Evidence-based practice has been defined by Haynes as “the integration of best research evidence with clinical expertise and patient values” (2002, p. 37). Evidence-based practice (EBP) is a formal information behavior recently imposed on healthcare providers, which emphasizes the incorporation of the best research evidence into the delivery of patient care. Internationally, policies that require both healthcare practice and the educational environment under which health science students are educated to be evidence based are on the rise. In medical and health sciences curricula, EBP and problem-based learning (PBL) are often seen as synonymous, as traditional medical PBL requires students to seek out research evidence related to posed clinical problems. However, students in an undergraduate radiography program exhibit difficulties in implementing EBP, despite successful completion of a PBL course. This study describes the findings of a needs analysis undertaken to better understand the issues hindering the development of effective evidence-based decision making skills in the PBL context.

Keywords
Problem-based learning; evidence-based practice; needs assessment; health professions education

INTRODUCTION
Evidence-based practice has been defined by Haynes as “the integration of best research evidence with clinical expertise and patient values” (2002, p. 37). The EBP movement arose in response to the 2000 Institute of Medicine report, *To Err is Human: Building a Safer Health System*, which revealed hospital errors in the U.S. costing nearly 100,000 lives and between $17 and $29 billion annually. The report identified a need to enhance the knowledge base about healthcare delivery and safety, and outlined implementation of this national focus through a combination of regulatory and funding initiatives. Where health practitioners and other professionals were once able to master a relatively static background knowledge base and then integrate personal experience to their professional practice, this is no longer an option. Professionals in a wide range of fields are now expected to base their decisions on the best and most current research evidence available in order to ensure the best outcomes for the clients they serve. In the past three decades, evidence-based practice (EBP) or evidence-based clinical decision making has become an expected part of healthcare delivery for a wide variety of health professions. In order to provide patients with the most effective care, the health care professional must be able to evaluate clinical evidence and incorporate it with the patient’s preferences and relevant research evidence.

The idea of evidence-based practice is relatively new to the medical imaging field, and the radiographer has historically relied upon tradition and subjective experience rather than investigation in the performance of their duties (Hafslund, Clare, Graverholt, & Wammen Nortvedt, 2008). This practice is changing, and, internationally, evidenced-based radiography is now an expectation (The International Society of Radiographers and Radiological Technologists, 2004), but adoption is still in the early stages.

Policy support and implementation of EBP across the healthcare spectrum has necessitated changes in the educational approaches utilized in health sciences programs to effectively prepare students for EBP (Ciliska, 2005). These changes have prompted increased utilization of constructivist pedagogies, specifically, the use of PBL (Raghavendra, 2009). Professionals, particularly those in healthcare fields, are routinely presented with ill-structured problems, supported by a myriad of symptoms, history and test data that are not clearly linked to the issue at hand. The PBL pedagogy is thought to help students develop connections between their background knowledge and the kinds of problems they will encounter regularly throughout their careers (Jonassen, 2010).

Needs Analysis
According to needs assessment theory (Wedman & Graham, 1998), a problem exists when there is a difference between the optimum performance and the actual performance. In the case of the currently offered PBL course, it is the state between the current methods of instruction and didactic support and the methods that would most effectively develop evidence-based decision making skills. The Performance Pyramid model (Wedman & Graham, 1998) illustrates that significant accomplishments or outcomes (such as the development of EBP) rely on adequate resources, clarity of vision, mission and objectives, and the organizational culture in which the change process is undertaken (See Figure 1). Undertaking needs analysis based on this model involves, first, determining the adequacy of the resources and the clarity of the vision, mission

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and objectives. If individuals have access to appropriate resources to accomplish the stated outcomes and see those outcomes as a priority, then a closer look must be taken at the organizational culture to determine if any of the performance elements are hindering outcome achievement. According to Wedman & Graham, the vision, mission and objectives and the committed resources must be aligned with performance elements in the organizational culture in order to affect change in an organization. Deficiencies in one or more of the supporting elements can lead to instability of the change process and negatively impact desired outcomes. A thorough needs assessment will evaluate each of the elements carefully.

**PURPOSE OF THE STUDY**

The purpose of this study was to systematically analyze the contributing factors involved in the implementation of an undergraduate PBL course and to identify those impacting the development of evidence-based decision making skills.

**METHODS**

A needs analysis was performed to determine the factors impacting the development of EBP skills within a PBL course.

**Context for the Study**

This study was undertaken in a junior-level PBL course within the Radiologic Sciences curriculum at a research intensive, public university in the Midwestern U.S. Seventeen students were enrolled in a regularly offered, semester-long course that has utilized PBL pedagogy for over a decade. The employed PBL strategy involves presenting students with a case that provides the kinds of information that would be gleaned in the clinical setting – symptoms, results of laboratory studies, imaging studies, etc. The students are tasked with analyzing the case, delineating the things they know, developing hypotheses regarding the patient’s prognosis, identifying relevant information that could be helpful for finding a solution, and formulating questions for further investigation. These questions become, what is known as, “learning issues” (Hmelo-Silver, 2004) that students need to pursue as part of their self-directed learning. Students then independently address selected learning issues, applying the ideals of EBP to present their team members with their findings and relating the information to the case scenario.

The majority of students were of the traditional college-age and could be classified as digital natives (Ng, 2012). In addition to the students enrolled in the course as part of the professional phase of their undergraduate training, there were also two Associate-degree prepared radiologic technologists who were pursuing their baccalaureate degree as a method of career advancement enrolled in the course. All of the students were junior-level health professions students who had completed college composition and at least one writing intensive course prior to enrollment in the PBL course. Approval to conduct the study was obtained through the institutional review board, and student consent was obtained for this study.

The course was taught online via the Blackboard learning management system.

**Data Collection**

Prior to the start of the semester, faculty interviews were conducted to determine expectations of students subsequent to participation in the PBL course. To determine if the organizational vision, mission and objectives, the available resources, and the organizational culture were sufficient to support the development of evidence-based radiography practice, the syllabus, course materials, student performance reflections, and team interactions were analyzed. Finally, a focus group interview of the students was conducted to target the elements of organizational culture.

The focus group interview, conducted near the end of the semester, emphasized the engagement in evidence-based practice and included the questions presented in Table 1. Collected data were imported into NVivo qualitative software (version 10.1.3) and independently coded by two raters. A number of codes were predetermined and coincided with the performance elements of the needs assessment model, i.e., Motivation, Values & Self-Concept; Tools, Environment & Processes; Expectation & Feedback; Rewards, Recognition & Incentives; Knowledge & Skills; and Performance Capability.

**FINDINGS**

**Vision**

The syllabus of the course describes the primary objective as developing “the ability to integrate and apply knowledge of the radiologic sciences, clinical reasoning, and self-directed learning to provide best practice and patient-centered care in real clinical case scenarios”. The course learning outcomes include locating and evaluating quality information, the interpretation of facts and the development of a system for investigating clinical topics. The syllabus and course materials online do not define these skills in terms of evidence-based...
just found facts student stated, "I feel like I haven't found any evidence, I've just found facts.

The students felt that a wide range of skills and character traits were helpful in conquering their search tasks, including computer skills, vocabulary, perseverance, communications, and a willingness to ask for help. They expressed a need for support in developing search queries, and help with targeting appropriate resources, particularly at the beginning of the course. A need for guidance regarding time management and effective use of available search time was noted as well.

Performance Capability
The papers produced by the students in this course were of appropriate depth, written clearly and succinctly, and based primarily on appropriate peer-reviewed resources.
DISCUSSION
The needs analysis undertaken in this study revealed that participation in the PBL course is fairly effective in developing EBP skills. The course could be more effective by explicitly communicating EBP skill development as the focus of the course and clearly defining what constitutes evidence for the purposes of EBP. Careful reflection on the six performance elements reveals strengths in the available resources, student motivation and self-concept, and performance capability. Improvements can be made in the areas of reward, recognition & incentives; expectations & feedback; and knowledge & skills.

The support needs noted by students in this PBL course are not unusual. Implementation of evidence-based radiography necessitates a certain level of information literacy. Shanahan’s (2010) study of the information behaviors of professional radiographers found that the majority of radiographers show little understanding of the availability and utility of internet-based information systems outside of standard web browsers; and Innes’ (1998) qualitative investigation of stress in postgraduate radiography students found that radiographers seeking advanced education and qualifications found inadequate computer literacy as a source of stress. Furthermore, targeting effective resources which are most appropriate for filling their information need can pose a particular challenge for radiographers. In a qualitative study on the nature of academic knowledge within the radiographic discipline (Castle, 2000), it was found that radiographic knowledge spans “both the natural sciences and the humanities” (p. 261). This finding is reflected in Shanahan’s (2007) observation of the difficulty in retrieving radiography specific information. She notes that no single database retrieves all three of the major radiographic journals – Radiography, The Radiographer, and Radiologic Technology, and this creates an even greater need for explicit instruction in the utility and purpose of the database options. Additionally, providing guidance regarding effective time management may be the most effective strategy for increasing EBP outcomes. The workload demands of the clinical environment may not provide adequate time to access the informational resources. The literature supports this finding, as one study determined that over 70% of clinical radiographers were not allocated time for professional reading (Shanahan, Herrington, & Herrington, 2010), and another demonstrated a strong positive correlation between time for reading professional journals and the implementation of evidence-based radiography (Ahonen & Liikanen, 2010). Teaching students to effectively use the time available, through formulating efficient searches, targeting appropriate resources and efficiently incorporating the information retrieved may be the most effective way to encourage future EBP.

CONCLUSION
Problem-based learning can be effective in developing evidence-based practice skills. PBL instructors should be aware of the importance of making the objectives of the course explicit and work to incorporate information literacy support for the development of search queries, targeting resources for information search and efficiently reviewing retrieved resources.

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REFERENCES