EDUCATION 333P: Science and Technology Curriculum and Methods

Spring 2010/ 3 CREDITS
Taken Con-currently with Language Arts Methods and Behavior and Classroom Management

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Welcome to Science and Technology Curriculum and Methods! This course is designed to give you a firm theoretical base for practical methods of planning and teaching science in the elementary schools. The basis of scientific inquiry is questions. This course will challenge you to question yourself, your attitudes, learning and teaching, and the learning of your students. This course will give you the opportunity to put theory learned into practice through analysis of professional journals and activities that correlate with the material that is being taught. We will be working from the premise that education is a career that involves complex problem solving. In addition, you will be involved in a one-week field experience which will allow you to teach a science unit that integrates language arts objectives in a neighboring school district.

Contacting Me:
My goal is to be available to help you. I will keep regular office hours and will be in my office frequently so feel free to stop by and see me any time. However, as a student teacher supervisor, I will need to out in schools at a variety of times so you may want to call ahead to arrange a meeting time. You may call me at any of the numbers listed; however, please limit calls to the home number to between 9AM and 10 PM.

Required Materials:
- Project Wild materials from the Iowa DNR (these will be purchased in class)
Course Description:
Prerequisite: completion of teacher education block I. Introduces students to a wide variety of teaching strategies and methods in elementary science and will highlight methods of meaningfully integrating technology in the elementary curriculum. Students will be exposed to sound educational philosophy, research and experiences, which can be implemented in the science classroom. Hands-on laboratory experiences and integration of technology will be stressed. Designed for students seeking K-6 licensure.

Education Department Goals and Competencies:
This class is designed to give you the tools and experiences necessary to meet the following education department goals and competencies:

Goal Two: “Uses and models effective communication skills, thinking skills, and creative expression.”

Competency 2.30: “Facilitates students’ development of communication skills, thinking skills, and creative expression as a basis for instruction.”

Goal Five: “Plans and implements learning activities that incorporate a variety of instructional and assessment strategies that are equitable, adaptable, and a reflection of best practice in education.”

Competency 5.30: “Designs effective instructional plans using a variety of methods and strategies.”

Competency 5.31: “Selects, constructs, and uses a variety of instructional assessment strategies to meet the needs of individual students.”

Each competency stated above (2.30, 5.30, and 5.31) requires an artifact from this class along with a cover sheet explaining how this artifact demonstrates your competency. Most of you will chose to use the units you plan, implement and assess as part of the Block II teaching experience to fulfill these competencies. However, it is your choice and you may select other artifacts to meet these competencies. The artifact must be appropriate for the competency and the explanation of the artifact must demonstrate your competency at least the 80% or higher level in order to pass the class. The template for the cover sheet can be found in course materials on Blackboard.
Course Objectives:
This course is designed to meet the National Standards for pre-service teachers and students in science methods are expected to be familiar with and use the NRC National Science Education Standards, the AAAS Benchmarks, and the essential learnings from the Iowa Core Curriculum. Links to the national standards, benchmarks, and Iowa Core are found on the course Blackboard Site.

In order to best meet National Standards and Benchmarks for pre-service teachers and the Central College SLO’s and measures, course objectives have been created. After completing Science and Technology Curriculum and Methods, the student will:

- Understand the recent trends in science education policy and goals.
- Effectively use a variety of strategies that promote science literacy.
- Use science content correctly in structuring a unit and lesson plans.
- Create unit and lesson objectives that are descriptive and measurable.
- Use the NSES standards, AAAS benchmarks, and the Iowa Core to create developmentally appropriate units and lessons.
- Design science lessons and units that are developmentally appropriate and sensitive to the learning styles, needs, and interests of a diverse group of students.
- Develop effective questioning techniques and construct assessment plans that are compatible with teaching goals and methods and that allow for multiple ways of representing knowledge.
- Use diagnostic observation skills, instructional strategies, and classroom management techniques to promote science learning in small group or whole-class settings.
- Establish rules and procedures that ensure the physical safety of children.
- Evaluate and use technology to support meaningful learning.
- Understand the organizations and resources that serve the professional development of elementary science teachers.
- Synthesize and implement research on teaching and learning as related to science and technology.
- Recognize the importance of reflection in professional development.

Students will demonstrate the following dispositions that are essential for successful teachers and for continuation in the teacher-prep program at Central.

- The teacher believes all students can learn.
- The teacher respects all people and values diversity.
- The teacher values the profession and exhibits behaviors that enhance the profession
Course Assessments and Requirements
To meet the standards, goals and objectives

1. Competencies Verification - cover pages will be submitted by each student for competency verification. **The cover sheet template is in course materials in Blackboard.**
2. Tests – you will take one test in this course. The purpose of this test is to make sure you are keeping up with the readings and that you have an understanding of the history, terminology, and policies involved in science education. The test may cover material from the textbook that is not specifically addressed in classroom lectures or discussions. The test may also cover information from guest speakers and may be any combination of multiple choice, matching, true/false, short answer or essay.
3. Test Questions - Looking at chapter ____________, it is your job to analyze the material in the chapter, any associated powerpoints, readings, handouts, and classroom activities and to design an excellent college-level test for your peers. Your entire class will be embarking on a learning adventure (aka exam). Your tests will serve as a study guide for your class and I will take some of the items from your “mini-tests” and add them to mine for the overall class exam.

Here are your guidelines:
- The items should “test” the most important concepts in the chapter. The items should require your students to think at various cognitive levels (some lower-level recall-type items, some understanding and application-type items, and some analysis and synthesis items).
- Your test must contain 15 multiple choice, true/false or matching items AND 2-5 short-answer questions (total of 10 points for short-answer so make as many as you need, worth as many points as are reasonable, to equal 10 points)
- The test should be written in a “test format” – directions, etc.
- Your answer key must include correct answers and for short answers must include HOW you will assign your number of points to each item.
4. Science Misconceptions Analysis– Locate 7-10 common misconceptions for your unit topic or a topic that is of particular interest to you. Address why they are misconceptions, discuss how students might have these misconceptions, and provide specific ways (besides just telling them – that works but you need to other ways as well) to help students come to the correct conception. This should be carefully written and provide a detailed discussion.
5. Wiki/Webpage – you will create a wiki or a webpage to share science content and ideas with other teachers, students, and parents/guardians.

The Wiki/Webpage should be interesting as well as informative. Pictures and Color make this assignment much more fun! You should have at least four separate sections:

- About Me – a description of yourself, your teaching philosophy, etc.
- Sites for Students – At least 25 science-based web sites that students can use as a part of classroom instruction or as homework
- Sites for teachers or parents/guardians – At least five websites that are science resources or references for teachers to use in the class or for parents/guardians to use at home with their children
- Two professional journal articles that were not part of the class reading assignments (please also include a copy of the article) that give information about science or science teaching.

These sections should be written in the form of an annotated bibliography. Each annotation should which includes a summary of website, resource, journal, etc. and a description of how the website/journal can be used. Please only select materials that you consider of high quality and that you would use with your own students.

6. Pella Focused Observation – you will observe science in a 5th grade classroom and complete at least 2 focused observations and write a reflection based on those observations.

7. Science Unit Plan – you will receive by random assignment a grade level and a topic for teaching. You will use national standards, AAAS benchmarks, and the Iowa Core to develop a unit plan to teach this topic. You will show you can use the planning process to develop effective lessons focusing on the characteristics of effective teaching. **You should use the unit plan template that are in course materials in Blackboard. The scoring rubric can also be found in course materials.**

8. Field Experience – the field experience enables you to observe and interact with students and teachers, to develop and teach science lessons, and to reflect upon the effectiveness of curricula and methods explored in course readings and class discussions. In pursuing the field experience, bear in mind that you are expected to be professional and to reflect upon and learn from your teaching, not to prepare or teach perfect lessons (stop worrying perfect lessons don’t really exist!).

- Unit Plan/ Daily lesson plans – you and your partner(s) will prepare a week of science lessons that address a science concept and that incorporate language arts objectives. You must discuss this assignment with your cooperating teacher and agree upon a topic for science lessons. Once a topic has been approved by your cooperating teacher, each of you will type and submit three copies of your unit to me by _______________. **The unit plan and lesson plans should follow the template found in course materials (Block II experience) on Blackboard.**

- Field Experience Daily Reflections – the daily reflections are an opportunity for you to integrate theory and practice in a coherent whole. The reflections should help you to explore tensions between practical and formal knowledge, conception and reality, and action and reflection. It should also help you manage these tensions and learn how reflection can play a role in professional practice.
<table>
<thead>
<tr>
<th>Competencies</th>
<th>Course Objectives</th>
<th>Course Topics/Themes/Focus</th>
<th>Assessment</th>
<th>Skills/Dispositions</th>
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<tbody>
<tr>
<td>2.30 Facilitates students’ development of communication skills, thinking skills, and creative expression as a basis for instruction.</td>
<td>1. Understand the recent trends in science education policy and goals. 2. Effectively use a variety of strategies that promote science literacy. 3. Use science content correctly in structuring a unit and lesson plans. 4. Create unit and lesson objectives that are descriptive and measurable. 5. Design science lessons and units that are developmentally appropriate and sensitive to the learning styles, needs, and interests of a diverse group of students. 6. Develop effective questioning techniques and construct assessment plans that are compatible with teaching goals and methods and that allow for multiple ways of representing knowledge. 7. Use diagnostic observation skills, instructional strategies, and classroom management techniques to promote science learning in small group or whole-class settings. 8. Establish rules and procedures that ensure the physical safety of children. 9. Evaluate and use technology to support meaningful learning. 10. Understand the organizations and resources that serve the professional development of elementary science teachers. 11. Synthesize and implement research on teaching and learning as related to science and technology. 12. Recognize the importance of reflection in professional development.</td>
<td>● ASK of science - 1  ● Brain-based - 5  ● Constructivism - 5  ● Limits of science – 1, 3  ● Misconceptions in science - 3  ● National Science Standards - 10  ● AAAS Benchmarks - 10  ● Trends in Science Education - 1  ● Scientific method - 2  ● Inquiry-based learning – 1, 2  ● Scientific literacy - 3, 4, 5  ● Science teaching methods that support inquiry – 1, 2, 3, 4, 5  ● Lesson and unit planning - 3, 4, 5, 7  ● Effective questioning - 6  ● Resources – 10, 11  ● Reading integration in science – 1, 5, 9  ● Technology integration in science – 9, 11  ● Safety in science – 8  ● Science for all students – 2, 5, 6, 7  ● Assessment in science – 3, 4, 5, 6, 7  ● Reflective teaching – 12  ● Teach a science unit – 2, 3, 4, 5, 6, 7, 8, 12</td>
<td>● Separations assignment (ASK) – 1, 3  ● Questions assignment - 6  ● C/C types of teaching for science literacy –1, 2  ● Inquiry Lesson Plan – 1, 2  ● Test – 1, 8, 6  ● Safety audit – 8  ● Teaching for teaching differences – 5  ● Wiki/Webpage – 9, 10, 11  ● Misconceptions Paper – 1, 11  ● Science Unit/Lesson – 3, 4, 5, 6  ● Classroom Observations – 1, 7, 8  ● Field Experience Planning – 3, 4  ● Field Experience Teaching –5, 6, 7  ● Field Experience Reflection – 12</td>
<td>● The teacher believes all students can learn.  ● The teacher respects all people and values diversity.  ● The teacher values the profession and exhibits behaviors that enhance the profession.  These are assessed in the classroom and in the field.</td>
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</table>
Course Expectations

Class Attendance
It is expected that students will attend and actively participate in all class sessions and activities. This class is highly interactive, participatory, and hands-on. Therefore, attendance is imperative for success in this course so please make every effort to be in class on time and to stay for the entire class session. Class attendance and participation will be an important component of the course grade. Occasionally, circumstances do make attending class impossible. It is the student's responsibility to get all notes and other make-up work.

Class Participation and Conduct
It is the responsibility of the instructor to provide an environment that enhances learning, to present information in a logical, clear manner, and to provide adequate, timely feedback to each student on his/her progress. Learning is the responsibility of the student. Each student is expected to act in a manner that is consistent with the highest academic and social achievement. Any student that is making learning difficult for himself or herself or for the other members of the class will be expected to adjust his/her behavior. It is the responsibility of each student to know his/her grade at all times and to act appropriately. Remember, although grades are important, acquiring knowledge and skills are the ultimate goals.

Late Work
All assignments are due on the due date. Any late work will be docked a letter grade for every day which passes before the work is turned in. **No late work will accepted one week after the due date.** All papers must be typed.

Notification of Participation in College Sanctioned Events
Mock Trail participants, choir tour participants, athletes, and others who must miss a class for participating in a college sanctioned event are expected to notify me in advance and complete work including tests in advance of the absence. It is the student’s responsibility to communicate with me in advance regarding his/her absence and to determine a schedule for make-up work.

Competencies
All primary competencies related to this course must be submitted by the student and verified by the instructor by the end of the semester. A course grade will be submitted to the registrar only when all primary competencies are verified. Verification of primary competencies in all completed courses is a condition for continuation in the Teacher Preparation program.

Evaluation
Each student will be given the opportunity to evaluate both the course and the instructor. Formative evaluations will be sought at least once during the term. Summative evaluations will be collected prior to the final examination but will be sealed and reviewed only after final grades have been submitted to the registrar. Course evaluations will be available to a faculty peer review committee and School of Education administrators.
Ethical Conduct
Central College students, whether on campus or off-campus are expected to promote the attitudes of acceptance, mutual respect, justice, compassion, service to others, and professionalism. In order to safeguard these ideals, the college must take disciplinary action in some circumstances. Although many lesser forms of discipline may be taken, the college/education department reserves the right, and the student concedes to the college/education department the right to suspend, expel or request the withdrawal of any student at any time when conduct challenged these ideals.

Students who commit major crimes face the possibility of campus discipline, as well as civil consequences. Likewise, all state and federal laws are enforced on campus, frequently in conjunction and cooperation with local authorities. Members of the college community are encouraged to utilize area law enforcement agencies to the fullest extent possible and can expect full support and guidance from campus staff.

Disabilities
Central College abides by interpretations of the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973 that stipulates no student shall be denied the benefits of an education "solely by reason of a handicap." Disabilities covered by law include, but are not limited to, learning disabilities, hearing, sight, or mobility impairments, and other health related impairments. If you have a documented disability that may have some impact on your work in this class for which you may require accommodations, please see me and Nancy Kroese, Director of Student Support Services and Disabilities Services Coordinator, (x 5247) during the first two weeks of the semester so that such accommodations may be arranged.

Plagiarism and Other Academic Dishonesty
Plagiarism and cheating of any form are serious offenses and may result in an F for the assignment, the course, or expulsion from the college. The details of Central's Academic Integrity policy are found in the Student Handbook, on the web. A copy will be sent to you via e-mail during the first week of the semester. It is your responsibility to read and understand the contents of that policy before you submit work to be graded. Questions regarding the policies and enforcement of the policies may be addressed to me during class or during office hours.

Grading
Your final grade will depend on points earned in each of the following categories:

<table>
<thead>
<tr>
<th>Category</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>50</td>
</tr>
<tr>
<td>Wiki/Webpage</td>
<td>50</td>
</tr>
<tr>
<td>Misconception Assignment</td>
<td>50</td>
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<tr>
<td>Test Questions</td>
<td>25</td>
</tr>
<tr>
<td>Pella Observations and Write-up</td>
<td>25</td>
</tr>
<tr>
<td>Science Unit – map, plan, questions, assessments</td>
<td>100</td>
</tr>
<tr>
<td>Field experience Unit Plan/Daily Lesson Plans</td>
<td>100</td>
</tr>
<tr>
<td>Daily Assignments/Participation</td>
<td>~40</td>
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<tr>
<td>Competencies</td>
<td>10</td>
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<tr>
<td>Total</td>
<td>450</td>
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Grade Range:
Your final grade will be determined by the percent of the total points possible (425) according to the scale below:

- 95% = A  Work of outstanding quality
- 92% = A–
- 88% = B+
- 84% = B  Work of very good quality
- 80% = B–
- 76% = C+
- 72% = C  Work of average quality
- 68% = C–
- 65% = D+
- 62% = D  Work of substandard quality
- 60% = D–
- <60% = F

Students must pass this course with a 68% or above. If this requirement is not met, the student will be required to retake the course to continue in the teacher education program. In addition, all students must maintain an overall GPA of 2.7 in order to continue in the education program.

Professional Bibliography:


Stilwell, T. Reconstruct science: It’s time to take a new approach to teaching the subject. The Des Moines Register. August 4, 2005, p. 17A.


Disclaimer:
This syllabus is representative of materials that will be covered in this class; it is not a contract between the student and the institution. It is subject to change without notice. Any potential exceptions to stated policies and requirements will be addressed on an individual basis and only for reasons that meet specific requirements. If you have any problems related to this class, please feel free to discuss them with me.
<table>
<thead>
<tr>
<th>Date &amp; Chapter</th>
<th>Topic</th>
<th>Assignment</th>
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<tbody>
<tr>
<td>Jan. 20 Ch 1</td>
<td>What is science? – ASK Themes – inquiry, life, physical, earth &amp; space Limits of science, Nature of Science (NOS) “bubble brew”</td>
<td>Syllabus – print a copy if you want! Read Ch 1 and 2</td>
</tr>
<tr>
<td>Jan. 22 Ch 2</td>
<td>Sharing/discussing your science journey Brain-based learning</td>
<td>Science Journey due All about Me recipe due</td>
</tr>
<tr>
<td>Jan. 27 Ch 2</td>
<td>Human Body activities Constructivism</td>
<td>Bring a human body lesson plan to class</td>
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<tr>
<td>Jan. 29</td>
<td>No Class <strong>Focused Observation of 5th grade science – call/e-mail ahead</strong></td>
<td></td>
</tr>
<tr>
<td>Feb. 3 Ch 2</td>
<td>Continuum of constructivism Identifying student pre-conceptions and misconceptions</td>
<td>Baggie/Think Like A Scientist Write-up due</td>
</tr>
<tr>
<td>Feb. 5 Ch. 8</td>
<td>More mis-conceptions/pre-conceptions AEA Online <a href="http://www.iowaaeaonline.org">www.iowaaeaonline.org</a> Discussion of wiki/webpage requirements Technology</td>
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<tr>
<td>Feb 10 Ch. 6</td>
<td>Questioning – effective questioning and using student questions</td>
<td></td>
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<tr>
<td>Feb. 12 Ch. 5, Bb and Handouts</td>
<td>Scientific literacy Defining Inquiry Types of inquiry</td>
<td>Complete Frayer Model on Inquiry</td>
</tr>
<tr>
<td>Feb. 17 Ch. 5 and 6</td>
<td>Combining questions with inquiry Claims and evidence</td>
<td>Bring your airplane model</td>
</tr>
<tr>
<td>Feb. 19 Ch 5</td>
<td>Types of Inquiry continued</td>
<td>Be ready to “teach” your inquiry model &amp; bring Science Lesson related to your model to share</td>
</tr>
<tr>
<td>Feb. 24 Ch. 1 &amp; 4 Iowa Core</td>
<td>Essential Questions and Essential Learnings – what are the need to know, good to know, nice to know? NSES Standards, AAAS Benchmarks, Iowa Core Curriculum Pick unit topics Floating and Sinking</td>
<td>Misconceptions Paper Due</td>
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<tr>
<td>Date</td>
<td>Chapter</td>
<td>Topic</td>
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<tr>
<td>Feb. 26</td>
<td>Ch. 4</td>
<td>Discussion of Unit Plan Requirements</td>
</tr>
<tr>
<td>March 3</td>
<td></td>
<td>Essential Learnings</td>
</tr>
<tr>
<td>March 5</td>
<td>Ch. 7</td>
<td>Assessment for Learning– electricity lesson</td>
</tr>
<tr>
<td>March 10</td>
<td></td>
<td>Focused Observation in Pella – assessment and classroom management</td>
</tr>
<tr>
<td>March 12</td>
<td>Ch. 7</td>
<td>Questioning and Assessment</td>
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<tr>
<td>March 17 &amp;</td>
<td></td>
<td>Spring Break</td>
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<tr>
<td>March 19</td>
<td></td>
<td>Writing Assessments</td>
</tr>
<tr>
<td>March 24</td>
<td>Ch. 7</td>
<td>Technology – mittens and balls</td>
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<tr>
<td>March 26</td>
<td>Ch. 8</td>
<td>Safety – find the safety issues in the tornado lesson</td>
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<td>March 31</td>
<td>Ch. 10</td>
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<tr>
<td>April 2</td>
<td></td>
<td>No Class – Easter Break</td>
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<tr>
<td>April 7</td>
<td>Ch. 3</td>
<td>Teaching for Learner Differences Water cycle</td>
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<tr>
<td>April 9</td>
<td>Ch. 3</td>
<td>Teaching for Learner Differences</td>
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<tr>
<td>April 14</td>
<td></td>
<td>DE visit Characteristics of Effective Instruction</td>
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<tr>
<td>April 16</td>
<td></td>
<td>Test</td>
</tr>
<tr>
<td>April 19</td>
<td></td>
<td>Initial Visit to the Field Experience site – plan to be gone from 11:30-2</td>
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<tr>
<td>April 20-28</td>
<td></td>
<td>Planning for Field Experience</td>
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<tr>
<td>April 29, 30</td>
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<td>Field experience 11-2:30 – please clear this with T/TH professors</td>
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<tr>
<td>May 3, 4, 5</td>
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<tr>
<td>May 7</td>
<td></td>
<td>Field experience de-briefing</td>
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<tr>
<td>May 10</td>
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<td>All Block II Unit Plan/Daily Lesson Plans Due Competencies Due by 8:00 AM</td>
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<tr>
<td>May 11 @ 1:00</td>
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<td>Final Exam – poster for your teacher due Individual conferences with Block II pros</td>
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