Motivational effects of hands-on, problem-based, and lecture activities in an introductory college course

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Introduction
Active Learning Works

• Active learning widely demonstrated to improve student interest, motivation, and achievement

• Important implications for college introductory courses

Hulleman and Harackiewicz, 2009
Active learning works: now what?

• Active learning encompasses a wide variety of methods\(^1\)

• Little research on specific course activities\(^1\)

• Existing research on specific activities obscures important variation\(^2\)

\(^1\)Chi and Wylie, 2014
\(^2\)Bernstein, 2018
“2nd generation” active learning research

• Empirical work on specific activities
• Description of activity features
• Analysis of underlying processes
• Elimination/examination of moderating effects

Bernstein, 2018
Active learning: underlying processes

Motivation
• The process that initiates, guides, and sustains goal-directed behavior¹

Interest
• An emotion that drives exploration and focuses attention²

¹Ryan and Deci, 1985
²Hidi and Renninger, 2006
Motivation is a spectrum
**Intrinsic** (internalized)

Interest/Enjoyment
Purpose, passion
Connection with values/identity

**Extrinsic** (external)

Rewards/punishment
Social acceptance
Praise
Grades, promotion

Ryan and Deci, 1985
Intrinsic (internalized)

- Interest/Enjoyment
- Purpose, passion
- Connection with values/identity

Extrinsic (external)

- Rewards/punishment
- Social acceptance
- Praise
- Grades, promotion

Ryan and Deci, 1985
Amotivation
External
Regulation
Identified
Regulation
Intrinsic

More impersonal
More connected with:
  Meaninglessness
  Control
  Avoidance

More internalized
More integrated with:
  Values
  Identity
  Enjoyment/Interest

(Extrinsic)

Ryan and Deci, 1985
Amotivation | External Regulation | Identified Regulation | Intrinsic

More impersonal
More connected with:
Meaninglessness
Control
Avoidance

More internalized
More integrated with:
Values
Identity
Enjoyment/Interest

Ryan and Deci, 1985
Many types of motivation important in educational settings\textsuperscript{1}

**Interest, intrinsic motivation** enhance learning, performance, and achievement\textsuperscript{2}

- Enhance attention, recall, task persistence, effort\textsuperscript{3}
- Associated with well-being\textsuperscript{4}

\textsuperscript{1}Hidi, 1990; \textsuperscript{2}Ainley, Hidi, and Berndorff, 2002
\textsuperscript{3}Deci and Ryan, 1985
The Present Study
Research Questions

• How do video lecture, laboratory station, and case study activities affect students’ situational motivation and situational interest?
Participants

- 178 students enrolled in introduction to animal agriculture
  - Overall response rate: 94.4%

- Predominantly
  - first-year
  - ANSC-major
  - female
Context

16wk Introduction to Animal Agriculture
Fall 2018 Semester

<table>
<thead>
<tr>
<th>M</th>
<th>Tu</th>
<th>W</th>
<th>Th</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 min LECTURE</td>
<td>50 min LECTURE</td>
<td>110 min LAB</td>
<td></td>
<td></td>
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</table>
Fall ‘17: Restructured to Active Learning
A cross-section of course activities

Lecture
Lab Station
Case Study
Method
Study Design

- IRB Approved
- Quantitative
- Latin Square Design
Instrumentation

• Situational Intrinsic Motivation Scale (SIMS)$^1$
• Situational Interest Scale (SIS)$^2$

$^1$Guay, 2000
$^2$Chen et al., 1999
**Lecture**
Independent
Passive
Watch slides
Listen to instructor

**Lab Station**
Groups of 5-7
Problem-based
Hands-on scenario
Instructors guide

**Case Study**
Groups of 5-7
Problem-based
Written scenario
Instructors guide
Lecture
Independent Passive
Watch slides Listen to instructor

Lab Station
Groups of 5-7 Problem-based Hands-on scenario Instructors guide

Case Study
Groups of 5-7 Problem-based Written scenario Instructors guide
### Study Design

<table>
<thead>
<tr>
<th>Group #</th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>Case Study</td>
<td>Lab Station</td>
</tr>
<tr>
<td>2</td>
<td>Lab Station</td>
<td>Lecture</td>
<td>Case Study</td>
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<tr>
<td>3</td>
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<td>4</td>
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<tr>
<td>5</td>
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<td>Lecture</td>
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</tr>
<tr>
<td>6</td>
<td>Case Study</td>
<td>Lab Station</td>
<td>Lecture</td>
</tr>
</tbody>
</table>
**Study Design**

Weeks 7, 9, 10

- **7:30**
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6

- **9:30**
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6

- **11:30**
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6

- **1:30**
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6

- **3:30**
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6

**Verbal Instructions** (5 mins)

**Assigned Activity** (10 mins)

**Questionnaire** (10 mins)
Statistical Analysis

- SAS Software
- Significance declared at p<0.05
- UNIVARIATE procedure
- MIXED procedure
Results
Situational Interest

- Exploration Intention
- Instant Enjoyment
- Novelty
- Attention Demand
- Challenge
- Total Interest
- Situational Interest

Data presented are LSM±SEM
Likert scale 1 = strongly disagree, 5 = strongly agree  N = 501

Mean Score

Video Lecture  Lab Station  Case Study
Exploration and Intention

Instant Enjoyment and Novelty

Attention Demand

Total Interest

Situational Interest

1) Lab Stations
2) Case Study
3) Video Lecture

Bar graph showing situational interest scores across different conditions.

Video Lecture  Lab Station  Case Study

Novelty  Attention Demand  Challenge  Total Interest  Situational Interest

* * * *
Exploration Intention

Instant Enjoyment

Situational Interest

Mean Score

1) LS and CS
2) Video Lecture

Video Lecture  Lab Station  Case Study

Novelty  Attention Demand  Challenge  Total Interest  Situational Interest
Situational Motivation

Data presented are LSM±SEM

Anchored scale
1 = not at all
7 = exactly

N = 501
AMOTIVATION

1) Video Lecture
2) LS and CS

EXTERNAL REG.
no differences

Data presented are LSM±SEM

Anchored scale
1 = not at all
7 = exactly

N = 501

Mean Student Rating

Situational Motivation
Situational Motivation

**IDENTIFIED**
1) Lab Stations and Case Study
2) Video Lecture

**INTRINSIC**
1) Lab Stations
2) Case Study
3) Video Lecture

Data presented are LSM±SEM

Anchored scale
1 = not at all
7 = exactly

N = 501
Conclusions
Conclusions

Problem-based and hands-on learning activities in this course improve **situational interest, intrinsic motivation**

Problem-based, hands-on activities appeared to connected more with students’ values, interests, enjoyment compared with video lecture activities
Limitations

Aggregating group data

Limited population, timeframe

Personal, context factors
Future Directions

• Personal factors:
  • Prior experience and attitudes toward active learning
  • Motivational traits and orientations

• Contextual factors (e.g. group dynamics)

• Performance outcomes

• Other activities
Acknowledgements

• Student and teaching assistant participants
• Undergraduate research assistants

• Karcher Lab Group
  • Dr. Liz Karcher
  • Jacie Grant
  • Danielle Marks
Thank You!

Questions?
References

- Mcdonald, F., Reynolds, J., Bixley, A., Spronken-Smith, R. (2017). Changes in approaches to learning over three years of University undergraduate study. Teaching and Learning Inquiry, 9(2). http://dx.doi.org/10.20343/teachlearninqu.5.2.6
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  http://dx.doi.org/10.1207/s15326985ep3402_2
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