High Altitude Ballooning into Undergraduate STEM Curriculum: Preparing for Widespread Implementation

Academic High Altitude Conference

June 27-29, 2012

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Background: NSF Grant

NSF TUES Program - Transforming Undergraduate Education in Science, Technology, Engineering, and Mathematics

- Preparing for widespread implementation of ballooning into undergraduate classes
- $534,000 grant
- 2010-2013
- 1st NSF CCLI/TUES Grant (2007-2010)
  - 52 universities trained – 2 day workshops
  - >10 universities regularly using ballooning in courses
  - 17 StratoSat Balloon Systems purchased
  - Assessment – Statistically & Practically Significant Student Learning Outcomes

Key Components: NSF Grant

What is needed for widespread implementation of ballooning into undergraduate classes?

Core Group of Universities	Best Practices - Engaging and Training Universities	Education Curricula – Training Future K-12 Teachers

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Core Group of Universities	Best Practices - Engaging and Training Universities	Education Curricula – Training Future K-12 Teachers

- Group of 10 Universities Established
  - Collaborative Project
  - Balloon Competition - U. Evansville Led
  - Regular Teleconferences
- Curriculum Development
  - $1500 Stipend
  - $500 Equipment and supplies
- Academic High Altitude Conference
  - 1st Year at Taylor
  - 2nd Year at Iowa State
  - 3rd Year at Travecca

Core Group of Universities	Best Practices - Engaging and Training Universities	Education Curricula – Training Future K-12 Teachers

- Website (www.cse.taylor.edu/~harp/)
  - Live tracking of balloon flights
  - Sharing of data from balloon flights
  - Videos on how to perform balloon launch
  - Curricula
  - Papers, references
  - Documentation on equipment/capabilities
  - Social Networking?
- Workshops
  - Small Sat Conference – Aug. 11, 2012
- Webinars
  - Marketing Study → Many do not understand Ballooning
  - Webinar – 1-hour intro by StratoStar and Taylor U.

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Core Group of Universities	Best Practices - Engaging and Training Universities	Education Curricula – Training Future K-12 Teachers

- Implementation into Education Courses
  - Huge impact on many students in U.S.!
  - Untapped during 1st NSF TUES Grant
  - Need
    - Test feasibility in Education Courses
    - Develop curriculum (to be shared with universities)

- Pilots
  - Taylor University
  - Ball State University
  - Science Methods Courses
  - 6th-8th Grade Curriculum
    - Development in Science Methods Course
    - Field Test in 6th-8th Grade Classroom

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Training Future K-12 Teachers

President Obama's National STEM Education Initiative

"Educate to Innovate"

National Science Education Standards

- Emphasis on improving the quality of math and science teaching to P-12 students
- Emphasis on inquiry/hands-on learning opportunities
- The challenge is preparing K-12 teachers with experiences comparable to the experiences we want K-12 students to have

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Training Future K-12 Teachers

Two Pilots – Two Contrasting Scenarios

Taylor University	Ball State University
Elementary Education Majors	Secondary Science/Math Education Majors
One Semester of Methods Class	Two Semesters of Methods Classes
Creating Curricula for Sixth Graders	Creating Curricula for Seventh and Eighth Graders

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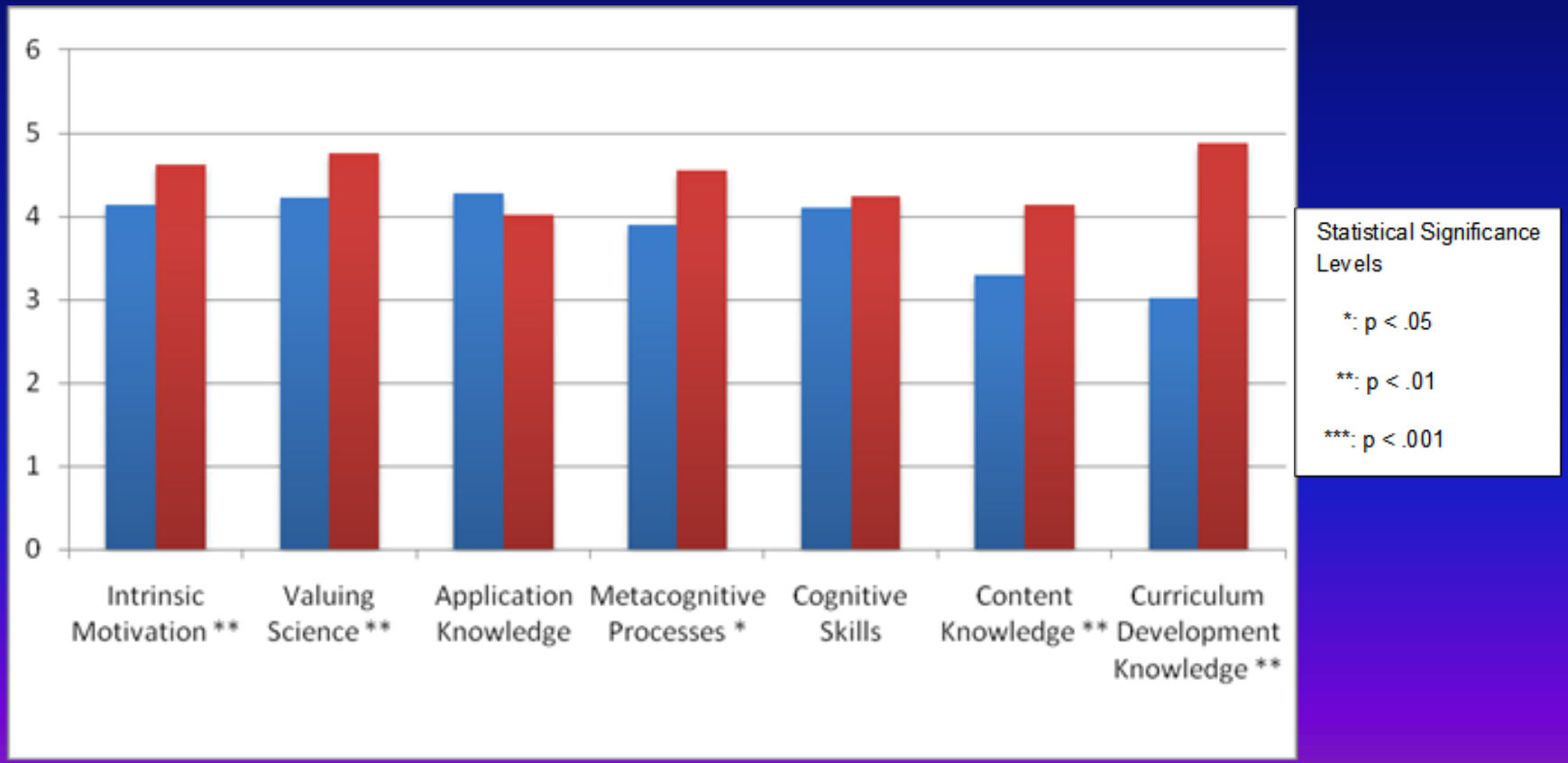
Assessment (Pretest and Posttest) Results – First Implementation of HARP in Taylor University Science Methods Course



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Challenges Encountered

Elementary Education Majors

- Inadequate science background/content knowledge limited understanding and experimental design

- Time commitment required to introduce content, design experiments, participate in launch, review results, and write curriculum affects course content/instruction

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Challenges Encountered

Secondary Science/Math Education Majors

- Experimental design was complex, some were inappropriate for the limitations of size, equipment or time

- Math majors had more difficulty designing experiments as the required math level was either two low or two high for the middle school math curriculum

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Challenges Encountered

Middle School Students

- Experiments tended to be ones that had pre-determined outcomes since freezing was inevitable

- Experiments tended to focus on physical changes easily observed in organic and inorganic objects after flight

- Main difficulties were with typical middle school behavior – forgetting to bring needed materials so that last minute inappropriate substitutions had to be made

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Preliminary Conclusions

- Using the HARP system seems to be an excellent way for students to use their content knowledge and the opportunity to “do” science to create interest and enthusiasm for STEM fields.

- Background knowledge is crucial if students (and their teachers) are to be able to use this knowledge to make applications in real world settings.

- Developing curriculum using the HARP system in an elementary science methods course takes a considerable time commitment especially if content development is employed.

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Preliminary Conclusions

- Limitations need to be considered when constructing experiments that will be launched using the HARP system. These include limited space in the pods, the ability to immediately view or control the environment of the specimen upon recovery, or ability to view the experiment via camera during the launch.

- It might be more advantageous with a greater likelihood of success if elementary/junior high students choose from a list of possible experiments rather than creating one of their own.

Thank You

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