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COMMENTARY/PERSPECTIVES

Challenges Facing New Educators: Expanding Teaching Strategies for Clinical Reasoning and Evidence-Based Medicine

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Context: It is the educator's responsibility to prepare the students to be clinicians who think and reason critically while integrating research evidence into practice. Those new to the role of faculty member, who lack clinical and teaching experience, face challenges in the classroom application of those concepts.

Objective: To discuss the challenges facing new faculty members and present strategies for addressing them. Specific faculty challenges addressed include learning their roles as educators and teaching multifaceted concepts, such as clinical reasoning and evidence-based medicine.

Background: Experience provides a framework for a professional to balance multiple demands, whether as a new instructor teaching or a clinician synthesizing information to determine a course of action. Many new educators do not have extensive experience either clinically or in the classroom. This can cause anxiety as educators are confounded by their roles and responsibilities. Students likewise lack experience and may not possess the ability to systematically analyze patient encounters or research evidence. Constructivist learning theory paired with adult learning principles can address the learning needs of faculty members and students alike.

Recommendation(s): Programs must provide assistance for new faculty and implement strategies for students to learn reasoning skills. Use of constructivist learning theory and application of the adult learning model are ways to address these deficiencies. Integrating concepts of active learning and self-direction while aligning expectations and creating overlap between classroom and clinical domains can assist in addressing the challenges faced by new faculty and students.

Conclusion(s): The systematic process of evidence-based decision making is grounded in utilizing evidence. Strategies must be identified and implemented throughout curricula to target and enhance students' abilities to organize and synthesize information. Educators must use new methods in their own learning and teaching to enhance their students' abilities. New faculty members in particular require assistance in negotiating their roles.

Key Words: Adult learning, constructivism, clinical education, critical thinking

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KEY POINTS

- Educators, specifically those who lack practice or teaching experiences, face challenges in preparing their students to use evidence and make clinical decisions.
- Applications of theory and learning models can assist educators in enhancing the student experience.
- Utilizing active learning strategies and activities in the classroom assists student development of skills, which can transfer clinically.

INTRODUCTION

Junior faculty members in higher education face challenges due to the need to fulfill the tripartite responsibilities of scholarship, teaching, and service.[1] For new faculty members the challenge may be particularly pronounced depending on the level of their previous training and experience.[2] The role of teaching presents a challenge, as it takes time to prepare new materials, implement lesson plans, correct student work, and provide feedback. New faculty members often feel they do not have enough time to perform each of those tasks, in conjunction with service and scholarship responsibilities, which can cause stress and anxiety.[3]

Another consideration for new faculty members in the health professions, and particularly for those in athletic training, is the extent of the faculty members' clinical practice experience. Clinical experience assists with decision making and reasoning.[4,5] Without practice experience new faculty members in healthcare professions can easily become overwhelmed. In an editorial, Turocy[6] highlighted the differences between those who are experts in a specific content area and those who are expert teachers. Just as it is unlikely for a newly licensed professional to be an expert in a specific content area upon graduation, it is unlikely that one who has recently graduated with a terminal degree will be an expert teacher upon taking a new faculty position. Furthermore, content knowledge does not indicate ability to teach content. As stated by Turocy, "it is not likely that new or less experienced athletic trainers would possess both abilities at an expert level."[6(p329)] Thus, new faculty members with a background that does not include time in practice seem to be at a distinct disadvantage, being neither content nor teaching experts.

Clinician expertise is at the center of the model of evidence-based practice provided by Haynes et al.[7] The traditional model of evidence-based medicine (EBM) comprised 3 overlapping circles representing clinical expertise, research evidence, and patient preferences. The combination of these are the components a clinician must consider when making a patient-care decision. In their model, Haynes et al[7] have not only moved clinical expertise to a central position but have added "clinical state and circumstances." This addition is intended to take individual physical and personal factors and the patient's environmental state into account. The best research evidence is relevant, but it is not the determining factor in making a clinical diagnosis or establishing a plan of care. Clinicians must rely on their expertise and the patient's unique presentation along with relevant research to determine appropriate diagnosis and plan of care.[7] All attributes of the model rely upon and are integrated into clinical expertise, which encompasses the clinicians' knowledge skills and experience level.[7]

OBJECTIVE

In this article we briefly describe the challenges[1] facing junior faculty members in their role. We present suggestions to assist in this transition, particularly as it relates to teaching responsibilities and instructing students in challenging areas such as critical thinking and clinical reasoning. Both the education of educators, through terminal degree programs, and the professional preparation of students, through Masters of Science in athletic training programs, occur at the graduate level, and the learning principles of adult education apply to all. Therefore, the adult learning model[8] will be discussed, with suggestions for incorporating it into our existing curriculums for both faculty development and student professional preparation. Finally, we provide strategies to assist faculty, clinically and didactically, in enhancing clinical reasoning and critical thinking in their students, as this is a vital component of professional preparation programs.[4,5]

BACKGROUND

Challenges for New Faculty

Development for new faculty must include a focus on the various roles of higher education professionals.[9] Difficulties for junior faculty include addressing the 3 components of teaching, scholarship, and service; most time is reportedly spent on meeting teaching requirements, which results in less time for scholarship endeavors.[2,10] These 3 primary components do not account for time that also may be spent engaged in patient care, which may also be a facet of a faculty member's position.

New faculty members feel they do not have enough time to fulfill their primary responsibilities because there are many other aspects of a new position to which they must become accustomed. Moreover, the educational environment and institutional support available also take time to understand; therefore, new faculty members do not have as much time to devote to their roles and responsibilities, which often causes stress and anxiety.[2,10]

One way to alleviate stress for a faculty member in a new position can be through faculty development and orientation sessions.[2] Interventions such as orientation workshops,[2] formal mentor pairings,[11] and decreasing of duties can help junior faculty to understand their new environment,[2] integrate effectively, and possibly reduce apprehension.[2] Orientation sessions and new faculty workshops should be presented

following adult learning principles, such as reflection and collaborative learning, both of which will encourage self-directed development and teamwork.[3] Program leadership may also assist new faculty in adjusting to the new environment by helping them to form positive relationships with other seasoned, experienced faculty, resulting in a more productive and happy faculty member.[2]

Morin and Ashton[2] determined that it could take 3 or more years for new faculty member to feel comfortable in the culture of a new institution. As new faculty members adjust to their roles there should be ongoing opportunities for development, reflection, and reinforcement, particularly as they experience new aspects of their positions.[11] For example, if an educator takes on a new class, colleagues who have taught the course before them or who have experience in that area can share their experiences or offer to observe the new educator teaching and provide feedback. Preparing new faculty for the demands of teaching is essential.[3] While health science fields may have at one time hoped that highly capable clinicians would easily transition to teaching roles, this is not necessarily the case.[2,3] New faculty must become familiarized with teaching roles and learning strategies.[2,3]

Teaching and Learning Decision Making

Health professionals, such as athletic trainers and physical therapists, are asked daily to solve complex patient problems. To successfully solve those problems clinicians must possess an understanding of research evidence along with the ability to think critically and reason clinically. It is the educator's responsibility to produce this type of clinician, one who is competent to practice and able to provide the best possible outcomes for the patients.

The practice of making an evidence-based clinical decision occurs when clinicians are able to synthesize each area (evidence, expertise, patient preference, and state) to make final judgments on an appropriate course of action that will benefit their patients.[12] This systematic decision-making process is explicitly grounded in utilizing evidence to inform the outcome of the decision and promotes bridging the gap between research and practice.[13] Clinical expertise allows the practitioner to balance the multiple and possibly conflicting pieces of evidence when weighing his decisions. As educators we cannot teach experience, but there are many ways we can provide experience.

SYNTHESIS

Constructivist Theory and Adult Learning

Constructivism is a theory of how people learn[14] that has previously been identified as applicable to health science fields such as athletic training,[15] physical therapy,[9] and nursing.[14,16] According to constructivist theory learning occurs best when a learner actively participates in the construction of the educational situation.[17] The theory relies on learners to be active, rather than passive, participants in the learning. Instead of sitting in class acting as a blank slate or having empty pages waiting to be filled with information, learners work to create and construct knowledge.[18] Hands-on laboratory sessions in evaluation classes, which require students to act out injuries or perform mock evaluations, are examples of active learning. Introducing a new concept by asking students what they already know about it and building from their comments to provide further information is another way to include students in the creation of classroom knowledge.

The theory of constructivism provides a framework that meshes well with andragogy, adult learning theory.[16] The premise of active learning is vital to both constructivism and andragogy.[19] According to Knowles,[20] the primary developer of adult learning theory, adult learning principles should allow the learner to build upon previous experiences as he constructs new knowledge, another similarity it shares with constructivism theory. The preference for being self-directed is a key trait that may set adults apart from children in the learning process.[21,22] Self-directed learning occurs when students take initiative, determine their own needs, and then design their own strategies and goals for achieving their needs.[22] This type of learning can occur in a social setting, with others or with help from peers, mentors, or teachers.[22] When educating, adults instructors become a resource and manager of the environment rather than the traditional subject-centered knowledge disseminator.[17] Including students in the design and creation of rubrics to assess their work and inspiring them to reflect on their assignments and tasks in class encourage self-direction.

Constructivism can be applied to graduate studies and in the preparation of faculty members by providing doctoral students, future junior faculty members, the opportunity to learn and participate in experiences that mimic those they will face in their future roles. Examples of this could include teaching modules in a class to their peers or assisting an instructor in the classroom as a teaching assistant. These activities allow the doctoral student to actively engage in teaching a course or material. Another example would be learning to design and then progressing through the execution of a research project, allowing the doctoral student to collect, analyze, and present her findings. Following these principles, junior faculty in their new positions will have actively learned strategies and have previous experience to draw from in executing their responsibilities and continuing to grow. Using the principles of adult learning with new faculty once they have started in their new position will also enhance their likelihood of success. Therefore, orientation workshops and other organizational socialization activities should both include active learning and capitalize on junior faculty members' previous experiences. Students coming into graduate allied health programs undoubtedly bring with them a variety of previous experiences; they are also older, more mature, and will gravitate to active learning processes.[16]

Developing Clinical Reasoning and Critical Thinking

In constructivism, the learning process is dynamic. New encounters change and add to the student's level of understanding.[16] Active judgments occur in the learning process and require the combination of new and old knowledge; students modify their practices to adjust to the new information.[16] Brandon and All[14] found that active learning helped nurses improve their critical thinking skills and enhances their ability to adapt to changes, particularly when dealing with evidence-based practice concepts.[14] This finding identifies the importance of critical thinking and its relation to the implementation of best practices. Those who

practice critical thinking are more effective than those who rely on memorization and regurgitation of learned information in quickly changing situations, such as those involving patient care.[14]

Critical thinking is a concept that has been evaluated in athletic training.[23–25] When students are engaged in critical thinking they are "... evaluating, analyzing and interpreting information, [he or she] is also analyzing inferences and assumptions made regarding that information."[25(p263)] Evaluations of critical thinking in athletic training have focused on students' disposition to perform it[24] as well as instructors' ability to integrate it.[23] Fuller[23] found that about 50% of learning objectives in athletic training courses contained items considered to be critical thinking related, while less than 20% of exam questions contained items that would require students to implement critical thinking strategies. Though this study is 20 years old, it appears that even when it was conducted educators had a hard time integrating and assessing critical thinking. More recently, Christensen et al[26] asked physical therapy program directors to self-report their program practices related to clinical reasoning. Findings indicated all programs explicitly incorporated clinical reasoning, though no common definition of clinical reasoning was found and although there were a large variety of methods used to teach and assess clinical reasoning.

Leaver-Dunn et al[24] determined that athletic training students have a "general but mild trend" in their disposition toward critical thinking. The study used the California Critical Thinking Disposition Inventory, which determines levels of certain dispositional factors, such as truth-seeking, open-mindedness, inquisitiveness, cognitive maturity, and self-confidence. These components predispose one to use critical thinking. The athletic training students' "highest" disposition was inquisitiveness, while they scored lowest in truth-seeking.[24] The authors[24] hypothesized this was due to the predisposition of students to be passive learners, whose inquisitive nature serves them only so far as to know the correct answer in a given situation rather than pursuing facts to determine why an answer may be the best or actively seeking alternative options. Though the students were exhibiting slight trends toward critical thinking, the results showed there is significant room for progress in educating students about their ability to critically think. The dispositions on the California Critical Thinking Disposition Inventory align closely with the principles of adult learning, such as self-directedness with truth seeking and maturity and inquisitiveness with active learning. Perhaps the implementation of the adult learning model and activities incorporating these principles will increase students' tendency to think critically.

Graduated autonomy has been theorized[23] as a means to enhance critical thinking. As students move through their education and gain more knowledge and experience they can be given more independence and opportunity to practice, thereby increasing their need to implement critical thinking.[23] Interestingly, Leaver-Dunn et al[24] found there was no correlation with the number of hours students had spent in the clinical education setting and their critical thinking disposition. This seems to refute the idea that increased experience will lead to greater ability to think critically, at least in students. Hours spent at the clinical site do not necessarily equate to hours of exposure to learning or skill practice. In fact, students may only spend ~50% of their clinical experiences engaged in active learning.[27] Educational strategies must overtly target this paradox by creating learning opportunities using adult education strategies that incorporate the concepts of critical thinking into both classroom and clinical settings, providing students with real-life applications of principles. Additionally, programs should consider openly evaluating the methods used to teach critical thinking and the impact critical thinking has on clinical reasoning and intentionally inform students of these theories.

While graduated autonomy alone may not enhance the clinical reasoning of allied health care students, there are other clinical reasoning strategies that have been studied. Schilling[28] and Heinerichs et al[29] describe a current method of clinical reasoning being taught in athletic training education using a hypothesis testing strategy termed *hypothetico-deductive reasoning* (HDR). Both contend the structure of HDR is burdensome to students and that utilizing other forms of reasoning will better prepare students to solve the problems they will face in the clinical setting.

An alternative to this approach is *case pattern recognition,* as described by Geisler and Lazenby.[5] Case pattern recognition is on display when an athletic trainer is faced with a new, unknown injury to evaluate. In this situation, as they progress through their evaluation, expert clinicians are able to discern recognizable patterns based on the primary features (reported history, symptoms, signs) of a patient's case. Using their knowledge of prior case patterns, which often have been learned through years of experience, the clinician is able to quickly and efficiently diagnose the patient's condition. The prior experience the clinician has with that particular case and pattern of signs and symptoms allows them to accurately diagnose the condition without needing the lengthy evaluation process that is often used by students and novices following the HDR approach.[5] Hypothetico-deductive reasoning has been used to explain the nature of diagnostic reasoning in physical therapy as well.[26]

If HDR and case pattern design are viewed as a continuum, then clinicians of any level can use both to "solve" a given situation. A student will rely more on HDR initially, but as they gain more experience and learn to recognize more patterns they may transition to rely on case pattern recognition. However, this is not to say that expert clinicians never use HDR. They are undoubtedly faced with situations with which they are not familiar and must use a more lengthy evaluation process to determine the appropriate steps.[5]

A similar approach to reasoning, termed *dual process theory,* is used by physicians and is described in the medical literature.[4,30] Consider again the situation of an athlete with an unknown injury entering the athletic training room. The athletic trainer confronting this new situation must begin the evaluation process. It is possible that in some situations a clinician will be able to quickly and intuitively diagnose an injury or illness, known as the *Type 1 process*.[30] The athletic trainer's level of expertise and experience may affect the likelihood and frequency of a quick appropriate diagnosis.[4,6,30] However, there will undeniably be situations in which the clinician will not readily ascertain a diagnosis. In this situation the clinician will need to glean more information from the patient and complete further testing; this is

undertaking the *Type 2 process*.[4,30] These 2 examples are the basis of the dual-process model of reasoning, as described by Croskerry[30]:

> *Relatively early on in the process, it will be clear whether the condition is recognized or not. If it is, Type 1 processes will rapidly and effortlessly make a diagnosis and nothing further may be required. If it is not, then linear, analytical, deliberate and effortful Type 2 reasoning will need to be engaged instead.*(p30)

In dual process theory students are often operating in the Type 2 line of reasoning, which is longer and more systematically based, whereas experts may more often operate following the Type 1 line of reasoning using their intuition.[4] The dual-process theory is similar to the continuum of HDR and case pattern recognition. Type 1 processing in the dual process theory is very similar to the case pattern recognition method of clinical reasoning. Hypothetico-deductive reasoning is closely aligned with the Type 2 reasoning identified in the dual-process theory. Just as experts can toggle back and forth between the 2 strategies of case pattern recognition and HDR, they may also flip back and forth from Type 1 to Type 2 reasoning in the dual-process theory.

A final reasoning theory that can be applied to athletic training is the *Bayes theorem*.[31] Bayesian analysis relies upon consideration of the evidence that is present (history, signs and symptoms) to determine the likelihood of that evidence causing a certain condition; this likelihood is reconsidered with each piece of new evidence that is gained.[31] Bayesian reasoning provides perhaps the most concrete link between constructivist learning theory and any of the reasoning strategies that have been described. Bayesian reasoning and constructivism alike are founded on the belief that new information builds upon old information, which in turn informs practice and clinical decisions. Athletic training students' predisposition to be inquisitive[24] bodes well for Bayesian reasoning. Rather than working to prove or disprove a preconceived hypothesis, as in HDR, an inquisitive student can use critical thinking and develop Bayesian reasoning. If students learn how to enhance and structure their questioning they can sequentially synthesize pertinent information as they conduct the evaluation and perhaps enhance the probability they will determine an appropriate diagnosis. Students must be taught the importance of accumulating all of the evidence they can find and using it to reason through a likely diagnosis.[31]

In teacher-centered classrooms, students are often told of typical, classic presentations of injuries and illnesses,[4] after learning to complete an entire evaluation process following a linear method such as HOPS (history, observation, palpation, special tests).[5] As a result of the difficulties they face in gathering and processing information they then have difficulty connecting those presentations to real-life patient encounters.[4] Transitioning from teacher-centered classrooms to learner-centered classrooms is the beginning of addressing this deficiency. Further strategies include structured activities to enhance students' information gathering and clinical reasoning processes coupled with providing feedback directly aimed at elevating their current status. Strategies that have been proposed in athletic training and medical literature include RIME,[4] SNAPPS,[4,29] and Injury Scripts[4,28] (Table). Additional strategies are described in the Table.

RESULTS

Evidence-Based Medicine Barriers and Strategies to Overcoming Them

In a study interviewing athletic training educators, Manspeaker and Van Lunen[1] found that athletic trainers understand the importance of including the concepts of EBM in their curriculums so that students will learn to integrate research evidence into their practice. Through the application of the principles of EBM, students develop the ability to make effective clinical decisions.[1] Though educators realize the importance of utilizing and implementing EBM into their courses they have identified barriers such as time, role strain, and limited knowledge that prohibit them from effectively incorporating these concepts.[1] In the face of such challenges, Manspeaker and Van Lunen[1] suggested a "full staff approach" in confirming existing knowledge among educators, particularly those who are new to their positions, and bridging the divide between clinic and classroom applications of EBM. Five steps form the major principles of EBM: (1) Ask a question; (2) Gather evidence to answer the question; (3) Assess and evaluate the evidence; (4) Implement and apply the evidence; and (5) Determine the effectiveness of the implementation.[12]

Both educators and clinicians agree that to effectively integrate EBM concepts they need more information, specifically easy-to-use information related to research evidence and its applications.[32] Referring back to the 5 primary concepts of EBM, as previously outlined,[12] this finding speaks to the need for more focused education in both step 2, gathering evidence, and step 3, evaluating evidence. Welch et al[32] highlight a plethora of available options for accessible, synthesized information, including free Web-based resources and CATs (critically appraised topics). The strategies and activities found in the Table include those proposed by Welch et al[32] and can be used to employ applications of EBM concepts.

Providing clinicians and students with the EBM framework and increasing their knowledge does not necessarily mean they will use that framework to change their practice.[32] We must increase knowledge through the use of active learning principles that involve students in their application and use so that EBM principles are not just abstract concepts to be applied intermittently but rather concepts that guide everyday practice and decision making. Furthermore, it has been shown[32] that repeated experiences and replication are necessary to fully understand and assist in integrating EBM principles. For students this repetition can be enhanced by crossing over classroom and clinical applications. For faculty and clinicians the roles of mentor and mentee are known methods by which to enhance reciprocal learning.[33] If clinicians serve as mentors for students learning EBM they may be able to advance their own knowledge through the student. Likewise, new faculty who are mentored by more seasoned peers can gain knowledge through their interactions and assistance.

The incorporation of EBM will require athletic training faculty/preceptors to understand and teach the principles of EBM didactically and be familiar with and willing to implement the concepts into clinical practice.[32] Incorporating the principles of evidence-based practice in clinical education gives students opportunities to integrate the concepts and

Table. Active Learning Strategies and Activities

Strategies and Activities	Description	Applications
Metacognition/reflection[4,24]	"Thinking about thinking" Consideration of recent situation, critically appraising behaviors and outcomes to determine way to improve Can be used as self-reflection or with direct questioning	Critical thinking and clinical reasoning
Questioning[25,38]	Used to challenge deeper thought or connection Encourage/require student to make judgment, form cohesive response Word choice and sequencing can determine level of challenge posed by the question	Critical thinking
SNAPPS[4,29]	Specific method of delivering a patient case Summarize, Narrow, Analyze, Probe, Plan, Select Requires students to verbalize their reasoning process Includes final step of self-directed learning through selection of new learning item	Clinical reasoning
Injury/illness scripts[4,28]	Pre-constructed set of signs and symptoms used to recognize an injury or illness May increase difficulty as knowledge base increases Helps assist in pattern recognition and organization of knowledge	Type 1 learning Case pattern recognition
CATs[13,32]	Articles that outline available evidence on a specific topic Critically appraised topics Evaluation of statistical methods and significance	Critical thinking
RIME[4]	Students are categorized to a role based on their processing abilities Reporter, Interpreter, Manager, Educator Allows monitoring of developmental process Concise description of roles gives students clear goals and an understanding of her own progression	Clinical reasoning
Case studies/experiential learning scenarios[23,25]	Create situations based on real-life patient encounters or contrived circumstances Students can role play the case, perform mock evaluations, or answer guiding questions related to the scenario	Critical thinking and clinical reasoning

practice the evidence-based decision-making process while including the real-life perspective of the individual patient's case and preferences.[13] Using evidence-based clinical reasoning can be an excellent way to integrate academic concepts with clinical practice[13] and provide a link for preceptors to grow their own knowledge and skills related to the evidence-based practice principles.

Uncertainty relative to the interpretation and impact of statistics can create apprehension for clinicians who seek to apply evidence to their practice. If educators and clinicians cannot understand or apply research that is being disseminated then they will not be able to use it,[1] implement it in their classrooms, or share it with their students. Educators must not be afraid of learning methods of statistical application. Examples of utilizing sensitivity, specificity, and likelihood ratios are provided in Denegar and Fraser[34] for scenarios of medial meniscus and anterior cruciate ligament tears. Examples of using sensitivity, specificity, likelihood ratios, and confidence intervals are provided in Denegar and Cordova[35] using the Ottawa Ankle Rules. Such examples are valuable for all faculty, preceptors, and students in learning how to apply these concepts. Numerous authors[13,30,34–36] have stated that uncertainty is part of clinical practice; faculty and preceptors must not shy away from sharing that fact with students. By applying the principles of EBM, the student will realize that existing evidence is often insufficient to direct a clinical decision.[13] Perhaps through repeated exposure to a variety of clinical decision-making activities students can become accustomed to the notion of uncertainty rather than being frustrated or paralyzed by it. Educators can engage students in active learning scenarios that include finding evidence, identifying appropriate statistics, and using their findings to determine the best clinical methods. These same activities could be replicated at faculty orientations or preceptor trainings.

Strategies for Integration of Clinical Reasoning

Methods for teaching adult learners should center on active and dynamic processes, which allow the learner to be involved.[37] Communication and trust between the teacher and student are critically important as adults seek to connect their prior experiences to their current ones; this extends to the clinical education component of athletic training education programs, as both settings must integrate knowledge of competencies throughout student experiences.[37] This can be a difficult task for educators, as they have likely accumulated a lifetime of participating in teacher-directed educational experiences themselves. Managing self-directed learning requires learning a new set of strategies.[22]

For nursing educators, strategies such as creating learning objectives with student input and using case studies are

beneficial ways of implementing the constructivist approach.[14] Both clinical and classroom settings can implement constructivist strategies, which will enhance the students' abilities to make connections between the 2 areas through the incorporation of previously learned information.[15] Overlap and synthesis of the classroom and clinic will increase self-efficacy,[15] while showing students the value of each in their education.[17] Carrying classroom knowledge to clinical situations and experiencing a variety of patient situations and scenarios will better prepare the student for the real world rather than teaching one set of prescriptive techniques.[16] When classroom course instructors can coordinate with clinical course instructors to use active-learning strategies in both settings students will be become comfortable with the expectations.[14] For athletic training students, Walker[25] and Heinerichs et al[29] have both advocated the use of active learning strategies to enhance critical thinking and reasoning. The Table provides an explanation of a variety of strategies and activities promoted by various authors, including those proposed by Walker[25] and Heinerichs et al.[29] Educators can use these strategies in one course or throughout entire curriculums to develop clinical reasoning and to promote critical thinking in their students.

Teaching clinical reasoning is challenging. Rather than attempting a plethora of wholesale changes immediately faculty and preceptors would be well served to select a few to initially implement. Programmatically, leaders or administrators can create training sessions to link reasoning and processing theories with strategies to increase the understanding of these applications.[4] It is imperative to provide examples and situations in which these strategies can be practiced with both didactic and clinical faculty, building a foundation for growth and change cohesively and collegially. Furthermore, athletic training leaders could take steps similar to those taken by the American Council of Academic Physical Therapy in creating the Clinical Reasoning Curricula and Assessment Research Consortium, a group attempting to define clinical reasoning for physical therapists and attempting to determine best teaching, learning, and assessment strategies associated with it.[26]

RECOMMENDATIONS

1. Assistance must be provided for new faculty. The challenges facing new faculty, who have a lack of expertise and limited teaching experience, must not be overlooked. Incorporating aspects of adult education in faculty development opportunities will assist their learning process. Additionally, the implementation of mentoring partnerships and orientation workshops will decrease stress and anxiety for new faculty.
2. Programs must consider holistic integration and application of adult learning principles across their full curriculum and in all areas of faculty development, preceptor training, and student outcomes.
3. Educators must incorporate active learning and allow students to be self-directed. Putting students in active learning situations will engage them in challenging tasks throughout their education and require their participation in the construction of their own learning. Active learning can help students retain and build on their stores of information, increase their ability to apply the information in a variety of contexts, and stimulate their interest in being active consumers as professionals.
4. Clinicians and students alike need examples of easily identifiable evidence. The skills of gathering and analyzing evidence can be cultivated in the classroom and shared with clinicians, particularly as they relate to statistical concepts and deciphering their results. Dealing with the uncertainty and unknowns of clinical practice, particularly as they relate to research evidence, should not be hidden from students. Through the use of creative learning strategies students can be exposed to the limits of the current literature.
5. Universal integration must also be considered to bridge the gaps that exist between clinical and classroom learning. This can be accomplished through including clinicians in integrating clinical reasoning strategies and developing programmatic strategies to be standardized and implemented throughout the curriculum, both clinically and didactically.

CONCLUSIONS

Twenty years ago, in his article evaluating critical thinking, Fuller[23] described that

> *Athletic training students who graduate with the ability to analyze or synthesize situations and to evaluate criteria to improve the quality of their skills may perhaps prove more beneficial to employers, and more importantly, to the patients with whom they work.*(p246)

This is a vision for the implementation of the EBM paradigm before it came to be seen in publications. Analysis coupled with evaluation of evidence used toward achieving improvement and ultimately assisting patients is the basis of practicing EBM and of making evidence-based decisions. Sitting in a classroom and learning new information, whether that is EBM, statistics, or thinking and reasoning, does not indicate students or clinicians will apply the newly learned skills or transfer their newfound knowledge to practice. To assist in the transfer and application of skills educators must learn and use active strategies, removing themselves from the center of the classroom. New educators and seasoned faculty must adjust to this paradigm shift and gain self-efficacy by enacting active teaching styles. Overt strategies can be identified and implemented throughout curriculums to target and enhance students' abilities to organize and synthesize the information they gather from both patients and the research literature. This will allow students to form appropriate, reasoned responses to the challenges they face. The students present in the classroom today will be the educators of future generations in years to come; incorporating adult learning strategies now may enhance educational outcomes and decrease the burden of learning them in the future.

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