MTI 647: Sports Biomechanics

FAST PASS DISTANCE COURSE FOR ANDREWS UNIVERSITY

Instructor Information:	
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Course Information	
Course Format (distance learning, online, webinar, experiential onsite courses):	**Distance Course** Once you have registered for this course, you can immediately begin working. This is the syllabus for the course, and all materials needed can be found at the bottom of this syllabus under "Course Materials" or via your own research on the topic. Approximately 135 hours of instructional time is devoted to this course. Please see rubrics below for assessment and grading criteria. MTI Instructor will evaluate, grade, and process your final work within 7-10 business days of receiving it. Grades will be posted within 14 days and a grade report via email will be sent to the student. ALL questions, customer service, grades and transcript questions are to be directed to MTI, **NOT ANDREWS UNIVERSITY** for this course. All distance courses allow you to work at your own pace as your schedule permits. All coursework is due within **one year** of the registration date. If you need more time due to unforeseen circumstances, please contact MTI at the address provided above to request an extension.
Formatting Requirements	All assignments should be included in the same document. Please do not submit separate documents for each portion of the course. The first page of your submission should include the following information: • Name

	• Home address • Email address • School district name, address • Date of submission All following assignments must be submitted in the same order as they appear on the syllabus. Please name your document with your course number and full name (ex. 500JohnSmith). You may submit a Microsoft Word document or a Google document (if using Google, please make sure to allow the grader to comment on the assignments). Any missing assignment will be treated as a zero. On the document, include a link to the assignment as required (*example, a Google form wouldn't post well onto the Google doc, so share a link to the form for us to see and grade*). Once you have completed all of your assignments, please submit them to grades@midwestteachersinstitute.org to be graded by your instructor.
Prerequisites and Credit Limits	All MTI courses are designed for educators who have a minimum of a bachelor's degree and professional educator license. Prior to beginning the course, check with your district office to ensure that credit will be accepted for salary increase and professional development. All courses are for 3 graduate semester hours (credits).
Course Materials	Resources provided for this course can be found towards the bottom of this document in the section labeled **Course Materials**.

Learning Outcomes/Competencies:
At the completion of this course, the learner will be able to:

1. Understand biomechanical concepts and their application to sports movement and performance.. InTASC 4
2. Apply biomechanical analysis to evaluate and improve sports techniques and equipment design. InTASC 5
3. Develop evidence-based strategies for injury prevention and performance enhancement in sports settings. InTASC 7
4. Utilize current technology and software in the analysis of movement and designing training programs. InTASC 6

Course Description: This course explores the application of biomechanical principles to sports and exercise. Students will gain a foundational understanding of how the human body responds and adapts to physical activity. The curriculum covers the analysis of movement, the mechanics of injury, and strategies for performance improvement. Through theoretical knowledge and practical application, students will learn to optimize athletic performance, reduce injury risks, and apply biomechanical principles in coaching and sports science settings.

Learning Strategies: Personal reflection, individual assignments (applications, research projects and evaluation essays).

Experiential Learning Opportunities: Educators will use this course to develop strategies and

techniques to provide meaningful responsibility-based instruction that promotes personal and social well-being.

Assessments		Approximate contact hours for each assessment
Resources and reflection time		35 hours
Resource questions	90 points	12 hours
Studying (time to reread and take notes)		8 hours
Applications- 2 @ 45 points each	90 points	12 hours
Journaling of field experience in the classroom implementing concepts from the course with students and fellow teachers.	60 points	33 hours
Action research project	100 points	14 hours
Research on sports biomechanics teaching strategies		7 hours
Final evaluation essay	100 points	14 hours
Total points possible	**440 points**	**135 hours**

Grading Scale: A (90-100%); B (80-89%)
Anything below a B will not receive graduate credit and receive a failing grade of F.
If you do not receive a B or higher, your work will be returned to you for further correction and completion. You will be allowed one (1) re-submit to your instructor to achieve a grade of B or higher. If after your re-submit, you still do not achieve a B or higher you will receive a failing grade of F and therefore forfeit the 3 graduate credits.

Resource Question Rubric- 10 questions @ 9 points each			
Category	**Superior (3 pts)**	**Sufficient (2 pts)**	**Minimal (1 pt)**
Supporting Evidence in Practice ***___/3***	Response shows strong evidence of ideas and insights from this course and how they are applied to the classroom.	Response shows evidence of ideas and insights from this course and how they are applied to the classroom.	Response shows some evidence of ideas and insights from this course and how they are applied to the classroom.
Accuracy ***___/3***	All supporting facts and statistics are accurately represented.	Almost all supporting facts and statistics are accurately represented.	Some of the supporting facts and statistics are accurately represented.
Grammar and Spelling ***___/3***	Response includes 0-1 mistakes in grammar or spelling.	Response includes a few grammar and spelling mistakes.	Response includes several grammar and spelling mistakes.

Application Rubric-2 assignments @ 45 points each			
Category	**Superior (15-13 pts)**	**Sufficient (12-10 pts)**	**Minimal(9-7pts)**
Supporting Evidence in Practice ___/15	Response shows strong evidence of ideas and insights from this course and how they are applied to the classroom.	Response shows evidence of ideas and insights from this course and how they are applied to the classroom.	Response shows some evidence of ideas and insights from this course and how they are applied to the classroom.
Accuracy ___/15	All supporting facts and statistics are accurately represented.	Almost all supporting facts and statistics are accurately represented.	Some of the supporting facts and statistics are accurately represented.
Grammar and Spelling ___/15	Response includes 0-1 mistakes in grammar or spelling.	Response includes a few grammar and spelling mistakes.	Response includes several grammar and spelling mistakes.

Journal Rubric- 10 journal entries @ 6 points each			
Category	**Superior (3 pts)**	**Sufficient (2 pts)**	**Minimal (1 pt)**
Supporting Evidence in Practice ___/3	Response shows strong evidence of ideas and insights from this course and how they are applied to the classroom.	Response shows evidence of ideas and insights from this course and how they are applied to the classroom.	Response shows some evidence of ideas and insights from this course and how they are applied to the classroom.
Grammar and Spelling ___/3	Response includes 0-1 mistakes in grammar or spelling.	Response includes a few grammar and spelling mistakes.	Response includes several grammar and spelling mistakes.

Project Rubric- 100 points			
Category	**Superior (20-18 pts)**	**Sufficient (17-16 pts)**	**Minimal (15-14pts)**
Understanding of web tool ___/20	Shows strong understanding of activity, concept, or tool and maximize learning	Shows adequate understanding of activity, concept, or tool and benefit learning.	Shows little understanding of activity, concept, or tool and may not benefit learning.
Practical evidence ___/20	Shows strong evidence of ideas and insights gained from this course and how they are applied to classroom.	Shows evidence of ideas and insights from this course and how they are applied to classroom.	Shows little evidence of ideas and insights from this course or how they are applied to the classroom.
Completion ___/20	Completed in a thoughtful and meaningful manner.	Completed, but with minimal quality.	Not all projects are completed and of those that are, some are minimal quality.

Grammar and Spelling ___/20	Includes no mistakes in grammar or spelling.	Includes few grammar and spelling mistakes.	Includes numerous grammar and spelling mistakes.
Sequencing ___/20	Sequenced, showing if-then thinking and the logical order required to complete skill, solve problem, or use tool.	Not always sequenced, showing incomplete if-then thinking and understanding of logical order required to complete skill.	Confusing making it difficult to replicate activities; little understanding of logic or if-then thinking evidenced.

Evaluation Rubric- 100 points				
Category	**Superior (20-17 pts)**	**Sufficient (16-13 pts)**	**Minimal(12-9pts)**	**Below Standard (8 pts)**
Supporting Evidence in Practice ___/20	Response shows strong evidence of ideas and insights from this course and how they are applied to the classroom.	Response shows evidence of ideas and insights from this course and how they are applied to the classroom.	Response shows some evidence of ideas and insights from this course and how they are applied to the classroom.	Response shows little evidence of ideas and insights from this course and there is little evidence they are applied to the classroom.
Accuracy ___/20	All supporting facts and statistics are accurately represented.	Almost all supporting facts and statistics are accurately represented.	Some of the supporting facts and statistics are accurately represented.	Many of the supporting facts and statistics are inaccurately represented.
Grammar and Spelling ___/20	Response includes 0-1 mistakes in grammar or spelling.	Response includes a few grammar and spelling mistakes.	Response includes several grammar and spelling mistakes.	Response includes numerous grammar and spelling mistakes.
Logical Sequencing ___/20	Response is written in a clear, concise, and well organized manner. Thoughts are presented in a coherent and logical manner.	Response is mostly clear, concise, and well organized. Thoughts are presented in a coherent and logical manner.	Response is somewhat unclear and/or disorganized. Some thoughts are presented in a coherent and logical manner.	Response is mostly unclear and/or disorganized. Many thoughts are presented in an incoherent and illogical manner.
Reflection ___/20	Response demonstrates an in-depth reflection on, and personalization of, the theories, concepts, and /or strategies presented in this course.	Response demonstrates some reflection on, and personalization of, the theories, concepts, and /or strategies presented in this course.	Response demonstrates a minimal reflection on, and personalization of, the theories, concepts, and /or strategies presented in this course.	Response demonstrates no reflection on, and personalization of, the theories, concepts, and /or strategies presented in this course.

Course Assignments

Resource Questions: Read, view, and Reflect (90 points)

Each question is designed to get you thinking about the concepts explored in the resources. As you engage with the resources, use the questions to help you reflect and determine how the information can be related to your current work. Each response is expected to be one paragraph or more. *(Note: some resources may provide information that impacts other resource groups as well. These are simply suggestions to help with resource questions).*

1. How do the principles of leverage apply to the biomechanics of weightlifting movements? **Resource group 1.**
2. Discuss the role of the stretch-shortening cycle in plyometric exercises. **Resource group 7**.
3. Analyze the biomechanical differences between sprinting and long-distance running. **Resource groups 1 and 7**.
4. How does joint stability contribute to injury prevention in contact sports? **Resource group 7**.
5. Explain the importance of torque and angular momentum in gymnastics or diving. **Resource group 4.**
6. Evaluate the effects of different surfaces (e.g., turf vs. grass) on athletic performance and injury risk. **Resource group 6**
7. Describe the biomechanical factors contributing to overuse injuries in athletes. **Resource group 7 (plus 2 and 5).**
8. How do footwear design and material affect athletic performance and injury prevention? **Resource group 6.**
9. How does the conservation of momentum influence the outcome of collisions between athletes in contact sports, and what strategies can athletes use to minimize injury during such impacts? **Resource group 3**
10. How do Newton's Laws of Motion explain the forces involved when an athlete accelerates, decelerates, or changes direction during sports activities? **Resource group 2.**

Application #1: Movement Analysis Project

Analyze the biomechanics of a specific sports movement or technique, focusing on efficiency and injury prevention. Share your findings in a presentation, lesson plan, or short essay.

Application #2: Performance Enhancement Project

Develop a plan to enhance athletic performance for a specific sport, integrating biomechanical principles and technology.

Journal entries

Journals are designed to demonstrate that students are reflecting on and implementing concepts and strategies in their own education settings. Journal entries are to be roughly 2-3 paragraphs each. Students are expected to complete 10 entries over the course of the class. You may use the same type of journal entry more than once. Make sure to include some examples of what you have

actually done to support your thoughts whenever appropriate. Some examples of acceptable journal topics include:

- How has what you learned about a strategy/topic changed the way you think?
- What were the results of trying something new that you learned in class, and how could you improve it next time?
- Reflections on conversations you had with students, colleagues or administrators about what you have learned.
- Research you've discovered on a topic and how it complements or contradicts what the author says.
- These are a few examples, but any journal entry along these lines is acceptable. Remember that you can use the same journal topic more than once to examine different concepts or strategies, or even to examine different impacts on multiple types of classes.

Research project: Emerging Technologies in Sports Biomechanics
Investigate a current technology or method used in sports biomechanics. Write a 1-2 page paper on its applications, benefits, and limitations.

Evaluation assignment
Reflect on the integration of biomechanical principles in sports science, including the implications for athlete performance, coaching strategies, and ethical considerations in the use of technology.

Summarize your findings in a 3-5 page essay.

*This course structure aims to provide students with a thorough understanding of sports biomechanics, preparing them for careers in sports science, coaching, and related fields by emphasizing practical application, critical thinking, and ethical considerations.

End of Course Survey
Now that you are finished with this class, please take the time to help us improve our product. In order to make sure that we are providing the best possible service, please take our **survey**. We appreciate your help and your commitment to the profession.

Course Resources

The following is a list of resources that can help you facilitate this course. You may need to do some extra research on your own to complete all assignments for this course. Some content in the categories is general for the topic, some is specific for that category.

Resource Group 1: Basic Motion Concepts: Position, Velocity, Acceleration, Angular Aspects, and Projectile Motion
Video

Biomechanics and Muscle Leverage
Article
Unlocking Human Potential
Video
The Right Hand Rule for Angular Velocity and Acceleration
Research
Angular Velocity and Acceleration
Video
Introduction to Projectile Motion
Article
Projectiles in Motion
Video
Lifelong Running: Sprint vs Distance Mechanics

Resource Group 2: Newton's Laws
Article
Applying Newton's Laws
Video
Newton's Laws
Article
Newton's Laws of Motion-Knowledge for Personal Trainers and Coaches

Resource Group 3: Momentum and Collisions
Video
Collisions: Crash Course
Course chapter
Linear Momentum and Collisions
Article
Colliding Skillfully: Preparing Female Athletes for Collision Events
Video
Making Sense of Newton's Laws with Vertical Jump Force

Resource Group 4: Rotational Concepts: Torque, Angular Kinetics and Momentum Conservation
Article
Rotational Movements in Sports (e.g. Gymnastics, Diving)
Video
Moment of Science: Olympic Physics-Gymnastics
Article
The Science of Hockey: Physics Principles at Play on the Rink
Video
Science of Sport-Baserunning and Angular Momentum

Resource Group 5: Work and Energy
Video
Work and Energy
Video
Work, Energy, and Power: Crash Course Physics

Resource Group 6: Fluid and Surface Dynamics: Friction, Fluid Dynamics, Hydrodynamics, The Magnus Effect
Article
Spin and the Magnus Effect
Article
Comparing Injury Risks on Artificial Turf and Natural Grass in Sports
Article
Sports Field Surface and Injury Risks: Grass vs Turf is Just the Beginning
Article
How Proper Footwear Can Prevent Sports Injuries
Video
How Running Shoes Can Prevent Injury
Course
Footwear Biomechanics and Design

Resource Group 7: Body Movement Applications: Kinetic Chain, Gait (Walking and Running)
Video
Stretch Shortening Cycle Explained
Article
Stretch Shortening Cycle (SSC)
Article
Flexibility, Mobility, Stability, and Injury Prevention
Article
The Link Between Mobility and Injury Prevention in Athletes
Video
A Physio's Guide to Joint Stability
Article
The Role of Gait Mechanics in Predicting Running Injuries
Article
Understanding Muscle Imbalances

Resource Group 8: Application of Biomechanics
Research Paper
Overuse Injuries, Overtraining, and Burnout in Young Athletes
Article
Simplifying the Science of Movement

The ten INTASC standards are listed below. Specific standards for knowledge, dispositions, and performances accompany each principle, but space does not permit listing them below. For a complete copy of the INTASC standards, contact Jean Miller, Director of INTASC, Suite 700, One Massachusetts Avenue NW, Washington DC 20001-1431.

The InTASC Model Core Teaching Standards (April 2011)

The Learner and Learning

Standard #1: Learner Development
The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard #2: Learning Differences
The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard #3: Learning Environments
The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Content Knowledge

Standard #4: Content Knowledge
The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.

Standard #5: Application of Content
The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Instructional Practice

Standard #6: Assessment
The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Standard #7: Planning for Instruction
The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross- disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Standard #8: Instructional Strategies
The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Professional Responsibility

Standard #9: Professional Learning and Ethical Practice
The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard #10: Leadership and Collaboration
The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

STUDENT LEARNING OUTCOMES (SLOs):
This course addresses the following student learning outcomes to the degree shown in the table. Degree Addressed is rated according to the following scale:

1=Basic, 2=Developing, 3=Proficient, 4=Advanced

Student Learning Outcome	Degree Addressed
1. Demonstrate growth in content knowledge related to teaching assignment and the application of content knowledge to classroom instruction and assessment.	3
2. Understand scientifically-based practices in teaching and learning, including strategies in literacy education, instructional technology, differentiation of instruction, and apply them to raise student achievement.	2
3. Demonstrate multiple means of assessing and evaluating student learning and use them to change teaching and learning.	2
4. Locate, interpret, synthesize, and apply educational research in best practices in teaching.	2
5. Understand models for professional change, including teacher collaboration, professional learning communities, strategies for mentoring and coaching to facilitate change, and effective professional development.	1
6. Demonstrate understanding of reflective practice that results in improved classroom teaching and learning, including teacher reflection, use of technology in self-assessment, collaboration for change, and self-management of change.	2
7. Demonstrate understanding of system and organizational change in education, including models for school change and current research and trends in school change.	1

8. Demonstrate responsibility for student learning at high levels.	3
9. Demonstrate responsibility for school reform and leadership in school change.	1