Effects of research experiences on retention in the sciences: Development of measurement instruments

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CASPiE Background Information

- Center for Authentic Science Practice in Education.
- Incorporate research into undergraduate laboratory experiences.
- Integrated into mainstream curriculum.
- Modular approach: 6-8 weeks per module.
- Access to advanced instrumentation through remote access network.
- Peer-Led Team Learning (PLTL) Model.

http://www.purdue.edu/dp/CASPiE

Instrument goals

Establish a means of determining the effects of authentic undergraduate research on student participants.

- attitudes
- short-term retention in the sciences
- participation

Other measurement instruments will assess:

- grades
- qualitative aspects of attitudes
- longitudinal retention in the sciences

Instrument Development Methodology

1. Identify concepts to be explored (Jan 05)
2. Compose free response question (Jan-Feb 05)
3. Gather free responses to questions (Feb-Apr 05)
4. Categorize free responses (reliability check) (Apr-May 05)
5. Develop fixed-response items with scoring (May-Jun 05)
6. Validate fixed-response items (Jun-Aug 05)
7. Produce and use instrument (planned Fall 05, Spring 06)
8. Revision(s) (on-going)

Adapted from Bennett, J. (2001). The development and use of an instrument to assess students' attitude to the study of chemistry. *International Journal of Science Education*, 23(8), 833.

Data Sources Timeline

Spring 2005, N=12

Summer 2005, N=7

CASPiE Participants

Spring 2005 Pilot

12 students

8 female, 4 male

12 freshmen

Summer 2005 Pilot

7 students

3 female, 4 male

2 freshmen,
4 sophomores,
1 post-baccalaureate

Free-Response Survey Work-up

- Two people used internal coding schemes with the first set of entrance free-response data.
- These were compared and discrepancies discussed (84% agreement), and the entire set was re-coded.
- Final coding scheme developed for free-response entrance survey had 88% agreement.
- This reliable set of codes was subsequently used on other data sets by one person.

Trends in Spring 2005 Open-Ended Data

1. Prevalence of equality and cooperation within lab groups
2. Amount of science practice in the experiments
3. Lack of content relevance to careers and academics
4. Thinking skills that are relevant to future careers and academics
5. Learning laboratory skills
6. Leaders' need for organization and social skills
7. Amount of fun in the experiments
8. Need for more instrumentation

Spring 2005 Open-Ended Data: Process versus Content

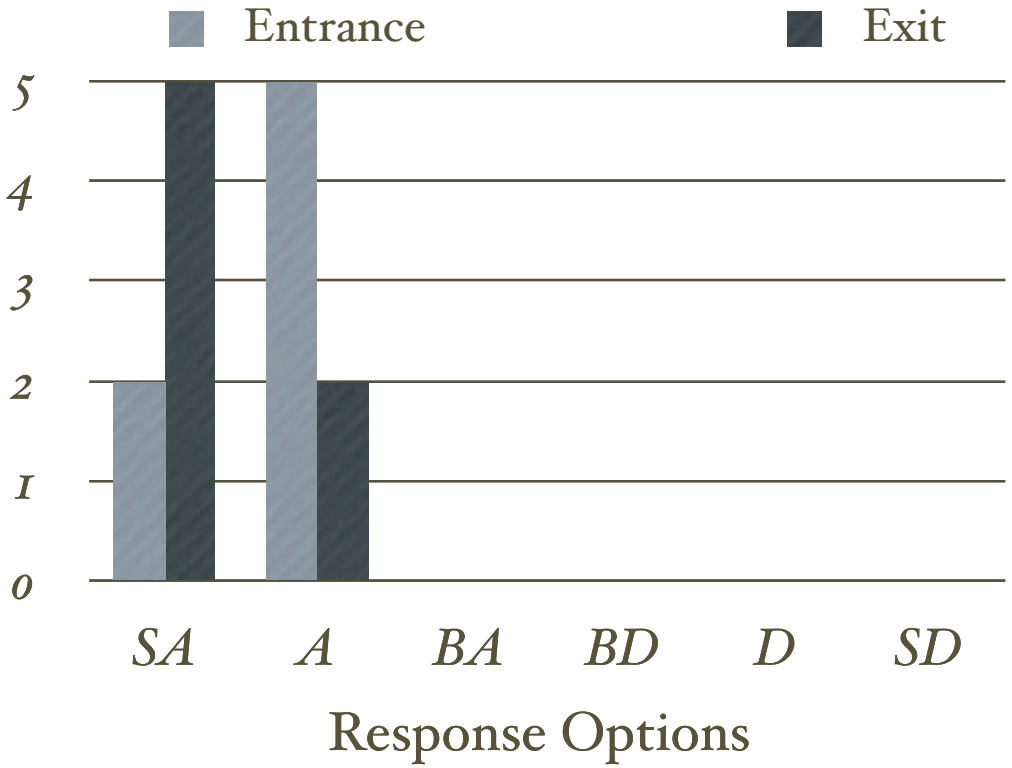
Q: Do you feel that the information you are learning can be used outside of school either presently or in your future career(s)? Why or why not? Please give specific examples when possible.

A: Yes and no... the reason I say no is because at the moment I am a business major. So what I learn won't help but how I learn will.

Fixed-Response Survey Development

- Data collected in spring 2005 were used to develop the fixed-response items.
- Items written to address the themes that emerged from qualitative data.
- Member check conducted with 4 of the participants from the spring session.
- Entrance and exit surveys.
- Scale: strongly agree, agree, barely agree, barely disagree, disagree, strongly disagree.

Summer 2005 Fixed-Response Data



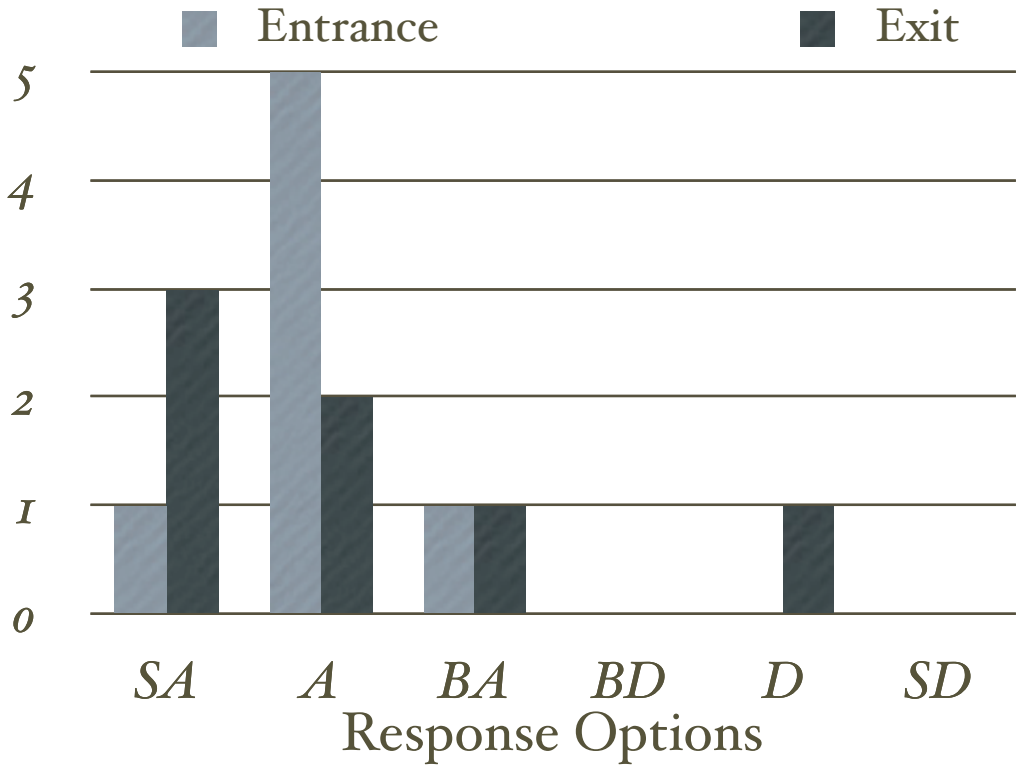
Number of Respondents

Entrance:
Mean= 5.3 (A)
SD= 0.50

Exit:
Mean= 5.7 (SA)
SD= 0.50

Statement: Working in a group has a positive effect on my learning.

Summer 2005 Fixed-Response Data



Number of Respondents

Entrance:
Mean= 5.0 (A)
SD= 0.58

Exit:
Mean= 4.9 (A)
SD= 1.5

Statement: I am confident when using advanced scientific instrumentation as part of the laboratory activities.

Future directions

Implementation of surveys with stronger language and more description.

Validation of surveys with open-ended data.

Collection of larger data sets with the instrument to test reliability and validity.

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Pilot Participants, Spring and Summer 2005