout the interviewing process and recorded non-verbal communication that the interviewer deemed important, such as discomfort, hesitancy, lack of understanding, or enthusiasm. It also provided the researcher an opportunity to note observations and to reflect about each interview and the process. Student reactions to specific questions could be significant; with patterns emerging indicating a need to modify or enhance certain questions. Questions eliciting rich responses and those eliciting no or little response were noted. The guide initially included a question about what metaphor might best describe the student's view of LLL. The question generally elicited a "I don't know" response and was eliminated after the pre-test. Maintaining this journal was particularly useful during the pilot study to fine tune the interview guide. Interviews were transcribed by the researcher. Once transcribed and reviewed, the recordings were destroyed.

4. Assumptions

This study made the following assumptions:

1) Medical students understand and are able to articulate their views on LLL.

2) Their views can contribute to understanding of how LLL develops and how students view its development.

D. Data analysis

General categories, patterns, or themes were identified by the researcher and entered into Microsoft Excel database software for text analysis. The researcher

coded the transcripts and submitted a sample (six) of the transcripts to a second

experienced coder. Both coders used the framework technique developed by Ritchie

and Spencer (1994), a totally manual method involving five stages. Swallow et al.

(2003) modified the method by using Excel to do the charting. The five stages are: 1)

familiarization, 2) identifying a thematic framework, 3) indexing, 4) charting, and 5)

mapping and interpretation. Stage 1 involves a close reading of the transcripts, from

which a list of key ideas and recurrent themes evolve. This is followed by the

development of a thematic framework in Stage 2. In Stage 3, the coding frame is

manually applied to the transcripts. Stage 4 involves the charting of the themes with

the text of the interview transcripts. Stage 5 involves comparing and contrasting

respondent accounts, searching for patterns and connections, and explanations for

patterns and structure. These categories need to emerge from the data, with

concepts grouped around them, as Strauss and Corbin (1990, p. 63) suggest with

their "open coding." The two coders discussed their differences and fine tuned the

process accordingly. Inter-rater reliability was high and averaged over 90%.

Generalizability limitations

Transferability, according to Guba and Lincoln (1981), is one of four criteria

for evaluating qualitative research. Transferability refers to the degree that findings

can be transferred to other settings or contexts; the degree to which findings may be

enhanced by detailing the methods, contexts, and assumptions of the study. Indiana

University School of Medicine (IUSM), a pioneer in implementing a competency-

based curriculum for undergraduate medical education, has become a focal point for

other medical schools that want to implement similar curricula. As such, although the

findings of this study were limited to the IUSM, they are useful to other institutions who seek to better understand the role of lifelong learning in medical education.

The interview questions focused on the students' views of LLL, how they defined, operationalized, gave concrete examples of attitudes, behaviors, and skills that a lifelong learner embodied, and the extent to which LLL related to major concerns in the practice of medicine. The researcher was interested in the students' thoughts about LLL and its value in their education. Did they come to consider themselves lifelong learners? If so, when and how? Is LLL an ongoing process? How has increased access to the Internet affected their views of LLL? Have developments such as Google diminished or increased the value of LLL? If LLL is a toolbox of skills, attitudes, and behaviors, what sorts of tools did they consider crucial to being well-equipped for their profession? As they reflect on these questions, certain concepts emerged as predominant. A new perspective of LLL, its definition, characteristics, and value emerged through their responses.

IV. RESULTS

Five themes emerged from the medical students' interviews on lifelong learning (LLL): 1) LLL defined, 2) LLL as characterized by attitudes and behavior, 3) LLL development, 4) LLL and role models, and 5) LLL and technology. The first theme related to interview question one: "How do you define LLL?" The second theme related to questions two and four: "Can you think of ways that LLL can be taught?" and "How would you determine whether a physician is a lifelong learner?" The third theme related to questions three and five: "How can LLL are learned? Does it begin at an early age? How does it develop?" and "Do you consider yourself a lifelong learner?" The fourth theme related to questions six and seven: "How do you recognize a lifelong learner?" and "Who have been role models for you in terms of LLL?" The fifth theme related to questions eight through twelve and deals with technology.

> I think that to be able to give our patients the best possible care that's available, you'll have to stay on top of what new techniques are out there or new info on certain drugs, therapies, and so in that instance you have to keep your ears open to what's going on in order to be the best physicians we can be. I personally have the idea that any knowledge that you have makes you a stronger person and so the more knowledge you have about a lot of aspects of life just makes you more aware of things that are going on and more capable to deal with things that may thrown at you. (MS1)

Definition of LLL

Medical students across all four years consistently defined LLL as continuing to learn, making an effort to keep up, not falling behind, taking the initiative to learn, and self-directed learning. Among first year students, the definition of LLL was more theoretical and general in character; often not related to medicine at all.

LLL is kind of like being an explorer and with all this info coming out you have to actively go out and find a way of making it a part of your thought process and looking at the world rather than waiting for it to come to you and have it presented. (MS1)

LLL was seen as keeping up with new studies and innovations in the care of patients.

LLL was depicted as being curious, having a passion for learning, wanting to know why something occurred and how to alter the outcome if need be. LLL was equated to self-directed learning, fostered by reading and creative activities that encourage independent learning. LLL was viewed as the desire to learn more about one's environment and how one can contribute to one's field. LLL demands flexibility and a willingness to re-evaluate one's own way of thinking. The lifelong learner asks "Is there a better way to do this?" "How could this situation have been handled better?" "What are other options I may have overlooked?" (MS1)

LLL involves one's own learning but also the sharing of knowledge and experience with the less experienced. Academia provides that opportunity and also stimulates openness to new ways of doing things.

Because medicine evolves quickly, keeping up is a real challenge.

Distinguishing the kernel from the chaff is an active process that requires

assessment and reflection. Learning to apply what one learns to a specific

patient is the key. Considering the whole patient is the ultimate test of a

lifelong learner, and this requires a certain level of maturity. (MS1)

LLL is a commitment each year to advance your education, to advance your

search for knowledge. (MS1)

I guess I would define it as your efforts to make sure that you are up on

current issues and the things that pertain to your everyday life, whether that

be your career or even your home life. (MS1)

The best example of LLL is not a school related thing. Last weekend my

water heater exploded at home. I don't have a lot of experience and I'm not a

plumber by any means and I have a tight budget and I own my own house, so

I went to get a book on plumbing, rented a blow torch and I learned how to

weld a pipe and did the water heater and the electrical wiring myself. I didn't

know how to do that so I had to go to the library and get a book and read it

and that is the sort of thing that is LLL. I see LLL as a very active way of

learning. (MS1)

I don't think you have LLL unless you have uncertainty; in terms of medicine,

if you have to find an answer and decide between answers A and B, you have

to be a lifelong learner. (MS1)

LLL attitudes and behavior

Medical students defined LLL as self-directed learning, a passion for

learning, requiring sustained motivation, and an openness to new information. The

lifelong learner was characterized by curiosity, skepticism, and being an avid reader.

Accordingly, LLL was an intrinsic attitude: "I think it's an attitude that individuals develop and/or instinctively have to want to be ready for any situation that they may face." (MS1)

> The first thing that comes to mind is childhood curiosity, asking why just for the sake of asking why; that innate curiosity is crucial. (MS4)

In response to the question, "Do you consider yourself a lifelong learner?" an MS4 student replied:

> I consider myself a lifelong learner. Am I good? Perhaps not, because I always see room for improvement. My problem is that I want to learn so much about everything. I'm very ambitious and in order to achieve my goals I have to learn a great deal. (MS4)

> Every physician I've run into is a lifelong learner, by default or by choice. I think you enter medicine because you want to be a lifelong learner. And I doubt that you can survive if you're not. I think it almost demands it. (MS 4)

> A lifelong learner   is inquisitive, always curious. It's not 'you know that happened. It's "I wonder why that happened and what could I do differently to change the outcome". (MS4)

> LLL was a habit that one developed over time with practice and success and

was the result of positive role models that include elementary school teachers, parents, grandparents, undergraduate professors, medical school faculty, residents, and clinicians. Medical students also included patients as a source of learning. Being close to academia, for some, seemed a necessity for maintaining one's currency and

involvement in the field. Learning from peers, getting their feedback, and sharing knowledge with others were also hallmarks of becoming a lifelong learner.

LLL also involved self-awareness in recognizing one's own learning needs and engaging in introspection and self-reflection. LLL was seen as a necessity for being a physician. Not keeping up could be equated with malpractice, for some. LLL was seen as part of being a professional and as a means for providing the best possible care for patients.

> You can find interesting things in everything; you can then continue searching, deciding or knowing what or which is more scientifically based; knowing where to look for that information and how to decide if it is pertinent for you and your patient. When you start 3rd year it kind of hits you that people die around you and you are not ready for that at all and we are taught we have to save lives, do good, no harm but we don't go into our rotations thinking that people are going to die on our service. (MS3)
>
> Working with a patient with a terminal disease may require helping that patient make the most of the time he/she has left, rather than extending that time with more interventions. (MS3)
>
> I think that LLL is more relationship-based; it's more important to lengthen someone's life by six months and help them relate to the life they do have left or if you're giving someone the diagnosis of a chronic illness that will lead to their passing. (MS1)

As a physician I will continue to do what I do now and talk with my mentors and ask them about how they keep up and still maintain a life outside of work. (MS1)

It comes down to your work ethic, to be willing to study every night; for myself, I have to draw connections between things for me to remember; if I can tie things together I learn much better; it's like having a coat rack to hang information on. (MS1)

A lifelong learner is somebody who has a thirst for learning and who has a real go get 'em attitude; Observational skills are important; lifelong learner is always seeking information from multiple sources, like looking things up on the Internet, in books, talking to patients or just talking to peers .(MS3)

On learning and mistakes: "a lifelong learner is someone who is not afraid to say I don't know; someone who has a thirst for knowledge; what's important is learning from your mistakes; if you are uncomfortable with learning from your mistakes, medicine is definitely not a field for you". (MS3)

Second year students related LLL to medical school and being a better practitioner:

Somebody who isn't frustrated that they have to learn more but realizes that learning is not a burden, but something that you can do to enable you to be a better practitioner; and just to learn more information for yourself; sometimes if you don't know a lot about a topic, if you go a little deeper it's more satisfying to be able to understand more fully this knowledge of it. (MS2)

The key skill is knowing what you don't know and then the next important

thing would be the motivation to go find out how to figure that out. So, if you

are not able to identify your weaknesses or things that are advancing without

your knowing about them, if you can't notice that, you can't even go and

continue learning; being able to know what you can do and what you can't do

to find out and then you have to be willing to find out how to fix that void

whatever it is that you are lacking, or maybe not what is lacking but what has

changed. (MS2)

Third and fourth year students related LLL to patients and clinical care: "LLL allows

you every day to increase your knowledge base and learn a little bit more so that

you can help people". (MS3)

Lifelong learners are more willing to seek the information really on a daily

basis and when they see a patient with an atypical illness or something they

haven't seen for a while, they are willing to look at the literature and get online

to pursue that question so that in a few minutes, just in taking care of this

patient, they learn a little bit more and catch up with knowledge. (MS3)

Third and fourth year students seemed to accept the inevitability that LLL is just part

of being a physician: "LLL means that there isn't an endpoint to learning; you are

learning something new every day". (MS3)

I learn something new each day; my decisions are going to affect someone

else's life directly. (MS4)

LLL means continuing to learn and revise what you know; applying what you

learn to your patient population. (MS4)

LLL development

When asked about how and when LLL develops, is fostered or encouraged, learned or taught, the opinions varied.

> LLL is probably something early on in elementary school, if you had good teachers who excited you about learning outside of school and beyond, then that stays with you. (MS1)

> LLL starts early, but it might fizzle out as you get older. (MS 2)

> I think it won't be enough for me to develop the LLL aspects as far as medical and business knowledge goes, if I don't develop and further the skill of introspection and developing myself as a person. (MS4)

> I think we are probably born with it [LLL], wanting to question stuff; you see all these babies trying to reach for all this stuff because it's new and it's different. I think maybe by the time you reach adulthood you might think 'I know my job and I can do it' so to the older work force, it is difficult to get them to use the new technology: 'I know it this way and therefore I don't have to change. (MS4)

> You have to be optimistic and want to know more; all the time you have to be very inquisitive; curious. Some people like to read; some people like to talk to others so I think that it depends on the personality; I like to read, first by myself then to talk to other people. I would think it is something that you have in you; you just have it. Either you have it or someone else has to interest you. Maybe my parents stimulated my interest in becoming a lifelong learner,

maybe my husband; my curiosity about things while traveling around the world. (MS3)

 I think pretty much everyone I'm surrounded by reads; reading to kids I think makes a huge difference. I think you can't really begin to have a passive attitude and want to be a learner. I think really from youth, I mean once again this is reinforcing my view that LLL can't necessarily be learned at a late age because I think a lot of it has to do with the role models you have early on in life and also inner passion a person has (MS3)

In my own words, I'd say LLL is almost like a pursuit for education, almost like that childhood curiosity--it's the genesis of LLL for me; to want to know more. (MS4)

Another aspect of LLL is personal development; one of the skills I have been developing over the last 3 years is introspection; it has allowed me to kind of analyze how I interact with people, with my daily activities, whether I am a detail-oriented person, how are my organizational skills; learning that skill has done wonders for me as far as helping me to achieve the things I wanted to achieve in business and science. (MS4)

According to third- and fourth-year students, LLL started early:

At the earliest educational age, I think the individuals who enjoy reading and learning new things; just exploring different books and getting more information expands through their educational career; it becomes more specific later on in life, in college and in graduate school in whatever field, but

I think it does begin in early grade school, learning to enjoy reading and gaining knowledge. (MS3)

I think you can't really begin to have a passive attitude and want to be a learner. I think really from youth, I mean once again this is reinforcing my view that LLL can't necessarily be learned at a late age because I think a lot of it has to do with the role models you have early on in life and also inner passion a person has. (MS4)

LLL begins in childhood; maybe you have good experiences in school and you are rewarded for learning things on your own and so that is a behavior you adopt as your own personal style; so I'd say a little inborn tendencies and environmental rewards for those tendencies. (MS3)

How do you teach LLL? It's almost I would say practice and helping someone realize what they enjoy. I often tell people to find that one thing in life you would do for free for the rest of your life and be content and happy and that's the one thing I'd say to go for it. If you tap into somebody's curiosity or somebody's enjoyment, you can always urge them to seek out more information. (MS4)

Another student seemed to think LLL comes from doing:

I guess it can be learned through the success and benefits of actually doing it; figuring it out myself and having success in that; that opens it up; it's a habit that forms so I think the more success you have with it, the more value-added that it is .(MS2)

Another student focused on the environment necessary to foster lifelong learners:

One way to encourage LLL is just to make the environment safer for people

who don't know things. So if it's ok to ask questions, then it's ok to learn

things, but if it's not ok to inquire, then you're not ever going to want to learn

everything or because people will look down on you just for asking questions.

(MS2)

This was echoed by a third-year student:

Reading, reading, reading, but I think that dialogue is important because

sometimes studies have great intentions but in practice we need to discuss

how is this affecting our standard of care and what we do clinically. (MS3)

You definitely have to be passionate about learning new things. You have to

be disciplined and have to be pretty systematic whether that be learning a

little bit everyday or maybe once a week just sitting down and brushing up on

certain topics. (MS1)

LLL and role models

Several students recognized other lifelong learners by their knowledge and

curiosity about other fields, outside of medicine:

A zoology professor in college was someone who was always reading about

something new and she encouraged us to learn more; she incorporated what

she read into her lectures. (MS2)

I see LLL as a very active way of learning; it's different when you are

expected to learn information as opposed to independently seeking out

information; it's almost like active learning vs. passive learning. (MS1)

I think for a person to actually be a lifelong learner that a person has to take it upon himself, that you can teach the tools of LLL but to teach the action, I think it is something that the individual must take upon himself. (MS1)

Instructors model LLL through intangibles: how they talk to patients and to their families. (MS4)

Negative role models were mentioned by two students:

I was just thinking about a situation this past semester where I went to a medical clinic and a young girl 13 years old was in there for a deep wound right around her elbow that they were trying to heal up. The nurse said very professionally to the doc: 'we have a positive pt' which I am assuming is a pregnancy test. They didn't even tell this girl that she was pregnant. Right there you see what to do and you see what not to do as well. (MS1)

Positive role models were the norm:

My greatest role model is a friend as well, he's been retired longer than I've been alive yet he is still current on surgical information; he didn't pursue surgery because it was an end or a means to an end, he pursued it because it was truly a passion he had and it was something he wanted to fulfill as a pure interest of his. (MS4)

One of my role models was Dr. X, anybody who meets him sees this is a person who seeks knowledge for the sake of fulfilling his enthusiasm and he enjoys it. He'll talk about anything. It's those individuals that inspire me to always seek out more information, not just in the field I am comfortable in

but to go beyond that and try to branch out and have dialogue with individuals

in a field outside my area (MS4)

They [lifelong learners] are usually pretty excited about what they are doing. I

guess I'll go back to the teaching thing: if they are interested in sharing their

knowledge with you, they are usually interested in knowing what is new and

current. So someone who is excited about what they are doing, it'll be easy

to tell when they are teaching anything, even if it's not the newest thing,

usually I find those people to be good lifelong learners. (MS4)

If you are around people who you know who ask 'Amy, are you curious? How

does this happen?' and in that way maybe then when you are out on your

own, the questions still come to you but I think that you almost have to see

how it works. I don't think that you can sit here and tell me you could describe

it and I would do a worksheet and understand it. It's almost like you have to

have a mentor, someone to show you. (MS4)

I had great teachers at my elementary school that gave you active projects

and gave you the freedom to go where you wanted with it and when you're

excited about learning that will affect your learning in general. (MS1)

One of my greatest role models was Malcolm X, he said not to let 15 minutes

go by without reading a book; it struck me that if I let 15 minutes go by without

getting information and deciding whether it was right or wrong-that's the

epitome of being a lifelong learner. In the back of my mind, I think about when

I am wasting time that a lot of information is going by. (MS1)

I suppose the best way to learn is by example. I would guess you learn the importance of it when you see how others apply it and so if you have good examples of that, I mean the way your preceptor does things tends to be the way you do things. If you had preceptors actively showing you the benefits of research and looking up stuff, you'll probably tend to be a person that does that. And if you've seen how it works and you can incorporate it, it will become part of what you do. (MS1)

I think it's amazing even though their job [researchers] is to be up on everything, we'll be talking about an experiment and we'll say I don't think there is anything on it, but maybe we ought to go look. Even in someone whose job 24/7 is to keep up on this, they don't know what's out there. There is such a wealth of information out there: that's the gold standard of LLL in a professional investigator; so that's my role model. (MS2)

LLL can be encouraged; you can encourage a child to ask questions, and explain things to them that they do not understand. I think they'll start feeling more comfortable first of all not knowing the answer. People who are always expected to know the answer and are never encouraged asking questions, they are very uncomfortable with not knowing something. So if you don't know something, you're scared to know it and then you might not go to someone for help. (MS2)

A lot of the professors do a good job of incorporating into their lectures newer techniques; they've done a good job of incorporating them and showing you how those techniques are able to be applied to medicine. (MS1)

You need the tools and you need someone to show you how to evaluate the tools. I learned the tools in CHD (Concepts in Health & Disease, a PBL course) and how to ask the questions and figure out how to get the info and then how to interpret it and then you get EBM that says this is how you do it; wow, a guide, how helpful. (MS4)

I think the way they model it [LLL] for me is they say 'This is a question we had yesterday and here's how I got some information about it and here's an article for you to read and the way I obtained it was… In addition to just saying 'oh that's a good question' they showed me how they found an answer and how they guided a patient to finding the answer. So I would go back to the mentoring thing again. (MS4)

Parents were frequently cited as major role models:

My mom is a nurse and she's always reading journals and from early on I saw her take the time to read through those journals and stay current because she wanted to know where the medical field is going and how it would affect her job, how it would help her improve the practice of the nurses she is responsible for. At the same time my dad did the same thing, he's a retired art teacher and he read journals looking for new techniques; he wanted to see how other artists were doing and how they were pushing , and how he could incorporate that into his teaching. (MS1)

Mine [role models] would be my parents. And again I'm biased because both are in medicine. I know my favorite thing is I suppose I never heard my mom or my dad say "Oh, I have to go to work today" it's "I get to go to work today

and I get to see kids and be home by 5. It's a privilege" and when there were questions, we would discuss them at the dinner table. "Amy, today I had this patient come in and what do you think it was?" That was my family table conversation. (MS4)

I think I learned from my father and grandfather kind of what it takes and what makes a good doctor. My grandfather is WWII generation and when he was in med school, they kind of beat the snot out of you and those who were left standing, they called them doctors. I think it was the hard-nosed work ethic I learned from him, and my dad has a very good bedside manner, he just makes the patient feel better because of his bedside manner. I really didn't have what it takes coming out of college. (MS2)

I would define LLL by continuance of education without the use of a lecture, more along the lines of using life experiences and what you take from them. LLL is more experience-based than academic-based. (MS1)

There are physicians who have stayed up to date on current trends in medicine and there are others who are old school, still talking about things they brought with them from 20 years' experience. You can see a kind of attitude: "I am comfortable with this and I'm not very interested in trying to stay current because it worked for me back then and it works for me now". I went through and got that education and I don't need any more education. The endpoint is very very rigid in the way they practice. Being a lifelong learner, you have to have some flexibility. (MS1)

LLL is always seeking new kind of information and applying it to how you do

your job. It's an active process, learning from others and from your peers; it's

all part of continuing education. (MS1)

You got to get to know other students and work together as a team. You know

medicine is all about working as a team completely; in 3rd and 4th year you

discover that. It's not about what I want to do with my patients, it's what the

residents think and the pharmacy thinks, the doctor in charge, the attending,

you know, what does everyone think, not just me figuring it out on my own.

So much of med school is just by default. (MS4)

Third- and fourth-year students seemed to focus on the internal drive to learn:

"someone who looks things up even though he has seen several cases already".

Another student stated it as follows: "someone who is open to new knowledge and

to different ways of doing things; LLL motivates you to practice optimal patient care".

(MS4).

Third- and fourth-year students related LLL to patient care: "knowing if the literature

applies to the specific patient population; knowing best practice; providing optimal

patient care". (MS4)

The idea of creating something new, pushing the field forward is expressed by third-

and fourth-year students:

I got a remote control car for Christmas and I played with it for about 2

months and then I took it apart and built a new car out of my Legos and a

bunch of wires and batteries and things that were garbage to most people; my

parents fostered that in me. I would design my own remote control car, albeit

a little more primitive than the one they had bought me but it was the ability to incorporate the resources and design in something new and I've been doing that ever since I was a little kid. (MS4)

I grew up in the middle of nowhere on a farm and all you could do is explore the world around you and mine was within a mile range from where we lived and there was no one my age so you learn to seek out your own interesting things, at least for me that is what carried over .(MS4)

I think in middle school they sort of focus on laying the foundation but there isn't a lot of encouragement to go out and seek your own knowledge until you get more into high school and start having science fair competitions and things like that where it's more of directing your own learning .(MS4)

I think if they're good teachers they usually are pretty up on the latest research that just came out. Someone who's always drawing diagrams, maps, and arrows and talking about the latest research that came out, I think something like that shows that a person is interested in not only their own learning but helping others; people who are actively trying to reach others around them have a good LLL mindset. (MS4)

Another example of the need to innovate:

In practice, I'll keep up because I want to be on the cutting edge of innovation and that's a goal. It's not enough for me to learn about a new device such as an angioplasty catheter; I want to look at the device and see how I can improve it. That's the way I'm going to stay up on the technology because I need to know it in order to further it. (MS4)

Filling information gaps was echoed by all participants, but third- and fourth year students often saw LLL as learning anew , almost starting from scratch:

> When I was a pharmacy student working in a hospital, one of the brightest pharmacist was an older gentleman who graduated from pharmacy school in 1964 and one day he told me that "when I finished school beta blockers which are now the cornerstone of cardiac medicine management were a theory not a reality and I've had to learn everything from that point on myself". (MS4)

One third-year student characterized LLL as more than just reading: "at first LLL means a lot of reading; as I'm growing further in my clinical years I'm realizing that it's not just all about reading journals, it's going to be about communicating with my colleagues and learning from each other and teaching hopefully younger students or others as well". (MS3)

Again, the emphasis on patients:

> I hope LLL will mean more learning from patients because the attendings I've worked with I've noted how awesome it is, not only are they relying on evidence based medicine but they are relying on experience and what their patients tell them as well. So I hope that metaphor of learning from my patient and not just from clinical studies will hold true as well. (MS3)

> My first attending [physician] at Riley did an outstanding job of bringing in review articles for our team to read and talking to us about those events; he was concerned that we had not seen a particular disease; he knew what we would be faced with in the future and wanted us to be prepared. (MS3)

LLL and technology

The Internet was viewed unanimously as a useful tool that needs to be used wisely. It is easy to access, retrieves lots of information with little effort. However, critical thinking tools were deemed essential to determine the value of that information. Certain sites were used by essentially all students; these included UptoDate, MEDLINE, Emedicine, and STAT!-Ref.

It [the Internet] is essential when dealing with patients who may use information from the Internet; the physician's role is to point out valid Internet sites for patients to consult, making sure that they are evidence-based. (MS4)

"LLL and EBM are tied together, totally tied together. It's about how to trust your sources". (MS4)

I think if anything, the Internet teaches us that not all information is valid. So LLL you may have the questions but you'll have to know your sources and the Internet provides more information than you could ever imagine but not all of it is useful, in fact, probably very little of it useful. The Internet is a great tool, but if you don't know how to use it, it doesn't help you in LLL. (MS4)

I personally haven't had a computer all through med school. I have chosen that route because my tendency is to just play and use it for purposes that aren't relevant. The way I've done it is if I have to go somewhere to use a computer, I go and use it and I focus and get my work done. (MS4)

I can't imagine how medicine was practiced 20 years ago when we didn't have all this technology; being able to pull up an article and have it electronically available is just remarkable. (MS3)

The Internet is a great tool but it may contain some wrong information; it has

a great impact on LLL. LLL allows you to be a better critical thinker because

you have a larger knowledgebase and you are able to incorporate new

knowledge by analyzing situations and problems. (MS1)

I think as you learn you need to be very critical of the information that's out

there [Internet], making sure that it is as accurate as possible, and that you

are not misled. You are the critical evaluator of the information that is there.

(MS1)

LLL and information overload

Students dealt with information overload in a variety of ways: simply

memorized a huge volume of information, tried to focus on main concepts,

contextualized the information, understood their limitations, tried to find clinical

correlates, and accepted that uncertainty is just part of the profession. Collaboration

rather than competition was seen as a way to enhance LLL. Sharing information and

learning from others was essential; it reflected the real world of medical practice.

Competing for grades seemed short-sighted, understanding concepts was ultimately

more important.

During the first year of med school you're in the biggest information overload

in our life, it's overwhelming and leaves most of us close to tears because

we've never had to deal with it. The way I found is by asking someone who is

a year ahead of me 'how did you do it? Could you give me some advice?' I

try to pick out the most important points and I do very well with things that

interest me because then it doesn't seem like information overload. (MS4)

> Everyone says that med school is like drinking from a fire hose, never going to get everything and I think there are people who will focus on all that water that passed them and not on trying to drink and they will die of dehydration because they are so worried about this water that they are not taking in . (MS1)

Medical school, at least the first two years, seemed counter to a LLL approach to learning. Some students characterized it as "learn what's in this packet; don't ask any questions, just learn it" One student mentioned a packet that included 137 biochemical pathways. (MS2)

> What you are learning now is current but in the future you'll have to learn more than what you learned in medical school to keep up with current technologies, theories, and research. I think at times it's overwhelming: we're learning so much and I can't believe that we have to learn more and keep learning that much when we are out of school. (MS2)

LLL, evidence based medicine, and critical thinking skills were considered intertwined; the latter two often seen as part of overall LLL skills. Most students considered themselves lifelong learners, but a few reflected that while in medical school, students were "spoon-fed" and as such could not be lifelong learners: "It is only when they are on their own that they will know whether they are lifelong learners or not. (MS1) Being affiliated with an academic environment seemed vital to some:

> I really think it would be hard to be in an academic setting and not be a lifelong learner. I had a rotation in family medicine that was outside of

Indianapolis and it was encouraging to me to see that he was very much a

lifelong learner, but there were also a residency program in the town and he

was very active and involved with that and it does make me concerned if I

didn't have that, I just wonder as a clinician how easy it is if you're out in a

practice in a rural area to stay up and involved. (MS3)

In sum, medical students' perceptions of LLL mirrored those found in the

literature: "learning to learn" (Mentkowski & Doherty, 1984, p. 5; Mentkowski, 1988,

p.115), "learning over the lifespan" (Titmus, 1999, p. 343), "free choice learning, "

(Falk & Dierking, 2002, p. 6), "self-directed learning, " "self-sustaining learning"

(Banta, 1993, p. 16), "learning without boundaries" (Edwards & Usher, 2001, p. 276),

or even "information literacy" (Saranto & Hovenga, 2004, p. 504). Edwards and

Usher (2001) argue that LLL is simply the new metaphor for learning. Mentkowski

(1988) identifies three student outcomes as focused components of self-sustained

learning: 1) taking responsibility for learning, 2) making relationships between

abilities and their use, and 3) using different ways of learning (as cited in Banta,

1993, p. 16). Does LLL symbolize simply the learner-centered movement, with its

emphasis on the active, independent learner, responsible for his or her learning?

LLL has been touted as the modern equivalent of "learning" as a

consequence of exponential growth of information (Wets et al., p.249). First- and

second-year students defined LLL in general terms whereas third- and fourth-year

students framed LLL often in terms of providing the best patient care. All students

tended to characterize the attitudes and behavior of lifelong learners similarly, but

third- and fourth-year students tended to mention patients and the patients' families

as sources of learning. LLL development was perceived to begin in childhood as an innate curiosity that flourished through positive reinforcement within a favorable learning climate. Role models were a powerful influence both at home and in school. Reading was mentioned frequently as a means of developing LLL. As for technology and LLL, students were unanimous in their praise of the Internet for quick and easy access to a large quantity of information and medically-specific sources. However they were aware of its potential to distract them from their work as medical students and its lack of peer review.

V. DISCUSSION

This research project interviewed currently enrolled medical students at the Indiana University School of Medicine (IUSM) to analyze how they perceive lifelong learning (LLL) and what roles, if any; information retrieval and access to web-based information have on the development of lifelong learners. In the last few years, IUSM has been at the forefront of curricular change in medical education, most notably with the implementation of a competency-based curriculum in 1999. IUSM has over 1, 100 students and close to 1, 200 full-time faculty. Lifelong learning is an integral part of the competency curriculum and is addressed as a component of numerous courses in all four years of medical education. One reason that LLL is emphasized throughout the four years is that medicine is an ever-changing and fast developing field. As one of nine competencies required to graduate from medical school, LLL is an ongoing responsibility for practicing physicians. Schrock and Cydulka (2006, p.786) note that, "first, do no harm implies ongoing learning" and being unaware of the potential harm from outdated therapies may result in poor outcomes or substandard care. Failure to stay informed on the latest developments and techniques in medicine may be tantamount to malpractice, as one participant in this study suggested. The need for LLL among students in professional schools has been extensively documented (Mentkowski, 1988; Swick, 2000; Epstein & Hundert, 2002). In many of these studies, however, the faculty point of view has been emphasized and the student perspective has all but been ignored. This applies to LLL in medical education as well. Attempts to assess LLL preparedness among physicians and medical students have used a variety of scales, notably the Jefferson

Scale of Physician Lifelong Learning (JSPLL) and the Self-Directed Learning

Readiness Scale (SDLRS). It is important to note, however, that these studies have

been quantitative in nature. This study, in contrast, has taken a qualitative approach

in order to gain a deeper understanding of how students perceive LLL. This study is

unique in three ways: 1) it is student-centered, 2) it takes a qualitative approach, and

3) it was conducted at a medical school that was among the first to implement a

competency-based curriculum. The themes discussed in the Results section relate

to the research questions posed in the introduction section, namely: 1) what

characterizes lifelong learning practices and attitudes of undergraduate medical

students? 2) How do lifelong learning practices and attitudes differ across the four

years of undergraduate medical education? and 3) How do undergraduate medical

students use technology to help them cope with the information they encounter?

These three questions are discussed successively.

1. What characterized lifelong learning practices and attitudes of undergraduate

medical students?

Definition of LLL

Students' definitions of LLL mirror the definitions of LLL stated in chapter one:

"self-directed learning," "learning over the lifespan," and   "continuous learning."

Moreover, students perceive LLL skills as a way of dealing with what Stronach and

Maclure call the "unruliness" (1997) of knowledge. These students mirror LaBlance

and Fagan's (1994) description of LLL as a "fact of life."   Most importantly, students

like Edwards and Usher (2001) view LLL as simply the new metaphor for learning.

Medical students in all four years define LLL consistently as continuing to learn, keeping up, taking the initiative to learn, and self-directed learning. They also view LLL as having its beginnings in early childhood, influenced by parents and other childhood experiences with grandparents, uncles, and elementary school teachers. High school teachers and college instructors are also included as contributing to the LLL development. They attribute continued LLL to being in an environment that fostered and encouraged their innate curiosity. Being encouraged to read and ask questions are deemed critical to continued LLL. Field trips, library summer reading programs, and accessibility to books and learning are specifically mentioned by students as positive contributing factors to continuing learning. Observed differences among medical students relate to whether the student is a preclinical (first- and second-year) or clinical (third- or fourth-year) student. Not surprisingly, preclinical students define LLL more in general or theoretical terms, whereas clinical students relate their definitions more to patient care. Although both preclinical and clinical students express being overwhelmed at times with the sheer volume of information that is available to them on any given topic, clinical students have come to terms with the impossibility of learning it all and have become more confident in their ability to discern the wheat from the chaff. Preclinical students, however, are still struggling with the difficulty of discerning main concepts from minutiae and grappling with information management.

Medical students viewed LLL skills as a necessity for their profession. While students in all four years were aware of the need for taking responsibility for their own learning, first- and second- year students described being "overwhelmed" by

the amount of information they encounter and are expected to learn and have difficulty just keeping up with what is required (readings and class notes). Third- and fourth-year students, however, regarded themselves as responsible for their own learning and feel that they needed to learn as much as they could from as many resources as possible, including mentors, attending physicians, residents, and patients. Students mentioned the Internet without exception as a tool for doing their research. They mentioned specific websites that they use frequently, but never mention using blogs or RSS feeds. Some stated that while using the Internet, they could easily be distracted from the work at hand and avoid spending much time browsing, except when looking for specific answers to a question. Time crunch is stated as the main reason for not spending more time on the Internet. Among third- and fourth- year students, just-in-time access to information was focused primarily on their use of UptoDate whereas first- and second- year students focus on the online textbooks provided by the IUSM Libraries. These primarily included Harrison's Online, Books@Ovid, and STAT!-Ref, the latter being the mostly frequently cited source.

There was very little variation among the students' definitions of LLL: regardless of year, all focus on self-directed learning, continuous learning, and keeping up with the research. This was essentially similar to how educators have defined LLL, even outside of medical school (Mentkowski & Doherty, 1984; Candy, 1991; Falk & Dierking, 2002). The nuances in definition among medical students centered on whether they relate LLL to patient care. Third- and fourth-year students tended to make the connection between the necessity for LLL skills and providing

the best possible patient care. These students are more likely to relate LLL to a more holistic approach. They are aware that medicine is more than acquiring knowledge, that it involves reflection and seeing the patient as a person rather than as an interesting case. The transition from learning basic science material to working on the wards challenges some third-year students: they realize that patients die on the wards and felt keenly their own lack of preparedness for such occurrences. How, then, can the curriculum better prepare third-year students to make the transition from the classroom to the hospital wards, and more specifically, to death and dying? At IUSM, death and dying issues are addressed in small group discussions in the Introduction to Clinical Medicine course,   but they remain theoretical. Other than working with the cadaver assigned to them in the first-year pathology course, few students have much experience with death. A number of medical schools approach this issue through medical humanities courses or seminars that examine the emotional issues associated with death and dying (Charon, 2001).

LLL attitudes and behaviors

Students agree on several attributes of lifelong learners' attitudes and behaviors: a thirst for knowledge, curiosity, skepticism, being an avid reader, and having a desire to deepen one's current understanding. Not surprisingly, all participants consider themselves lifelong learners. Self-reflection is also mentioned as a necessary component of LLL; this may be due to the heavy emphasis on reflection in the IUSM curriculum.

Do third- and fourth-year students, because of their heavy clinical involvement during their rotations, feel well prepared to tackle their patient responsibilities after

they leave the comfort of the university setting, where their actions are continuously monitored by senior faculty members? It is hoped that the skills developed during these rotations will stimulate new practitioners to keep up with the latest research in drug development and patient care. Most of the students interviewed were well aware that drugs in use today may prove to be unacceptable in the future. For example, some cite the medical community's changing stance on the use of hormone replacement therapy in the treatment of post-menopausal women. The examples of thalidomide and more recently Vioxx, Halcion, Avandia, and Celebrex illustrate the necessity for physicians to remain current, a challenge that participants in this study rightfully emphasized.

Third- and fourth-year students are in contact with critically ill patients or with patients in the emergency room. These students are acutely aware of the necessity for split-second decision making, with little or no time to consult published materials. Students also realize that being up- to-date on the latest research and technologies may, in some cases, be a matter of life or death. In these instances, being a lifelong learner can make a critical difference. This aspect of medicine was not brought forth by first- and second-year students because their exposure to clinical situations has been minimal.

In an effort to improve medical students' preparation for problem solving and self-directed learning, numerous medical schools, including McMaster University, Harvard University, University of Albuquerque, and IUSM, have implemented problem-based learning (PBL). On the Indianapolis IUSM campus, the Concepts in Health and Disease (CHD) course is taught using PBL principles. CHD was

mentioned most often by the participants in this study as the one course that foster their LLL skills. In CHD, first-year students are presented with four clinical cases to study over a two month period. On the first day of each case, the students identify learning issues as a group, individually research a specific aspect of the case, then report back to the group on the second day of the case. After each student shares his or her findings with the group, they review the case objectives with the faculty facilitator and work toward a diagnosis. At the end of the week, a wrap-up session is presented by a physician who reviews the case with the entire class.

2. How do lifelong learning practices and attitudes differ across the four years of undergraduate medical education?

LLL development

Students' views on how they developed as lifelong learners can be grouped into two major subthemes: 1) the importance of their formative years either at home or with early teachers and 2) the impact of medical school on the development of LLL was not especially strong.

Students mention that LLL is an innate characteristic that most children possess, but in some cases, it is thwarted by the milieu in which they grow up. Many cite childhood curiosity as the origin of LLL, with such curiosity considered "crucial" by several students. This finding is comforting in the sense that one can influence LLL early in childhood, but may be troubling to medical educators. Although the curriculum may have a limited influence, a number of participants indicate that role models within medical school still have an impact. Students report that they generally emulate strong role models whom they perceive as lifelong learners and

tend to be less drawn to physicians who fail to keep up with recent advances in their fields. Age of the practitioner is not an issue, although students refer to negative role models as "old school". In fact, a long-retired physician is admired because of his continued involvement in the field through readings and participation in seminars, grand rounds, and lectures. Based on students' responses, the influence of role models in medicine cannot be overstated. The competency-based approach to training physicians goes far beyond the old adage of "See one, do one, teach one". As Hall (1999, p. 115) states, perhaps it should be replaced by "read about one, go to a course on one, do fifteen simulated ones, be evaluated about one, have some clinical experience about one, then teach one and expect ongoing evaluation."

In analyzing student perceptions, one has to keep in mind that these participants have yet to complete their medical school education and are not in a position to assess its impact on their commitment to lifelong learning throughout their careers. They may simply be unaware of what they do not know. When students call themselves lifelong learners, they may be saying that they are high achievers, a requirement for medical school admission. In addition, they are highly motivated to do what is necessary to become physicians. One may argue, therefore, that equating LLL to children's inherent curiosity about their world is oversimplifying the notion of LLL.

Participants mentioned another incentive to being a lifelong learner: that patients are more sophisticated and can retrieve information about a given disease more readily than in the past. If the patient does not feel that his or her physician is keeping up with recent protocols, the patient may not return. Most medical students

are unfamiliar with consumer health materials and rarely are familiar with quality

Web sites such as MedlinePlus (http://medlineplus.gov) intended for the lay person.

Role models

As expected, many students cited parents and other family members as

significant influences on their development as lifelong learners. This is true across all

years of medical school. Some students cite elementary or high school teachers,

others their college professors. Still others focus on medical school professors and

attending physicians, as well as professionals outside of medical school such as

practicing physicians, nurses, and pharmacists. Students stress the importance of

having someone to show them the way: how a predecessor has dealt with issues

they are now encountering. In fact, when asked if they could identify others as

lifelong learners, their answer is a resounding yes. While on clinical rotations,

physicians who take the time to explain how they have found the answer to a

challenging question are given high marks for LLL. Clinicians who read and bring to

the students' attention recent articles on a particular patient's condition are also

highly regarded. One student mentioned a clinician who brought in journal articles on

conditions not seen during the rotation because the students might encounter them

later. Positive role models included physicians who treated patients and their

families with respect and take the time to explain complicated cases in language that

families can understand. LLL role models are described as having an interest in

many areas outside of their specialties, as well as outside of medicine. Some

students describe their role models encouraging questions and being willing to say

they do not know the answers to some of those questions. The best encourage

these students to explore a question themselves and share their findings with others on the team. Yet others are reassuring when students express doubt or feel overwhelmed by how much there is to learn about patient care.

Role models identified in medical school may be part of long-standing relationships, may result from brief encounters, or may last the duration of a clinical rotation. Some experiences and observations provide negative role models. "Old school" physicians who continue to practice as they have for the last twenty years are seen as ineffective at best and dangerous at worst. It is clear that this model, however comfortable, is to be avoided.

3. How do undergraduate medical students use technology to help them cope with the information they encounter?

As noted earlier, Hojat (2003, p. 434) defines lifelong learning as "a concept involving a set of *self-initiated activities* (behavioral aspect) and *information-seeking skills* (capabilities) that are activated in individuals with a sustained *motivation* (predisposition) to learn and the ability to recognize their own *learning needs* (cognitive aspect)."   How well do the study findings relate to LLL as defined by Hojat? It is clear that students across all four years considered self-directed activities (initiative) as a defining element of LLL. As for information-seeking skills, again all students strongly believed that in this digital age, competent use of the Internet and other online services is an integral part of LLL and becoming a competent physician. Undoubtedly, in the future this will be even more pronounced as the digital divide diminishes. In fact, in many institutions, including IUSM, access to online databases is indispensable (often physical access has been superseded by online only

access). In PBL courses such as Concepts in Health and Disease where students are required to solve clinical cases as first-year medical students during their first week in medical school, ready access to online sources becomes essential.

While no students mentioned non-medical uses of the Internet, use of Web 2.0 sites such as MySpace and Facebook were probably omitted due to the context and emphasis of the interview questions, rather than their lack of use. In a follow-up study, it would be informative if interview questions were included that specifically address the social networking aspects of the Internet. As for the sustained motivation to learn, although medical students viewed the need for continued learning over their lifetime, preclinical students were somewhat overwhelmed by the volume and intensity of the information that they felt they had to learn (the proverbial fire hose) and were therefore less enthusiastic about seeking out additional materials; clinical students, however, understood the need to continually stay informed of new developments in their future specialties, and reported observing this practice by their role models who practiced LLL. Lastly, medical students from all four years expressed the need to recognize gaps in their own knowledge and experience. Overall, this study's findings fully support Hojat's conception of LLL.

LLL and technology

When asked about the value of information technology, students stress the ability to retrieve pertinent and appropriate information as a primary skill essential to being an effective physician. Students unanimously endorse the use of the Internet

for quick and easy access to information and more specifically, for access to

bibliographic databases provided by the IUSM library. Students note the Internet's

lack of peer review but still are in awe of its possibilities, particularly its ease of use

and rapid access to multiple sources of information. These students' use of the

Internet for many of their information needs is not surprising. They cite specific

resources that they use frequently, most often mentioning UptoDate. This product

provides expert opinions, referenced in the current literature, on specific clinical

questions that may arise at point of care (Schilling et al., 2005). In addition,

MEDLINE and STAT!-Ref are mentioned frequently. STAT!-Ref is an online, cross-

searchable library of full-text clinical, medical textbooks. It is particularly useful to

first- and second-year students and is heavily used in the first-year problem-based

learning course called Concepts in Health and Disease. In the course, students are

presented with clinical scenarios. Based on the data presented, students may

request further data (such as laboratory results) and proceed through a differential

diagnosis to determine the patient's problem. Students are evaluated on the process

rather than whether they reach the correct diagnosis.

Summary

In sum, the results of this study indicate that medical students across all four

years consistently define LLL as continuing to learn, as keeping up with ever-

increasing new knowledge, and becoming a self-directed learner. Differences

between students' perceptions of LLL are directly related to their year in school.

More specifically, differences emerge between preclinical and clinical students.

Whereas preclinical students relate LLL to medical school, clinical students relate

LLL to patients and clinical care. Clinical students also more readily accept the inevitability that their learning is never done and that LLL is just part of being a physician; preclinical students, on the other hand, are still struggling with the overwhelming nature and volume of medical information yet to be learned. Despite their heavy study load, preclinical students' progress is hard for them to discern. This difference is best portrayed by the image of trying to drink from a fire hose: one could either die of thirst by worrying about all the water one could not drink or quench one's thirst a little at a time, realizing that learning is incremental and simply not the rote memorization of facts.

Knowles' psychosocial theory of adult learning applies well to medical student development. As adult learners, medical students are highly motivated to become physicians, and therefore, are internally motivated to learn. In some cases, they have had other careers, and do in fact draw upon their previous experiences, as Knowles suggested, enhancing their current learning. Knowles' assertion that adult learners need to know why they need to learn something before learning it may explain first- and second-year students' dissatisfaction and frustration with the amount of material they must learn. In contrast to Knowles' theory, preclinical students are repeatedly told "don't ask any questions, just learn it," as one student states. Third- and fourth-year students, on the other hand, have come to realize that what they had to learn in the first two years has a direct impact on their performance in the clinical years.

This dichotomy between preclinical and clinical students can be refined further by examining Chickering's seven vectors. In Chickering's terms, third- and

fourth-year students have started to establish their identities as physicians (vector 5)

and to develop purpose (vector 6) and integrity (vector 7); first- and second-year

students may still be struggling with vectors 3 (moving through autonomy toward

independence) and 4 (developing mature interpersonal relationships). This may

contribute to understanding why role models are more often stressed by third- and

fourth- year students than students in the first two years.

Among cognitive structural theories, Perry's model of intellectual and ethical

development delineates nine "positions" and maintains that development occurs

during transitions between the positions (Perry, 1981). His theory is applicable to the

development of medical students as they transition from preclinical to clinical

activities, moving from relativism to commitment. Students in the clinical years tend

to see themselves as future clinicians whereas preclinical students are immersed in

the basic sciences, with minimal involvement in patient care. Perry sees

development as moving through discrete "resting points" along a linear continuum: in

contrast, this study found that medical students progress in two distinct stages: from

preclinical to clinical (Perry, 1981, p. 78).

Medical students consistently report that their desire to learn originated in

early childhood and, unless discouraged or thwarted by their environment, this

intrinsic curiosity and motivation to learn would continue, especially if fostered and

encouraged by parents, teachers, and other early role models. Although they agree

that the motivation for LLL cannot be taught in medical school, the specific set of

skills needed to be a lifelong learner in medicine can and should be addressed. One

student summarized the most common view of LLL as a combination of inborn

tendencies and environmental rewards for those tendencies. In addition to learning specific skills, clinical students also express the need for dialogue, reflection, and introspection.

Both preclinical and clinical students described similar qualities for good role models: enthusiasm, passion for their work, curiosity about their own field and fields outside their specialty or area of expertise, the ability to admit their ignorance, and a desire to teach. Not surprisingly, the preclinical students focused on basic science instructors or pre-medical school role models, clinical students, on the other hand, are focused more on how their clinical instructors related to their patients and to the patients' families. These students also noted how physicians related to others on the wards: residents, students, attendings, and nurses.

VI. IMPLICATIONS & FUTURE RESEARCH

Implications for medical education

The major bodies governing medical education in the U.S. and Canada (the Association of American Medical Colleges and the Accreditation Council for Graduate Medical Education) have mandated the inclusion of LLL skills in both undergraduate and graduate programs. Traditionally, LLL has been viewed as a focus for the formal curriculum. This study suggests that although LLL skills may be taught in the formal medical curriculum (classes in information resources, evidence-based medicine, and citation management), the importance of the informal curriculum cannot be overstated. It is within the informal curriculum that students observe physicians interacting with patients, other health providers, and other students; and these observations are vital to the development of their identity as physicians. How physicians use, misuse, or ignore information resources in the course of practicing medicine has a major impact on how students will perform these tasks in their careers. The disconnect between the formal and the informal curriculum is at the source of the disillusionment and frustration that some students experienced.

In terms of practice, faculty must become more mindful of their own influence not only through their behavior and actions, but also through their interactions (verbal and non-verbal) with others, in and out of the classroom and hospital wards. Role models, mentoring groups, and one-on-one mentoring (formal and informal) provide the everyday conversations and interactions in which students participate

that leave a lasting impression. Faculty development becomes crucial to bridging the gap between the informal and formal curricula. The challenge in a medical academic setting is to encourage faculty participation despite heavy clinical, teaching, and research responsibilities.

The Relationship-Centered-Care Initiative at the IUSM attempts to bring the formal (competency-based) and informal curricula more closely together (Suchman et al., 2004; Litzelman & Cottingham, 2007). This ongoing initiative is based on two theories of organizational change: appreciative inquiry (AI) and complex responsive process (CRP). Through conversations with various organizational participants, appreciative inquiry and CRP attempt to induce a change in culture. Appreciative Inquiry encourages dialog about "what is right, what is working, and how to have more of it"; CRP fosters reflection "to notice what patterns are propagating and how, and to explore opportunities to act differently, thus introducing the possibility of new and potentially more desirable patterns." (Suchman et al., 2004, pp. 503-504)

The importance of "training for uncertainty," as Fox described in 1957, (Fox, 1957, p.9 as cited in Fox, 1980, p. 5) remains central to the educational process. Medical students' views on lifelong learning and their coping with the uncertainty inherent in applying medical information to specific patients.

Limitations

This study was limited to only one medical school at nine campuses and included students from four out of the nine centers. However, prospective medical students for all centers meet the same criteria (Medical College Aptitude Test, grade point average, science GPA, personal statement, and interview). Placement at non-

Indianapolis centers is based on student requests, time of application within the

recruitment year, and slot availability. As discussed in the section on student

recruitment and sampling, the initial randomized sampling plan had to be adapted

because of the many demands on students' time. It is possible that this change

resulted in the over-representation of students committed to LLL.

Implications for information fluency and library education

Librarians must themselves adopt the attitudes and behaviors of the lifelong

learner and be willing to change their thinking and actions to support LLL physicians.

As medical school librarians integrate themselves into the larger organizations, they

have moved out of the library into the classroom as TBL facilitators and into clinical

arenas by attending morning report and ground rounds, and, in some cases,

facilitating these morning reports. Librarians are thus better able to understand

specific information needs, the what, when, how, and where information is needed in

order to know what emphasis to place on course management systems, citation

management systems, and database searching. Attending meetings of common

interest with students and faculty fosters greater understanding, a sharing of mutual

expertise, and closer relationships, enabling librarians to introduce students and

faculty to alternative sources and perspectives. Medical school librarians' integration

into the curriculum has enhanced their abilities to develop a more central role at their

institutions as curricular, technology, and policy leaders. Liaison programs, already

in place in many medical libraries, have been a valuable means of integrating

librarians into basic and clinical sciences departments. Specific librarians select or

are assigned to one or more departments in the organization and are responsible for

updating and providing training to their faculty on new databases, software, and hardware.

Medical librarians have gone through several major changes--from traditional gatekeeper to expert searcher, clinical librarian, and teacher--in response to paradigm shifts in health sciences librarianship. Dowlin and Wingerson (1995, p. 45) summarized the changes: "*scarcity vs. overabundance;* librarian as *gatekeeper vs. facilitator;* the library as *fortress vs. pipeline".* This transition is ongoing and has manifested itself in a variety of ways. One of the most innovative ventures, clinical librarianship, began in the early 1970s. This was followed by end-user searching in the mid 1980s, and Internet searching in the 1990s. These trends have led medical librarians to re-question their role once again. One possibility, proposed by Davidoff and Florance (2000), suggest the creation of a new health profession, termed the informationist. The informationist is versed in both information science and the basics of clinical work not merely a "server" of information, but a vital member of the clinical team with specialized expertise. The major difference from previous models is that the informationist would "answer directly to clinical directors, chiefs of staff, and their services should be paid for directly, as is done for other health care providers" (p.998). Davidoff and Florance's proposal generated much debate: some saying this was not a new idea at all but simply a refinement of what some clinical librarians already do; others welcomed the opportunity that this new role provided. Two years later a Medical Library Association meeting to discuss the role of the informationist gave rise to a different term: "librarian-in-context." Still others used the term "embedded librarian" (Duberman et al., 2007). These terms are often used

interchangeably. As Lee, associate editor of the *New England Journal of Medicine*, pointed out in his editorial, "Quiet in the Library", "physicians no longer find the time for 'lifelong learning' through such activities as reading journals or attending grand rounds. Instead they rely on 'just-in-time' learning tactics, such as searching the Internet or tapping the expertise of specialists to answer questions raised by patients who are often sitting directly in front of them" (Lee, 2005, p.11). The informationist may be seen as a response to this change in how physicians practice medicine and to librarians' awareness of declining visits to the physical library and ever-increasing reliance on remote online access. The informationist thus would provide yet another specialist for the physician to draw on at point of care.

This potential new role for medical librarians would be open to other health professionals as well and would be overseen and compensated by clinical departments. Seen by some as having its basis in the clinical librarianship model, it could benefit both the information science and informatics disciplines by supplementing the knowledge bases of both clinicians and librarians (Frisse et al., 1995). Some see this as the next welcomed step in the evolution of medical librarianship and are preparing themselves for this role (Brown, 2004); others (Kronenfeld, 2002) have been skeptical. However the informationist movement plays out, medical librarians have realized for some time that leaving the comfort zone of the library and entering the arena of clinical medicine was inevitable.

Perry et al. (2005, p. 204) have seen this model as an opportunity for collaboration: as boundaries disappear among published data and patient data, "becoming key players requires staking out new professional ground, not for

possession but for participation." The confluence of the informationist role and the concentration on the impact of medical librarians' work on patient care seems appropriate. Medical librarianship has been evaluated primarily from an efficiency perspective, but O'Connor (2002) recommended evaluating effectiveness (outcome) not just efficiency (productivity) when measuring librarians' clinical impact. The Rochester Study (Marshall, 1992) supported the hypothesis that medical information provided by librarians to physicians did make a difference in patient care. Physicians (448 in the Rochester area) requested information relating to current clinical cases and were asked to judge the impact of that information on their patients' care. The physicians surveyed reported changes in patient care in five categories: diagnosis (29%, selection of tests (51%), selection of drugs (45%), reduced hospital stay (19%), and patient advice (72%). In addition, physicians reported that the information also enabled them to avoid hospital admission (12%), patient mortality (19%), hospital acquired infections (8%), surgery (21%), and additional tests or procedures (49%).

A medical information specialist (MIS or MLS) degree or a joint degree with an informatics school might be considered. Detlefsen (2002) presented five possible options for training as an informationist: Vanderbilt University offered an on the job model (post-MLIS), combining traditional library services, clinical librarianship, and the library's consulting services with auditing courses in the school of nursing and attending medical informatics seminars; Pittsburgh University's MLIS approach offered a specialization in medical librarianship and medical informatics; Texas Woman's University offered the dual master's degree in library science and health

studies; Stanford University's Medical Informatics division offered a week-long short

course for all types of health professionals including physicians, nurses, medical

librarians, and medical web developers; finally, the Medical Library Association

supported its continuing education model. Not mentioned by Detlefsen, but equally

important as a form of continuing education for librarians, is the Marine Biology

Laboratory (MBL) model. It is similar to the Stanford short course in that health

professionals from a variety of disciplines are brought together in both lectures and

workshop formats. In the researcher's experience with the MBL and Stanford

programs, both approaches seek to partner health professionals and librarians in

ways they might not otherwise experience and in both programs participants come

to appreciate their counterparts' expertise. Detlefsen envisions two tracks for the role

of informationist, one for medical librarians and one for other health professionals.

This will entail forging new partnerships between LIS schools and medical, nursing

and public health schools to provide courses in medical terminology, medical

decision making and clinician-patient communication. In addition, librarians will need

to learn about medical knowledge in the area of bioinformatics, medical genetics,

and biostatistics. The two tracks may overlap in some educational areas, providing

opportunities for the all students to meet together and benefit from each others'

previous experiences (p. 65).

With respect to future research, it would be valuable to extend this study to

assess perceptions of LLL held by students from the satellite campuses of the IUSM

and more importantly, students who have attended traditional (non-competency-

based) medical schools. Additionally, interviewing the participating students five or

ten years into their professional careers would provide a measure of how LLL is understood after leaving medical school.

It is noteworthy that even third- and fourth-year students who are currently in clinical rotations still mention their CHD course as a valuable experience: one that prepared them best for solving clinical questions. It would be of interest to explore expanding the PBL approach to some second-year courses. This may bridge the gap between the more passive lecture-based courses and the participatory nature of clinical rotations.

VII. APPENDICES

Appendix 1--Statements on LLL by medical organizations

Accreditation Council for Graduate Medical Education (ACGME)

The ACGME accredits teaching institutions (teaching hospitals) and residency training programs. It operates through 26 residency review committees, a Transitional Year Committee, and the Institutional Review Committee (IRC). The ACGME approves standards, deals with appeals, and other administrative issues (http://www.ama-assn.org/ama/pub/category/2376.html).

The Association of American Medical Colleges

The AAMC "is a nonprofit association founded in 1876 to work for reform in medical education. Originally representing only medical schools, today the AAMC represents the 125 accredited U.S. medical schools; the 17 accredited Canadian medical schools; some 400 major teaching hospitals, including 98 affiliated health systems and 68 Veterans Affairs medical centers; 94 academic and professional societies, representing 109, 000 faculty members; and the nation's 67, 000 medical students and 104, 000 residents. Additionally, the administrative leadership of medical schools and teaching hospitals are served by a variety of professional development groups housed within the AAMC" (www.aamc.org).

Institute for Improving Medical Education (IIME) was created in 2002 by the AAMC to "identify opportunities to improve the three phases of U.S. medical

education: medical school, residency, and continuing medical education"

(http://www.aamc.org/meded/iime/about.htm).

Liaison Committee on Medical Education (LCME) is the accrediting body for

educational programs leading to the MD degree in the U.S. and Canada. It is

organized "under the sponsorship of the American Medical Association and AAMC"

(http://www.ama-assn.org/ama/pub/category/2376.html).

Appendix 2—Methods used to evaluate medical education

The Medical School Graduation Questionnaire (GQ) The GQ is a national questionnaire administered annually (since 1978) by the Association of American Medical Colleges (AAMC) to U.S. graduating medical students. It has been computerized since 1999 and in 2003 collected data for over 14, 000 participants nationwide. (IIME Glossary, 2004).

> The   questionnaire assesses more than 200 items covering a wide variety of topics. These include educational experiences, student support programs, and potential problems including harassment. The GQ also gathers information on student debt and career plans. Data is analyzed for each school, compared across schools and then reported to each participating school. There is an aggregated report created of all the 125 participating schools known as the "All Schools Report" (http://www.aamc.org/data/gq/).

Objective Structured Clinical Examination (OSCE), introduced in 1972, is a more standardized way of assessing clinical competencies, using standardized patients (actors trained to feign particular disorders, injuries, or conditions). It allows assessment of "breadth and depth of knowledge" and "is particularly suited to situations where a pass/fail decision has to be taken and where a decision has to be made as to whether a student has reached a prescribed standard http://www.iime.org/glossary.htm). This method has been adapted to measure non-clinical skills such as awareness of social context and EBM (Fliegel, et al., 2002).

United States Medical Licensing Examination (USMLE)

"This 3-step examination for U.S. medical licensure provides a common evaluation system for licensure applicants. Results of the USMLE are reported to state medical boards for use in granting the initial license to practice medicine. Each medical licensing authority requires, as part of its licensing processes, successful completion of an examination or other certification demonstrating qualification for licensure" (http://www.ama-assn.org/ama/pub/category/2376.html).

Taken together these groups of terms represent 1) approaches to learning that are being discussed in the medical education literature and practiced 2) organizations that have stimulated and led U.S. medical education reform, embracing and encouraging these approaches for the 21st century, and 3) terms that have been used nationally to evaluate medical education at the school and student performance and attitude levels.

Appendix 3—Email message to invite students to participate

You are invited to participate in a study of Lifelong Learning as seen through your experience as an IUSM student. The interview will take about an hour and can be scheduled at your convenience. The results of this study will help to enlighten faculty about students' perspectives. You are in no way required to take part. Please let me know if you would be interested in participating. I can be reached by email at **fbrahmi@iupui.edu** or by phone at 317 274-1401. Your help with this research is greatly appreciated.

Fran Brahmi

Ruth Lilly Medical Library

Indiana University School of Medicine

Appendix 4—Interview Questions

1. How would you define LLL?   What does it mean to you as a medical student?
Probes:

       1a. Can you give me an example of LLL skills?

       1b. How would you describe the attitude of a LLL?

       1c. How does a Lifelong learner behave in terms of seeking information?

2. Can you think of ways that LLL can be taught?

3. How can LLL be learned? Probes: Does it begin at an early age? How does it develop?

4. Have you ever shadowed a physician? (For 1st & 2nd year students that have not done their clinical years yet); how would you determine whether a physician is a Lifelong learner? (For 3rd & 4th year students who have already rotated through clinical courses)

5. Do you consider yourself a Lifelong learner? If yes, probes: ask the next four questions; if no, skip the next four questions.

       5a. How did that come about?

       5b. When did that happen?

       5c. What experiences have taught you to be a Lifelong learner?

       5d. In what courses, if any, have you learned to be a Lifelong learner? Probe:
       Does a particular course standout in your experience in medical school with
       regard to LLL? The best? The worst? Why?

6. How do you recognize a Lifelong learner?   Have you encountered any Lifelong learners in medical school? Probes: Among your peers? Staff? Residents? Faculty?

7. Who have been role models for you in terms of LLL? Probe: Have any of your instructors modeled LLL? If so, how?

8. How is being a Lifelong learner useful to you? Probes: in medical school? in medical practice? How is it valuable?

9. How do you cope with information overload in medical school?

10. How do you think you will keep up with your field over time?

11. How does LLL relate to the Internet?

11a. How does LLL relate to critical thinking?

11b. How does LLL relate to evidence-based medicine?

11c. How does LLL relate to medical errors?

12. When you use the Internet to search for information, where do you begin?

(Probes: Google, E-medicine, WebMD, MEDLINE)

Are there any other comments that you might want to make about LLL that we have

not covered so far in this interview?"

Appendix 5--Table 1. Demographics

- **Table 1.** Demographics
-
	Year		Sex	1st 2years
- Pilot | MS 1 | (3) | M | IN |
-
- Study | MS 1 | (5) | M | IN |
- | MS 1 | (1) | F | IN |
- | MS 2 | (2) | M | IN |
- | MS 2 | (1) | F | IN |
- | MS 3 | (1) | M | IN |
- | MS 3 | (4) | F | IN (2), FW, SB |
- | MS 4 | (2) | M | IN |
- | MS 4 | (2) | F | IN, LA |

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qualitative data using 'Framework' and Microsoft Excel. *Journal of Clinical*

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evaluation: Faculty of 1000. *Learned Publishing, 16*(4), 249-258.

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Whittle, S. R., & Murdoch-Eaton, D. G. (2001). Development of lifelong learning and

self-evaluation skills through special study modules. *Medical Education,*

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students. *Journal of General Internal Medicine, 12*, 53-56.

"WONDER RATHER THAN DOUBT IS THE ROOT OF KNOWLEDGE"

Abraham Joshua Herschel

CURRICULUM VITAE

Frances A. Brahmi, M.A., M.L.S., A.H.I.P.

Librarian at Full Rank

Curriculum and Education Director

Ruth Lilly Medical Library

Statewide Lifelong Learning Competency Director

Indiana University School of Medicine

Department of Medicine, Adjunct Professor

School of Library and Information Science, PhD Candidate

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PROFESSIONAL EXPERIENCE

Indiana University School of Medicine**, Lifelong Learning Competency Director, 1997-present**

Indiana University School of Medicine Library**, 1979-present**

Curriculum Development & Education Director, 2000-present

Interim Director, July 1, 1998-September 1999

Director of Information Services. Responsible for library operations, which include reference, online searching, and circulation, 1987-1999

Head of Reference, 1984-86

Medical Reference Librarian and Search Analyst, 1981-84

Acquisitions Assistant, 1981

Interlibrary Loan Assistant, 1979-80

Pasteur Institute (Paris, France and Algiers, Algeria). 1970-1978

Director of the Pasteur Institute Library in Algiers which included overseeing the day-to-day operation of the medical library as well as its long-range planning, budgeting, acquisitions, cataloging, and reference. Responsible for administration and supervision of staff. During the first year, traveled extensively between Paris and Algiers for intensive training in cataloging at the Bibliotheque Nationale and to implement technology transfer under coordination of the Pasteur Institute of Paris for development of the library facilities at the Pasteur

Institute of Algiers. Exercised complete fluency in both social and technical French as the working language of the Pasteur Institute.

EDUCATIONAL BACKGROUND

B.A.	(English; Secondary Education)	University of California at Los Angeles, 1966
M.A.	(English)	Butler University, Indianapolis, 1975
M.L.S.	(Library Science)	Indiana University, 1981
Ph.D.	(Information Science)	Indiana University (degree expected Fall, 2007)
		Research interest: Medical Education

TEACHING RELATED ACTIVITIES

Indiana University School of Medicine (IUSM)

Edward C. Moore Symposium: Multiculturalism matters: educating for a global society, March 2, 2007, Indianapolis

Indiana University Trustee Teaching Award, 2004-2005

Angel demonstration, June 1, 2005, for RLML librarians

2004 IUSM Annual Faculty Education Retreat, 10/11/04, Indianapolis

Neonatology Fellows Expert MEDLINE & full-text searching workshop, 9/22/04 (3 fellows, 1 faculty)

Assessment Institute, November 2-4, 2003, Indianapolis, INAssessing and Developing Critical Thinking Skills, Nov 2, 2003, pre-Conference Workshop

Online Review Course for USMLE Step 2, an Angel-based course, created by MS4 (class or 2003) for elective credit for lifelong learning and 93ZM710.   Made public October 8, 2003.

Competency Directors Retreat, September 5, 2003, organized by Medical Education and Curriculum Affairs (MECA)

EBM 1 (X602) Course lectures: 2000-present: Small Group Facilitator: 2000-present

Introduction to EBM and to Treatment Concepts

Introduction to Diagnosis

Introduction to Harm

Biostatistics

Oncourse/Library Meeting, September 16, 2002

Discussion of future developments in Oncourse as it relates to policy, technology, and library services.

Intersession I Day 1 and Day 2 planning group; coordinated all EBM-based activities involving RLML librarians for all 3 mega blocks: Medicine(M720), Neurology, Psychiatry (MN&P); Pediatrics, Family Medicine; Obstetrics/Gynecology, Surgery, and Anesthesia; MN&P Planning group, 2002-present

How Do I Know I'm Teaching Effectively? August 28, 2002, Pediatrics Grand Rounds presented by Larrie W. Greenberg, M.D., the Griffith Visiting Professor.

Angel Course Management software Consultant and Trainer, 2002-

Tech Camp III, Center for Teaching and Learning, July 30-August 1, 2002: a 3-day workshop devoted to incorporating video and audio into coursework. The focus was

in alternative media: the WWW, CD, CD-R, CD-RW and DVD. Each participant prepared two videos, which he/she taped, edited, and presented.

School of Medicine Faculty Development Retreat, August 25, 2001, Bradford Woods, Martinsville, Indiana: Mentoring, Feedback, and the Competency-Based Curriculum: served as small group facilitator

Active Learning Workshop: Helping the Learner to Learn: What Does it Mean? How Can I do it? August 2-3, 2001, facilitated by Harold Modell (National Resource for Computers in Life Science Education, Seattle) and Joel Michael (Rush Medical College, Chicago)

Curriculum Council Competency Roll-out Meeting, Lifelong Learning Level 2 presentation, April 9, 2001.

Literature and Medicine: developed this elective for fourth year medical students to address level 3 of either Effective Communication or Self-Awareness competencies (submitted September 2000).   Facilitators include Drs. Meg Gaffney, Greg Gramelspacher, Richard Gunderman, Gary Mitchell, Bill Tierney, and Elizabeth Van Allen.

Department of Medicine Morning Report (MR) at University Hospital, coordinated videotaping and editing of a MR session for the purposes of demonstrating problem solving, lifelong learning, and communication competency skills as seen in the real world, July 21, 2000.

EBM CME, Statewide Workshop for health professionals, June 27, 2000, co-planner and co-facilitator for small group session,

Evidence-Based Medicine 1 (formerly Biostatistics), a first year medical school course at Indianapolis: co-developed and facilitated 6 2-hour sessions as part of a pilot project; Course Director, Gary Weiner, M.D.; January 2000, August 2000; Facilitator, Course Director Rolly McGrath, M.D., August 2001, August 2002

Evidence Based Medicine 3, Department of Medicine Clerkship, developed and taught one seminar of a three part course which was piloted in 1999/2000 and which has been revised and implemented for 2000/2001; participated in pilot EBM computer based examination in May 2000. Course Director, Deb Litzelman, M.D.

Teaching EBM: from classroom to bedside, Midwest Society for General Internal Medicine, Chicago, IL, September 1999. Co-presented with Sachin Dave, M.D. and Kurt Kroenke, M.D.

Medical Informatics Clerkship (93ZI690)

This fourth-year required clerkship, which I developed with a colleague, was implemented in June 1998. This clerkship is designed to meet the criteria for the achievement of Level 3 of the Lifelong Learning Competency, one of nine competencies required for the IUSM entering class of 1999.

Concepts in Health and Disease

Have helped facilitate the problem-based small group sessions for this course as well as its predecessor, Biochemistry B503 since 1993. This involves attending the twice-weekly PBL sessions as well as the facilitators' meetings once a week. Have counseled students on both academic and social concerns.

Electronic Resources via the Ruth Lilly Medical Library- presented at the Electronic Trends in Medical Education Symposium, April 12, 1997

Medical Student Computer Workshop- August 19, 1997

Liaison from the Student Computer Task Force to the Ruth Lilly Medical Library to insure successful orientation for first year students required for the first time to have computers. Participated as a teacher as well.

X802 Biomedical Paper Course, 1992-1997

Reviewed all Literature Review papers submitted for meritorious recognition, making recommendations for the awards presented at the SOM Awards Dinner annually. This course was a required course until 1997; it has since become an elective.

Computer Applications for Writing and Research (93ZM710), 1997-present

Developed, direct, and teach this elective for fourth year medical students. Since May 1997, enrollment has soared. The one-month rotation is normally limited to four students, but I receive requests well above that level regularly. Feedback has been excellent and enthusiasm is high. Students are required to use the WWW and MEDLINE to research a topic of their choice. They evaluate Web resources according to established guidelines and incorporate that analysis in the paper they write. This elective qualifies for achievement of Level 3 Lifelong Learning Competency credit.

From Evidence to Practice-- developed this Evidence-based Medicine Course for SOM faculty and residents for which participants are awarded 1 hour of Category I CME credit (April 1997). The course has since been taught to Anesthesia residents in July 1997 and 1998.

Campus Computing Resources --developed and presented to SOM, Medicine Department Course for Fellows, July 1997 (Rich Kohler, M.D.)

Evidence Based Search Strategies, 2000 Innovations in Education Symposium,

August 3, 2000, facilitator of concurrent workshop

Indiana University School of Library and Information Science (IU SLIS)

SLIS L596: Internship, mentor, summer & fall 2004

SLIS L570: Fall 2004, Beth Whipple, mentor

Guest Presenter for the following courses:

SLIS L559 Introduction to Health Sciences Librarianship, 2004-2007

SLIS L520 Organization of Materials & Information, October 21, 2003

SLIS L528 Collection Development & Management, November 7, 2003

SLIS L527 Library as an Organization, December 6, 2002

SLIS L524 Information Sources & Services, February 7, 2003

SLIS L559

Co-Developer (1985) of the first and only health sciences librarianship course taught at IU SLIS; Co-Director of the course in 1985-1986, 1987-1988, 1989-90, 1991-92, 1993-94, 1999-2000; Course Director in 1995-96, 1997-98, 1999-2000, 2002. This graduate course, L559: Introduction to Health Science Librarianship has been revised substantially each time it is taught to reflect new trends in technology and current issues. It has been a very popular class, receiving high marks from the students and the SLIS administration. As an instructor for SLIS, I am currently ranked as an Adjunct Associate Professor.

SLIS L600

Instructor, Readings course in Health Sciences Librarianship, Summer 2001 (Jerry Parsons, MLS student)

SLIS Internship program: liaison between SLIS and the Ruth Lilly Medical Library (RLML) for sponsorship of graduate student interns. Have coordinated and/or mentored a dozen students in the last ten years. Each student usually spends about 150 contact hours at RLML per internship.

Other Teaching

Medical Research, IUPUI Continuing Studies, P. F. Oldknow, instructor,

Guest lecturer, February 13, 2001, IB 102 "Finding What you Want: WWW, MEDLINE

Medical Library Association (MLA)

Evaluation of MEDLINE on CD-ROM. Taught May 19, 1990. 8 contact hours

Publications/Presentations Related to Teaching

Brahmi, FA et al. Lifelong Learning Competency at Indiana University School of Medicine: Creative examples of Level 3 Achievement

CGEA poster, March 22-24, 2007

Kaneshiro, K et al., Brahmi, FA. A Team-Teaching Approach to EBM in a Competency-Based Curriculum: Lifelong Learning Strategies.

CGEA poster, March 22-24, 2007

Brahmi, FA. The Future of Librarians. Guest presentation to graduate SLIS L559 course: Introduction to Health Sciences Librarianship, Nov. 14 2005 (~11 students)

London, S. and Brahmi, FA. Thomson Scientific's Expanding Web of Knowledge: Beyond Citation Databases and Current Awareness Services. MRSQ 24(4): 59-66, 2005.

Qualifying Presentation, IU SLIS, for doctorate in Information Science: Lifelong Learning and Medical Education, July 14, 2005 (passed)

Brahmi, FA. "Remembering". Reflections: Enriching Ourselves, Inspiring Others, Indiana University School of Medicine, 2005-2006, p. 34.

Brahmi, FA and Wales, PS. Implementation of Lifelong Learning (LLL) across the curriculum at Indiana University School of Medicine. Paper presented at Generalists in Medical Education, Boston, MA, Nov 5, 2004

Brahmi, FA. Transitions & passages. Guest presentation to graduate SLIS L559 course: Introduction to Health Sciences Librarianship, Nov. 2, 2004 (~25 students)

Hatfield, A J and Brahmi, FA. Angel: Post-implementation evaluation at the Indiana University School of Medicine. MRSQ: 23(3):1-15, 2004.

Gall, C and Brahmi, FA. Retrieval comparison of EndNote to search MEDLINE (Ovid and PubMed) versus searching them directly. MRSQ: 23(3):25-32, 2004

Srinivasan, M, Weiner, M., Breitfeld, PP. Brahmi, F, Dickerson, K., Weiner, G. Early Introduction of an Evidence Based Medicine Course to Pre-Clinical Medical Students. Journal of General Internal Medicine 17(1): 58-65 (Jan 2002).

Brahmi, FA. "Educating Future Physicians" (Interview) In Super Searchers on Health & Medicine: the Online Secrets of Top Medical and Health Researchers, Susan M. Detwiler, Reva Basch, Ed. CyberAge Books, October 2000

London, SK., Brahmi, FA., Kaneshiro, K. et al. Integrating MSOP Lifelong Learning Skills at Indiana University School of Medicine. Contributed paper presented by FAB at the annual MC/MLA Meeting, September 24, 2000, Cincinnati, Ohio.

Srinivasan, M, Weiner, M., Breitfeld, PP. Brahmi, F, Dickerson, K., Weiner, G. Early Introduction of an Evidence Based Medicine Course to Pre-clinical Medical Students. Poster presented at the Indiana University School of Medicine's 2000 Innovations in Education Symposium. August 3, 2000; also presented at the Midwest Chapter of SGIM, 21-23 September 2000.

Morning Report (videotape), coordinated Morning Report (Elizabeth Skatch, Chief Resident, Department of Medicine), Concepts of Health and Disease (CHD) Course Directors (Dave Allmann and Chip Wilde) , and MERP to record MR on 7/21/00. The video was subsequently distributed via IMDS to all Centers for Medical Education., 8/18/00, MERP, 2000. The resulting videotape was an edited version (CHD course directors and FB) of a specific Morning Report session, conceived and used as part of the CHD MS-1 orientation as a way to introduce them to the usefulness of problem based learning.

Brahmi, F.A., London, S.K., Emmett, T.W., Barclay, A.R., Kaneshiro, K.N. Teaching Lifelong Learning Skills in a Fourth-year Curriculum. Medical Reference Services Quarterly, 18(2): 1-11, summer 1999.

Indiana University Librarians Association, invited presentation, "Jambo Kenya:
Make the Journey, Share the Knowledge," IUPUI, October 15, 1999

RESEARCH

Brahmi, FA. Indiana Health Resources. 2004 Update. Indiana Libraries 24(3): 17-19, 2005.

Brahmi, FA. and Gall, C. Endnote and Reference Manager citation formats compared to "Instructions to Authors" in top medical journals. (Accepted by MRSQ October 10, 2005).

London, S and Brahmi, FA. Thomson Scientific's expanding web of knowledge: Beyond citation databases and current awareness services. MRSQ 24(4): 59-66, 2005.

Brahmi, FA, Riley EH, and Gall, C. Endnote & Reference Manager: How do citation formats and styles compare to those specified in "Instructions to Authors" for 40 top medical journals. Poster for Medical Library Association's   annual meeting. San Antonio, TX., May 16-18, 2005.

Brahmi, FA. EBM Solutions: Evidence-Based Guidelines. In Electronic Resources Reviews. Journal of the Medical Library Association, 92(1): 109.January 2004.

McCarthy, LJ. and Brahmi, FA. Jean-Batiste Denis: France's Pioneer in Human Transfusion. International Society of Blood Transfusion, July 9-14, 2001, Paris, France.

Brahmi, FA. Major Depression on the Internet. Health Care on the Internet , 5(2): 51-9, 2001.

Brahmi, FA. and Coggan, J. Health Sitings: Medical Matrix. Health Care on the Internet, 5(1): 67-71, 2001.

Brahmi, FA. Editor. HealthWeb Health Informatics Page, http://64.118.64.81/index.cfm, last modified July 6, 2005.

The HealthWeb project is a Midwest multi-institutional effort, supported by the Committee on Institutional Cooperation (CIC) and the Greater Midwest Region of the National Network of Libraries of Medicine, which provides links to evaluated World Wide Web sites in specific medical and health subject areas to an international audience.   HealthWeb has won numerous awards including the Institute for Scientific Information/Frank Bradway Rogers Information Advancement Award and an $115,000 grant from the National Library of Medicine to develop database capabilities.

Brahmi, F.A. MD Consult: One-Stop Web Based Clinical Information. Medical Reference Services Quarterly 18(3): 29-37, Fall, 1999

Brahmi, FA and Emmett, TW. Physicians' Online: a Free Version of MEDLINE. M.D. Computing, 12 (5):398-400, Sept/Oct 1995.

Brahmi, FA. Selected Medical Informatics Sites on the Web. Medicine on the Net, 11-3, July 1998.

Brahmi, FA. MEDLINE Retrieval: Grateful Med, PaperChase, and Physicians' Online. Proceeding. Nineteenth Annual Symposium on Computer Applications in Medical Care, p. 928, 1995.

Brahmi, FA and Kaneshiro, K. CD Plus' OVID MEDLINE: Software in Transition. Medical Reference Services Quarterly, 13 (2): 11-28, 1994.

Tyler, JK and Brahmi, FA. The Effect of a Local Area MEDLINE Network on Online End-User and Mediated Searching: An Update. <u>Medical Reference Services Quarterly</u>, 12(4): 1-6, 1993.

Brahmi, FA and Kaneshiro, K. Online Journal of Current Clinical Trials (OJCCT): A Closer Look. <u>Medical Reference Services Quarterly</u> 12(3): 29-43, 1993.

CD-ROM Implementation and Networking: the Indiana Experience. <u>in</u> <u>CD-ROM Implementation and Networking in Health Sciences Libraries</u>. M. Sandra Wood, ed. Binghamton, NY: Haworth Press, 1993.

CMC Research's CD-ROM Products. <u>M.D.</u> <u>Computing</u>, 7(4):220-2, July-Aug 1990.

Brahmi, FA and Tyler, JK. Effect of CD-ROM MEDLINE on Online End User and Mediated Searching. Part II. <u>Medical Reference Services Quarterly</u>, 9(3): 15-21, 1990.

Brahmi, FA and Kaneshiro, K. CD Plus: MEDLINE on CD-ROM. <u>Medical Reference Services Quarterly</u>, 9(1): 29-43, Spring 1990.

-------------------- Current Contents on Diskette and Reference Update. <u>M.D. Computing</u>, 7(1): 55-8, Jan-Feb 1990.

-------------------- Institute for Scientific Information's SCI CD Edition. <u>Medical Reference Services Quarterly</u>, 8(2): 1-13, Summer 1989.

-------------------- CD-ROM Applications: MEDLINE SCI CD Addition and CANCER-CD. <u>M.D. Computing</u>, 6(1): 12-19, 49, Jan-Feb 1989.

-------------------- Effect of CD-ROM MEDLINE on Online End User and Mediated Searching. <u>Medical Reference Services Quarterly</u>, 7(4): 47-56, 1988.

--------------------- Subject Searching of Monographs Online in the Medical Literature. Medical Reference Services Quarterly, 7(1): 41-8, 1988.

Corbett, Ann L. and Brahmi, Frances A. Grateful Med: NLM's Front-end Software. Database, 9(6): 94-99, December 1986.

--------------------- Verifying the Elusive Proceedings: a Review of Available Sources. Medical Reference Services Quarterly, 5(4): 1-11, 1986.

Brahmi, Frances A. Indiana State Resources for Health Science Libraries. In Basic Library Management for Health Science Librarians, 2nd ed., edited by Patricia Jones Wakeley, and Ruby S. May. Chicago: Midwest Health Science Library Network, 1982.

GRANTS

Co-investigator, Integrated Advanced Information Management Systems (IAIMS) Planning Grant, Principal Investigator: Clement McDonald, M.D., July 1, 2001-2003, $300, 000; 10% effort.

Participating Faculty, Regenstrief-Moi Informatics Fellowship, and International Training in Medical Informatics, Principal Investigator: William Tierney, M.D. (RFP TW-98-003), July 1, 1999 - June 30, 2003, $600,000. Have traveled to Eldoret, Kenya and have also coordinated the RLML effort there, enabling another RLML faculty to travel and teach there.

Co-investigator, A Pilot Indianapolis-wide 10 Megabit Network for Patient Care and Research, National Library of Medicine, Principal Investigator: Clement McDonald,

M.D. (Funded April 1, 1994 - March 31, 1997 for $2,400,000; renewed April 1, 1997 -

March 31, 1999 for $800,000)

SERVICE

Professional Associations

Association of American Medical Colleges, Central Group on Educational

Affairs, 1998-

Indianapolis Foundation Library Partners, Professional Development

Committee, 2000-

Friends of the National Library of Medicine, 1999-

American Medical Informatics Association, 1996-

Beta Phi Mu International Library Science Honor Society, 1981-

Health Science OCLC Users Group, 1988-90

John Shaw Billings History of Medicine Society, 1988-

Indiana Health Science Librarians' Association, 1981-

Indiana Online Users Group (IOLUG), Charter Member, 1981-87

Indiana University Librarians' Association (InULA), 1982-

Medical Library Association/1982-

International Cooperation Committee, 1984-85, 1985-86, 1997-

Midwest Chapter, 1981-

Public Services Section, 1984-

Medical Informatics Section, 1988-

Nominating Committee, 1998-

Medical School Libraries Section, 1988-

Sigma Xi, Associate Member, 1984-85

Special Libraries Association, 1981-87

Indiana Chapter, 1981-87

Indiana Health Science Librarians' Association

Health Science Library Survey Committee, Chairman, 1983-85

President-Elect, 1988-89

President, 1989-90, 1990-91

Indiana Online Users Group (IOLUG), Treasurer, 1982-83

New Technology Committee Chair, 1988-89

Medical Library Association:

Medical Informatics Section, MLA Career Development Grant Jury, 2001

Medical School Section, Secretary, 1988-90

Public Services Section, Nominating Committee Chairman, 1986-87

Public Services Section, By-Laws Committee Chairman, 1987-88, Re-appointed 1988-89

Public Services Section, Chair-Elect, 1990-91; Chair, 1991-92

Evaluation Committee for the Bulletin of the Medical Library Association, 1989- 1990-91

Estelle Brodman Award for Academic Medical Librarian of the Year Jury, 1994-96, Chair, 1996

MLA's first Satellite Teleconference, Indianapolis Site Coordinator, "The Role of the Library in Accreditation", March 13, 1996. Arranged for a local downlink for area health sciences librarians

Special Libraries Association/Indiana Chapter, Networking Committee, Chairperson, 1982-84

Conferences & Workshops Attended/Courses Taken

Conferences & Workshops

Generalists in Medical Education, Boston, Nov 5-6, 2004

Generalist in Medical Education, San Francisco, Nov 9-10, 2002

Medical Library Association, Midwest Chapter, Indianapolis, Sept 19-23, 2003

Medical Library Association, Midwest Chapter, Cincinnati, Sept 23-26, 2000

AAMC Annual Meeting, New Orleans, October 31-November 3, 1998

Heath Sciences Education for the New Millennium: A Technology Awareness Conference, Minneapolis, MN, and September 10-11, 1998

Problem-based Learning Tutor Training and Case Development Workshop, University of New Mexico, School of Medicine, Albuquerque, NM, October 15-17, 1996

HII96: The Emerging Health Information Infrastructure: Enabling the Vision, Georgetown University Conference Center, Washington, D.C., April 14-16, 1996, Virtual participant via the Internet

Current Topics in Health Sciences Librarianship, Welch Medical Library, Johns Hopkins University, June 24-27, 1996. Virtual participant via the Internet. Poster submission required for attendance

Tricentennial McMaster Conference on Problem Based Learning, McMaster University, Faculty of Health Sciences, Hamilton, Canada,

June 28-July 1, 1994

Courses Taken

Stanford Course in Clinical Teaching, a 7-part 20-hour course offered to Regenstrief fellows, taught by Debra Litzelman, M.D. April 1999. The course addresses educational categories relevant to clinical teaching, including learning climate, control of session, communication of goals, understanding and retention, evaluation, feedback, and self-directed learning. Clinical role playing is videotaped and based on feedback from peers as well as self-evaluation, the session is videotaped a second time.

Biostatistics course, X607, graduate course, Juanita Keck, PhD, IU School of Nursing, Instructor, Fall, 1999.

Edward C. Moore Teaching Symposium: Problem Based Learning, February 28, 1997, followed by 4 half-day workshops: The Tutor's Role in PBL Groups, Case Writing for PBL, Facilitation of PBL, and Assessment of Students in PBL

IUPUI, March 6, 7, 20, and 21, 1997

Marine Biological Laboratory Medical Informatics Fellowship, May 29-June 5, 1996, Woods Hole, Massachusetts. One of 30 fellows selected worldwide

Medical Informatics Introductory Short Course, Center for Advanced Medical Informatics at Stanford University, Palo Alto, Ca, August 29-September 2, 1994

Editorial Boards

Editorial Board, <u>Helping Hands: Reflections on Humanity in Medicine</u>, 2007-present

Editorial Board, <u>Medical Reference Services Quarterly</u>, 1990-present

Editorial Board, <u>Bulletin of the Medical Library Association</u>, 1992-95, 1997-2000;

<u>Journal of the Medical Library Association</u> (JMLA) Editorial Board-2002-5

Referee, <u>Journal of the Indiana Dental Association,</u> 1990-

Reviewer, <u>AMIA Proceedings</u> papers, 1996-1999

Moderator and Editor for the PBL-List, a listserv for Problem-based

Learning (800 subscribers), December 1997-present

Consultant to IUSM Dean's Office, IU<u>SM Bibliography</u>, electronic publications,

editor, 1995-2000

Haworth Press, Prepublication Reviewer for <u>Women's Health on the Internet</u>, 2000

Medical Library Association, Expert Reviewer, <u>Administration and Management in</u>

<u>Health Sciences Libraries</u>, 1999

Referee, <u>Special Libraries</u>, 1987-90

Indiana University School of Medicine

IUSM Graduate Questionnaire Task Force, 2003; reappointed 2004

IUSM Curriculum Council, Elected member, 1996-98

IUSM Curriculum Council Steering Committee, 1997-

IUSM Curriculum Council, Director of Lifelong Learning Competency, 1997-

IUSM Curriculum Council, OSCE Task Force, 2000-

IUSM Curriculum Council, Biostatistics/Evidence-based Medicine Task Force, 1999-2000

IUSM Statewide Triple Jump Examination Task Force, Co-Chair, 1999-2000, piloted the first statewide triple jump exam for MS 1 students; the Curriculum Council Steering Committee has since approved it as a requirement for system wide implementation

IUSM, Biomedical Paper Committee, 1992-97

IUSM Ruth Lilly Medical Library Review Committee, 1996

IUSM Faculty Steering Committee, 1997-99

IUSM Concepts in Health and Disease course Committee, 1997-2000

IUSM, Computer Assisted Instruction Task Force, Chair, 1989-96

IUSM Student Computer Task Force, 1996-98

IUSM Faculty Community Relations Committee, 1985-86

AWARDS and HONORS

Indiana University Trustee Teaching Award, 2004-2005 ($2500)

Nominated for a Teaching Excellence Recognition Award for 2002 (November 14, 2001)

Distinguished Member of the Academy of Health Information Professionals (AHIP), Medical Library Association, 1990-2009 (renewable every 5 years)

Fellow, Regenstrief Institute Medical Informatics Training Fellowship, 1998/99

Hardin MD Clean Bill of Health award for the Health Web Heath Informatics site, January 19, 2000. This award is based on the connection rate of the links on the web page.

Consultant to the National Library of Medicine (NLM) to participate in the Multilateral Malaria Initiative (MMI) whose goal is to bolster resources and research in countries where malaria is endemic. In July 1998, conducted training sessions in Bamako, Mali (West Africa) at the   Malaria Research and Training Center (MRTC). The staff included researchers at the MRTC, the National Medical Library, and the Medical School. Demonstrations as well as hands-on sessions were held to work on their Internet skills and use of PubMed. Prior to the Mali experience, the MMI delegates met at the NLM Jan 20-21, 1998.

Recipient of an IUSM Teaching Excellence Recognition Award for 1997 ($1500)

Selected as one of 30 fellows (worldwide) for the National Library of Medicine Medical Informatics Course at the Marine Biological Laboratory in Woods Hole, MA, May 29-June 5, 1996

Medical Informatics Introductory Short Course, Center for Advanced Medical Informatics at Stanford University, Palo Alto, Ca, August 29-September 2, 1994

Selected as one of ten finalists from the IUPUI campus to the Faculty Colloquium on Excellence in Teaching (FACET) and received an honorable mention, March 1989.