

# Development of a Rubric to Improve Critical Thinking

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**Context:** Health care professionals, including athletic trainers are confronted daily with multiple complex problems that require critical thinking.

**Objective:** This research attempts to develop a reliable process to assess students' critical thinking in a variety of athletic training and kinesiology courses.

**Design:** Our first step was to create a panel of professionals, faculty, students, and critical thinking specialists to create a list of desirable traits and skill sets. Next, the panel specifically examined the language used by a university's existing critical thinking rubric and considered possible modifications for the kinesiology and athletic training education programs. This process involved the creation of a team of raters who participated in a norming process.

**Setting:** University undergraduate classroom.

**Participants:** Students enrolled in a lower level anatomy class and a higher level motor learning class within the kinesiology program and a group of stakeholders.

**Outcome Measures:** To develop consistency using a norming process to examine the validity and reliability of a critical thinking rubric.

**Results:** The panel norming process for the human anatomy course resulted in an overall interrater reliability score of 94% for a low (poor) paper, 90.5% for a medium (average) paper, and 89% for a high (excellent) paper. This high reliability coefficient provided confidence that evaluations of critical thinking would be reliable. In terms of validity, the results indicated that the group assessment of critical thinking can distinguish between various papers.

**Conclusion:** Using the rubric allowed an established set of skills to be intentionally linked to critical thinking.

**Key Words:** Assessment, critical thinking, rubric, athletic training, curriculum

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## INTRODUCTION

A program director with a good grasp of athletic training education may encourage the use of methods such as evidence-based practice (EBP) and problem-based learning (PBL) to facilitate the transfer of knowledge from didactic course work to clinical education. These methods are grounded in the idea of a student's ability to think critically. The Critical Thinking Community defines critical thinking as "the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action."<sup>1</sup> Critical thinking is developed within two important components of an athletic training curriculum, clinical and didactic education. While didactic education provides general knowledge and background, clinical education's goal is to promote the student's ability to apply that knowledge. Critical thinking skills are fundamental to athletic training education, and in clinical courses they are evaluated as students learn injury assessment, diagnosis, and treatment planning. However, it is important when developing transferable "generic" skills such as critical thinking that these skills are emphasized throughout the didactic curriculum.<sup>2,3</sup>

It is clear that critical thinking is a central component of athletic training education. However, how do educators assess critical thinking? The growth of disciplinary knowledge provides pressure to teach more and more content within the classroom.<sup>2</sup> The challenge is to create a valid and reliable assessment of student skill development and learning both in the disciplinary content area and in generic transferable skills like critical thinking and written communication.

Athletic training education programs (ATEP) have long used clinical education model and considered it an essential component in the education of future athletic trainers. However, much of the foundational basis for skills needed in clinical education come from didactic courses within the academic program.<sup>4</sup> Traditionally, many ATEPs incorporate core athletic training courses with classes from a larger kinesiology-type program or other health profession education program. One challenge faced by ATEPs is how to encourage critical thinking in these shared courses, many of which might not be directly controlled by the ATEP (ie, human anatomy, biomechanics, motor learning, and exercise physiology).

Purposeful evaluation of program effectiveness is crucial in allied health and medical professions. Practitioners must be able to analyze multiple pieces of information and develop sound decisions regarding clinical care on a consistent and repetitive basis.<sup>5</sup> Creating a reliable method to assess critical thinking is an important step in developing a kinesiology or

athletic training curriculum. Traditional assessments such as final examinations are not an effective way to report student competency to potential employers. Further, these examinations are not generally designed to assess critical thinking.<sup>6</sup> One broad assessment method commonly used to evaluate student projects and writing is the rubric.

A rubric is a set of criteria and standards linked to learning objectives and used to assess a student's performance on papers, projects, essays, and other less objective assignments. A rubric is also characterized as a way to build consensus or interrater reliability among participants.<sup>7</sup> To create a valid rubric, it is important to work with stakeholders to establish standards of agreement on what they value and to strategically develop those values into a scoring tool measuring the evaluator's objectives.<sup>8</sup>

Washington State University developed a school-wide rubric to assess different levels of a student's critical thinking.<sup>9</sup> The rubric contains seven dimensions with each dimension rated on a scale from 1-6. A rating of 4 indicates competency and a rating of 6 demonstrates the highest level of critical thinking. The rubric was developed as a non—discipline-specific tool to assess general components of critical thinking. To validate the rubric, Washington State University's staff at the Center for Teaching, Learning and Technology (CTLT) developed a group process to promote the rubric's interrater reliability.<sup>3,9,10</sup> In order to make effective use of the critical thinking rubric and evaluation process, the kinesiology and athletic training education programs joined together to adapt the rubric for discipline-specific skills. Previous research has suggested that engaging stakeholders in establishing and validating a shared discourse around principles of quality provides a rich and useful way to legitimize and provide increased accountability in education.<sup>8,11</sup> Accordingly, the purpose of this article is to present the process used to develop a rubric that is useful and valid for assessing critical thinking in a variety of kinesiology courses.

The development of this tool was based on a previously validated and reliable critical thinking rubric.<sup>9</sup> The first step in the process involved using a cohort of stakeholders in the kinesiology and athletic training education programs (including faculty and students directly involved in the respective disciplines) to improve content validity by developing a list of important skills to emphasize in the rubric. This group also served as the assessment team. The second step was to use the established norming process to improve reliability for the team and rubric. The final step was to validate the rubric by assessing work from both an introductory and advanced didactic course within the kinesiology curriculum.

METHODS

Step 1: Discipline-Specific Critical Thinking Rubric

Prior to conducting the research, we received approval from the university's Institutional Review Board to pursue the project. Our first step was to create a panel of professionals, faculty, students, and critical thinking specialists to create a list of desirable traits and skill sets for students entering various kinesiology professions and athletic training. Also, the kinesiology program's assessment cohort and department chair worked closely with the CTLT staff between 2006 and 2008 to design a comprehensive plan to increase students' skills in critical thinking.

Students, faculty members, and professionals in the field formed a stakeholder community to provide feedback that was broad-based and industry-specific. The panel consisted of three professionals: an athletic trainer with eight years of experience, a physical therapist/athletic trainer with 10 years of experience, and a high school teacher/coach with 10 years of experience. In addition, the group included two students in the general kinesiology major, two athletic training students, two faculty members (athletic training and movement studies) and two critical thinking specialists from CTLT. The panel met six times over the course of a semester to discuss the critical thinking skills that would be important for graduates of the kinesiology and athletic training education programs. Because the stakeholder group did not include possible clientele for these professions, they attempted to predict desired skills from the client perspective.

After the stakeholder groups developed a list of desirable traits and skill sets for entry-level graduates (Table 1), they specifically examined the language used in the university's existing critical thinking rubric and considered possible modifications for the kinesiology and athletic training education programs. To establish content validity and create language that kinesiology users would find easy to understand and use in the assessment of student work, the panel believed it was important to incorporate within the rubric the practical skill outcomes listed in Table 1.<sup>8</sup> The panel modified the rubric's language several times during the assessment process, especially for those components of the rubric that proved less reliable than other components. This recurring process resulted in the rubric presented in Table 2.

Step 2: Norming

After the first draft of the kinesiology rubric was created, the next step was to ensure reliability of the group assessment using the CTLT's norming process. The norming process allowed panel members to develop consensus on how they rated an example of student work. For the norming process, the panel collected three papers from a first year human anatomy course required by the kinesiology and athletic training education programs. The papers were the final product of a semester long focus on critical thinking. As an example, students were given an injury situation and had to write about possible complicating factors, possible treatments, and the prognosis for rehabilitation and future physical activity.

Table 1. Desired Skills for Entry Level Graduates

Faculty	Find and assess new information
	Address audience and purpose in communication
	Content knowledge
	Professional ethics
Professionals	Good verbal skills and ability to teach
	Enthusiasm
	Strong interpersonal skills
	Interest in being active
	Holistic view of people
Students	Good communication skills
	Ability to communicate the best information
	Prepared and organized
	Content knowledge
	Experience in a variety of settings
Client	Awareness of bias
	Critical thinking
	Ability to evaluate source information
	Communicate with other professionals and clients
	Holistic content knowledge
	Positive attitude
	Open minded
	Listening skills
	Confidence

The papers had previously been graded as poor, average, or excellent; however, for the norming process, all grades and student identification were removed so that panel members were not aware of the previous evaluation. Each panel member read every assignment and scored the paper using the critical thinking rubric. In a group norming session, panel members discussed each paper and tabulated ratings from each component of the critical thinking rubric. The norming process used group discussion to pull out different interpretations of rubric dimensions in order to develop a common understanding. When the ratings were discrepant, the panel discussed potential reasons for the inconsistency and sought consensus on a final rating. Norming thus promoted interrater reliability, or uniformity, on how outcomes are identified and assessed because when the raters came to exact or nearly exact agreement, they shared a common interpretation of a given construct in the rubric.<sup>12</sup>

Data collected during the norming process included scores for all rubric dimensions for each paper and rater, mean scores for each dimension on each paper, overall critical thinking scores for each paper (means of dimensional

Table 2. Discipline-Specific Rubric

1. Identifies, summarizes, and reformulates the problem as necessary:

Emerging		Developing		Mastering	
1	2	3	4	5	6
Identification of the problem or issue is incomplete, too broad, or in error OR identifies simplistic issues.		Summarizes issue though some aspects are confused or incorrect. Relates the issue to larger context but does not include the entire scope of the context.		Identifies a focused and challenging issue or completely and clearly summarizes assigned issue. Relates the issue to the academic field and/or larger context.	
The context and impact of the issue are minimally or incorrectly reported.		Identifies some aspects of the impact.		Identifies full impact of the issue.	

2. Identifies and assesses quality of evidence/data:

Emerging		Developing		Mastering	
1	2	3	4	5	6
Limited evidence of search, selection or source evaluation.		Demonstrates adequate source searching skills.		Uses information from a wide variety of current, quality sources as well as foundational and classic sources.	
Repeats information without questioning or dismisses without justification.		Is able to summarize source accurately.		Summarizes source in a way that precisely reflects the sources' importance to the issue.	
Confuses cause with correlation. Some sources are not on topic.		Discerns fact from opinion.		Reported data and information is clearly connected to the issue or question.	
		Recognizes bias but not consistently.		Consistently identifies source of evidence and questions its accuracy, precision, relevance, and completeness.	
		Quality and relevant sources are used but may not completely cover topic.		Consistently identifies bias in the evidence.	

3. Consideration of context:

Emerging		Developing		Mastering	
1	2	3	4	5	6
Recognizes and describes only the contexts explicit in the assignment prompt.		The various assumptions and influential contexts are explored in a limited way. OR A limited number of assumptions or contexts are explored more thoroughly.		Understands and presents the influence of various contexts – social, educational, technological, political, scientific, economic, ethical – on the issue	
Does not recognize own bias or the bias of other sources.		Relies on established authorities and does not consider own biases.		Identifies the assumptions made in constructing the problem, as well as disciplinary assumptions, and their influence on the issue.	
Assumptions are stated minimally if at all.				Recognizes and describes the effects of own bias.	

4. Presentation of own perspective, hypothesis or position:

Emerging		Developing		Mastering	
1	2	3	4	5	6
Position or approach to the topic is chosen with little consideration. Includes a single or limited number of sources of data or information. Inadequately presents and justifies own opinion and/or hypothesis. Position is simplistic or unclear.		Position includes some original thinking – synthesizes or extends the research. Presents own position though not completely addressing or integrating other views. Gaps in thinking may exist.		Clearly identifies own position on the issue. Supports the position using synthesis of own experience, assumptions, and data/information including that outside of assigned sources. Clearly justifies own position and contrasts with other views or interpretations. Thinks outside the box.	



Table 2. Continued

## 5. Integrates issues using a variety of perspectives and positions:

Emerging		Developing		Mastering	
1	2	3	4	5	6
Deals only with a single perspective. Avoids challenging ideas. Misrepresents or omits other positions. Begins to connect with the real world.		Is able to discuss and integrate alternative views. May overstate conflicts or dismiss alternative views too quickly. Analysis is mostly accurate and may be incomplete. States some application to real world situations, career, and civic responsibilities.		Fully integrates ideas from multiple perspectives. Can present and justify own view or hypothesis while respecting other views. Thoroughly connects to career and civic responsibilities and real world problems.	

## 6. Identifies conclusions, implications, and consequences:

Emerging		Developing		Mastering	
1	2	3	4	5	6
Minimally identifies conclusions, implications, and consequences. Conclusions presented as absolute. Begins to explore alternative possibilities.		Conclusions consider consequences that extend beyond a single issue or discipline. May consider various points of view as equivalent. Attempts to compare and evaluate possibilities.		Fully identifies, discusses and extends conclusions and consequences. Understands that while there are different points of view, some can be more completely supported by data and logic than others. Considers consequences and implications of conclusions for future research or action. Raises new questions.	

## 7. Communicate effectively:

Emerging		Developing		Mastering	
1	2	3	4	5	6
Language obscures meaning. Grammar is distracting. Little evidence of proofing. Work is unfocused and poorly organized so that audience is lost. Few sources are cited or are cited incorrectly. Little attempt to connect with intended audience.		Language does not interfere with communication. Most use of language or presentation methods is adequate and appropriate to the audience. Errors are infrequent and not distracting. Basic organization is apparent, with transitions, although use may be clumsy. Audience may be confused at times. Most sources are cited correctly.		Needs and interests of intended audience effectively inform presenter's approach and organization. Audience seems well able to follow presentation. Communication style is appropriate to discipline, polished, professional and virtually error free. Sources are cited accurately and bibliography is complete and properly formatted.	

ratings), and reliability scores for each dimension and paper. Data collected in the validation process (Step 3) included individual and mean ratings for each dimension and paper. We continually measured interrater reliability as the panel used the rubric to assess student progress in critical thinking. Finally, to assess construct validity, we compared mean critical thinking ratings for each class to assure that, as would be predicted by content validity, critical thinking ratings were higher for the fourth year class compared to the freshman class. Reliability is defined as the ability to make repeated measures to yield the same results, while validity is defined the ability for the measure to accurately assess what is being measured.<sup>1</sup>

## RESULTS

## Discipline-Specific Rubric

The first task completed by the stakeholders was to create a list of desirable traits and skills for students entering kinesiology or athletic training professions. The trait/skill outcomes determined by the panel are listed in Table 1. Critical skills are listed by stakeholder group. Note that only the student and faculty groups mentioned content knowledge specifically. The professional group and projected client responses included more critical thinking components. The discipline-specific Kinesiology Critical Thinking Rubric

developed by this stakeholder group is displayed in Table 2. Although this rubric is based on Washington State University's critical thinking rubric, some of the language used has been simplified to accommodate better stakeholder group understanding of the various dimensions. Comparing Table 1 and Table 2 also demonstrates that many of the desired skills from Table 1 are incorporated in the rubric.

### Norming Process

The initial panel norming process for the human anatomy course resulted in high interrater reliability. Figure 1 illustrates the reliability for each rater and each paper, collapsing across dimensions. The reliability values represent how often the rater matched the group's mean ratings for each dimension. Averaging across raters, the overall interrater reliability scores were 94% for the low (poor) paper, 90.5% for the medium (average) paper, and 89% for the high (excellent) paper. These high reliability coefficients indicated that further evaluations of student critical thinking using this rubric would be reliable. Figure 2 represents the interrater reliability for each dimension of the rubric for each of the three papers. The chart suggests that the biggest problem with reliability lay with the "conclusion" dimension; therefore, the team discussed the meaning of "conclusion" within the context of the assignment and discipline.

In terms of validity, the results indicated that the group assessment of critical thinking using the rubric can distinguish between the papers receiving high and low grades, but not between low- and medium-graded papers (Figure 3). The numbers next to the column labels (eg, 24/33) indicate the grade originally assigned to each paper. The results indicated that more discussion between members of the assessment panel was needed to determine if the rubric criteria needed revision. It is also possible that the instructors' grading metrics needed revision, or a combination of the two issues was needed.

Figure 1. Percent Agreement by Rater by Paper for MVTST 262 Norming

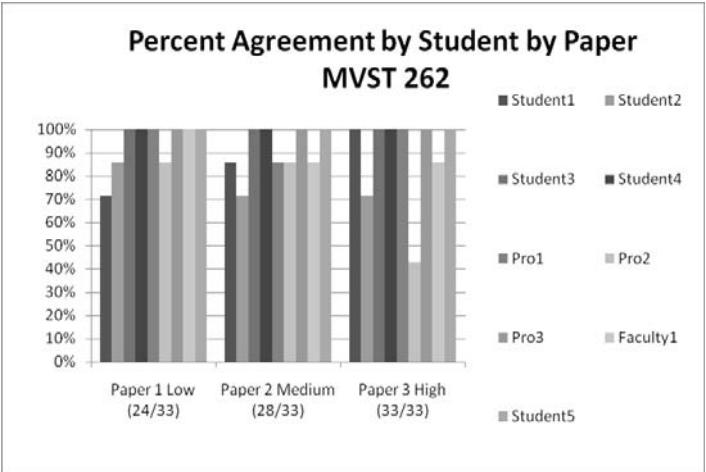
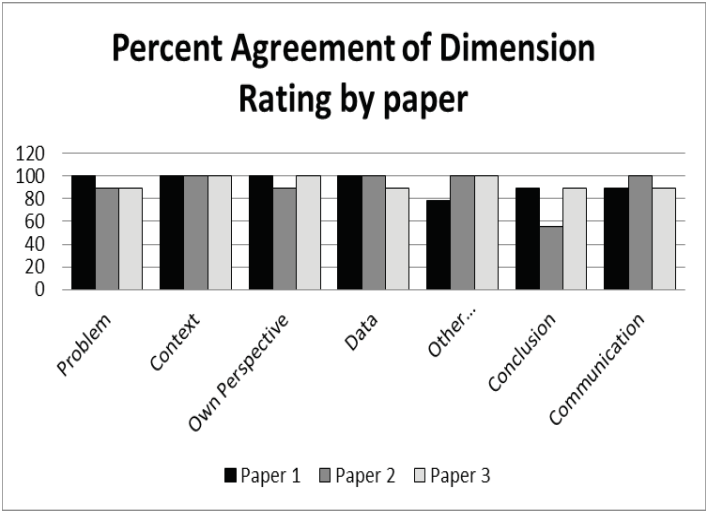


Figure 2. Reliability of Dimension Rating for Each Paper in Human Anatomy.

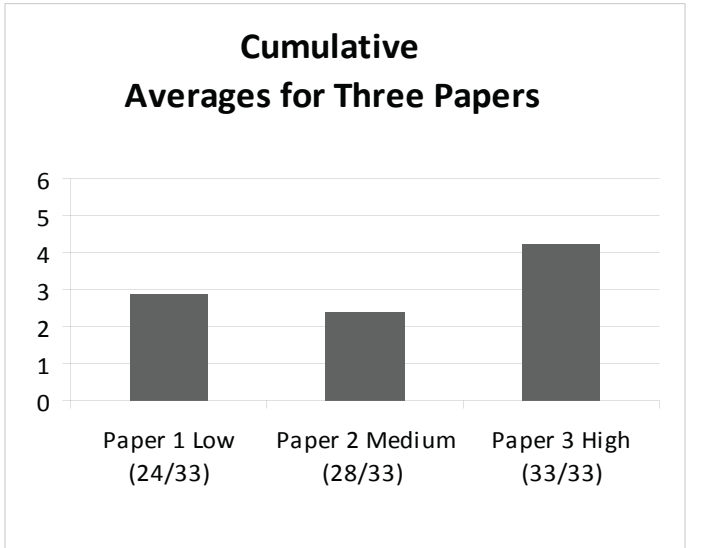


### Critical Thinking Development and Rubric Validity

As a third step in the process, we assessed critical thinking for multiple students in two general kinesiology classes. Figure 4 presents the percent agreement between raters for each dimension with the human anatomy course. Figure 5 presents the percent agreement for the upper division motor learning and control course. Percent agreement ranges between 65% for the "conclusion" dimension (both courses) and the "other perspectives" dimension (motor learning and control) to 90% for the "context" dimension (human anatomy) and the "own perspective" dimension (human anatomy).

For those dimensions with the lowest rater agreement, the assessment team discussed the rubric language and made adjustments to be tested in the next round of evaluations. Overall, agreement between raters on the assessment team averaged 80% for the two courses. This level of agreement between stakeholders is extremely high compared with other departments who have completed this process with the CTLT.<sup>11,13</sup> Based on the results of the norming process

Figure 3. Validity of Norming Process for Human Anatomy



used in steps 2 and 3, the panel members were able to develop consensus on the language within the rubric. Figure 6 illustrates that group consensus was very strong in determining critical thinking differences between students in an introductory course (human anatomy) and students in a higher level course (motor learning and control).

DISCUSSION

The primary goal for this project was to discuss the process used to develop a valid and reliable rubric to assess critical thinking within didactic courses. The first step involved engaging stakeholders to be a part of the assessment process for critical thinking. Including professionals from the field not only provided a method to validate the assessment using the rubric, but it also provided the opportunity for professionals to be connected to the education of potential future employees.<sup>8</sup> In 2006, the Conference Board, Corporate Voices for Working Families, Society for Human Resource Management and the Partnership for 21st Century Skills conducted a nation-wide survey to look at how employers felt about the education system of the United States and its ability to prepare students to enter the workforce. The survey found that employers placed critical thinking in the top 5 applied skills needed; however, they ranked the ability of recent graduates to think critically at number 11.<sup>8</sup>

Table 1 provides the list of traits and skills that the stakeholder group thought was important for students entering health care professions. The differences between what each stakeholder deemed important allowed the panel members to discuss how to merge the skills into improved marketability upon graduation.<sup>8</sup> Many of the skills listed in the table were not necessarily taught in the traditional classroom setting. One way to address these somewhat intangible skill sets may be through internships, clinical education opportunities, service learning, and community-based projects.

The second goal of this project was to adapt an existing general rubric to be discipline specific for the kinesiology and athletic training education programs. Using the skill sets developed by the stakeholder group, the rubric was modified to contain the skills that the stakeholders listed as important for graduating students. In addition to the discussion among the stakeholders, we examined previous research on how

Figure 4. Percent Agreement by Dimension and Overall Average Rating for Human Anatomy Papers

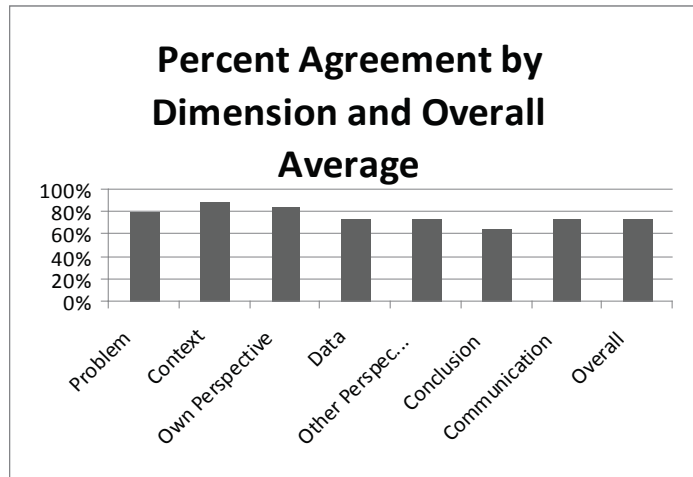
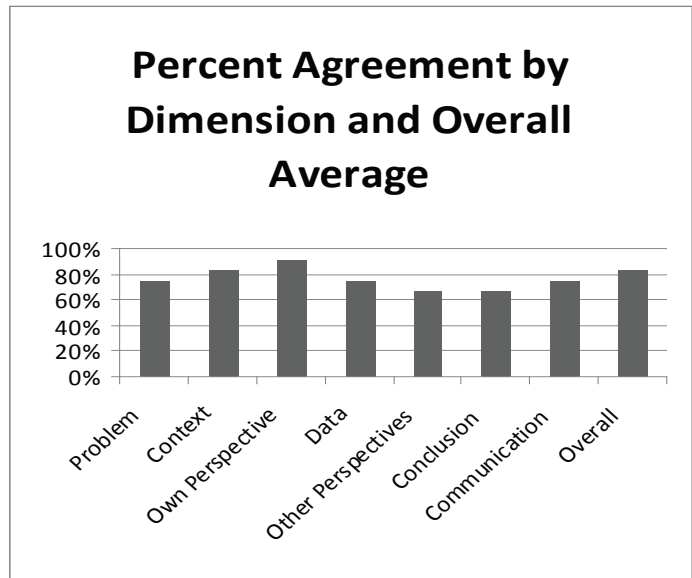


Figure 5. Percent Agreement by Dimension and Overall Average Rating for Motor Learning Papers.

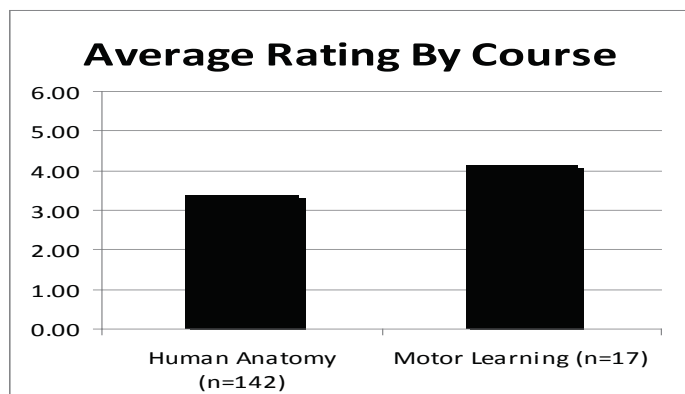


instructors in the health professions teach critical thinking.<sup>3</sup> Our review found that effective teachers facilitate the development of critical thinking skills when they purposefully implement learning activities that have authentic real-world contexts and personal relevance to students.<sup>14</sup> Critical thinking must be intentionally taught: It does not happen by accident. Thus, using this process will evolve into ways to create and evaluate assignments that teach critical thinking.

The development of a rubric to assess critical thinking by students in athletic training and kinesiology majors was important since all classes may not have the same focus on critical thinking. In athletic training, one of the main goals of both didactic and clinical education courses is to create a practitioner who can critically examine a situation. Most core courses in athletic training are taught by former or current practitioners from health care fields. These practitioners should teach students to follow the same template, analyze similar pieces of information, and then compare data from their own previous experiences before arriving at a decision. This clinician has the ability to generate alternative theories or solutions to solve a particular problem, which distinguishes him or her from a merely competent peer.<sup>5</sup> Future practitioners must be able to analyze multiple pieces of information and develop a sound decision regarding clinical care on a consistent and repetitive basis.<sup>5</sup> General kinesiology courses are not necessarily taught by practitioners. These instructors may not appreciate the need for a student to follow a prescribed template, conduct an efficient and orderly evaluation, and think critically to arrive at possible solutions. These instructors may be competent, but the barrier that keeps them from success and expert status may be the ability to promote critical thinking.<sup>5</sup>

The third goal of this research was to develop a reliable process for assessing critical thinking using the rubric. Using the rubric allowed an established set of criteria and standards to be intentionally linked to a set of learning objectives. Once reliability has been established, the rubric

Figure 6. Group Consensus of Average Score for Each Course



can be used to assess a student's performance on papers, projects, essays, and other assignments. A high quality rubric has three essential features: evaluative criteria, valid definitions, and a scoring strategy.<sup>7</sup> Criteria in a rubric specify the characteristics of a learning outcome at different levels of achievement. A rubric promotes a sense of shared expectations among students, faculty, and professional communities, and is an indispensable component of ongoing reflection and improvement. It evolves based on input from stakeholders and the continuing refinement of learning goals. When the targeted outcomes are shared in a rubric and incorporated into course design programmatically, students experience a more uniform and recursive focus on these outcomes throughout the program and, therefore, they are more likely to achieve them.

Figure 6 provides evidence that the discipline-specific rubric is a reliable assessment method. The student members of the group found the rubric helpful in developing, revising, and judging their work. The students felt the rubric provided a reference point to consult repeatedly as they monitored their own learning and developed the skill of self-assessment. For the instructors within the kinesiology and athletic training education programs, the rubric encouraged the development of a coherent curriculum that integrated the course, department, and college around uniform and clearly identified goals. It helped support systematic organization and assessment of curriculum using criteria that characterized quality learning and aligned program assessment with professional standards. Finally, the rubric helped guide faculty decisions about curriculum, course, and assignment design. It also informed teaching practices and clarified expectations.

#### Relationship to Evidence-based learning

As the athletic training curriculum moves to EBP, it will be important to assess how a student critically thinks. The five steps in EBP<sup>15</sup> are nicely linked to the seven dimensions within the rubric provided here. The first step in EBP is for a student to ask a clinical question, which aligns with the rubric's first dimension to identify, summarize, and reformulate the problem as necessary. The second step of EBP is to research the best evidence, which aligns with the rubric's second dimension to identify and assess the quality of evidence or data. The third EBP step is to critically evaluate

the validity, impact, and applicability of the evidence, while the fourth step is to apply the evidence to the clinical problem in context. These steps are covered in dimensions 3-5 of the rubric. The final step in EBP is to evaluate the effectiveness of previous steps and seek ways to improve the evaluation and treatment. This last EBP step is covered in dimension 6 of the rubric, and then the 7th dimension of the rubric is overall communication including grammar and organization.

#### Future Considerations

Once the rubric is consistently used to evaluate critically thinking in individual courses, it can be applied to a program-wide assessment. As accreditation agencies and universities place a larger emphasis on accountability and assessment outcomes, it will be necessary for programs to develop ways to demonstrate their desired outcomes. If critical thinking is not intentionally and deliberately addressed within courses, it will not happen.<sup>3</sup>

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