

Three Classes of Interaction Treatments in Distance Education: A Within-DE Meta-Analysis

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History of this Project: 2000 – 2004

- **Question:** How does distance education compare to classroom instruction? (inclusive dates 1985-2002)
- Total number of effect sizes: $k = 232$
- **Measures:** Achievement, Attitudes and Retention (opposite of drop-out)
- Divided into **Asynchronous** and **Synchronous DE**

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Primary findings

- DE and CI are essentially **equal** ($g^+ \approx 0.0$ to low average effect) on all measures
- Effect size distributions are heterogeneous; some DE \gg CI, some DE \ll CI
- Generally poor methodological quality
- Pedagogical study features account for more variation than media study features (Clark, 1994)
- Interactive DE an important variable*

*Lou, Y., Bernard, R.M., & Abrami, P.C. (2006). Media and pedagogy in undergraduate distance education: A theory-based meta-analysis of empirical literature. *Educational Technology Research & Development*, 54(2), 141-176.

2005 – present: Interaction treatments in DE

Question: What are the effects of three classes of interaction treatments in DE vs. DE studies?
(Inclusive dates 1985 to 2006)

Interaction treatment: Instructional and/or technological strategies (designs) in DE that are intended to promote interaction and learning engagement among students

Dependent measures: Learning achievement and attitudes toward the course (satisfaction)

Interaction treatments in DE

- Three classes of interaction treatments (Moore, 1989)
 - student-student interaction
 - student-teacher interaction
 - Student-content interaction
- Hypothetical relationship of ITs to learning and satisfaction (Anderson, 2003)
 - Deep, meaningful learning is produced from two out of three interactions at a high level
 - High levels of more than one interaction type will produce satisfying educational experience

The unique problem in this meta-analysis

- In most meta-analyses, treatment and control designations are unambiguous (e.g., DE vs. CI)
- In DE vs. DE studies, which condition is the treatment and which is the control?
- We used IT classes as a structure to sort treatments and controls

Procedure: Treatment/control designation

- **First: Identified 74 achievement and 44 attitude effects that contained interaction treatments**
 - Sorted effects into SS, ST and SC categories
 - Defined levels of independent variable for each study
- **Second: Defined “treatment” and “control”**
 - Two judges determined which condition was the “best type” for each class
 - That group became the treatment and the other the control

Procedure: Methodological quality

- Rate methodological quality (research design, measure quality, statistical quality, equivalences)
- Categorize methodological quality (3 categories)
- Add constant to bring low and medium up to the mean of the high category
- Average effect size changes, variability remains the same

Achievement: Unadjusted and adjusted

| Methodology | k | Unadjusted Effect Sizes | | | Adjusted Effect Sizes | | |
|----------------|----|-------------------------|-------|----------|-----------------------|-------|---------|
| | | g+ | SE | Q | g _{adj.} | SE | Q |
| Low | 25 | -0.036 | 0.048 | 47.025 | 0.293 | 0.048 | 46.433 |
| Moderate | 32 | 0.087 | 0.041 | 97.916 | 0.287 | 0.041 | 96.237 |
| High | 17 | 0.294 | 0.057 | 45.173 | 0.294 | 0.057 | 45.173 |
| Within-class | | | | 190.114 | | | 187.843 |
| Between-class* | | | | 19.744** | | | 0.016 |
| Total | 74 | 0.096 | 0.027 | 209.857 | 0.291 | 0.027 | 187.859 |

- g+ adjusted to the mean of the high quality category
- Variability between groups removed, variability within groups retained.

Do the three types of interaction differ?

Moore's distinctions

Achievement and Attitude Outcomes

| Interaction Categories | Achievement | | Attitudes | |
|------------------------|-------------|--------------|-----------|--------------|
| | k | $g^+_{adj.}$ | k | $g^+_{adj.}$ |
| Student-Student | 10 | 0.342 | 6 | 0.358 |
| Student-Teacher | 44 | 0.254 | 30 | 0.052 |
| Student-Content | 20 | 0.339 | 8 | 0.136 |
| Total | 74 | 0.291 | 44 | 0.090 |
| Between-class | | 2.437 | | 6.892* |

Moore's distinctions seem to apply for achievement (equal importance), but not for attitudes (however, samples are low for SS and SC)

Investigating “treatment strength”

- **Given:** The treatment/control relationship is in the same direction for all effect sizes, but the difference between them is not the same
- **Strength:** The coded differential between treatment and control (Validated by three independent coders)
- **Coded strength as:**
 - 0) conditions are essentially equal
 - 1) treatment is $>$ control
 - 2) treatment is \gg control

Does strengthening interaction improve achievement and attitudes? Anderson's hypotheses

Achievement and Attitude Outcomes

| Interaction Strength | Achievement | | | Attitudes | | |
|----------------------|-------------|-------------|-------|-----------|-------------|-------|
| | k | $g_{+adj.}$ | SE | k | $g_{+adj.}$ | SE |
| Low Strength | 30 | 0.163 | 0.043 | 21 | 0.071 | 0.042 |
| Med Strength | 29 | 0.418 | 0.044 | 18 | 0.170 | 0.043 |
| High Strength | 15 | 0.305 | 0.062 | 5 | -0.173 | 0.091 |
| Total | 74 | 0.291 | 0.027 | 44 | 0.090 | 0.029 |
| (Q) Between-class | | 17.582* | | | 12.060* | |

- Significant linear relationship (regression) for achievement; not for attitudes

- Anderson's first hypothesis about achievement appears to be supported
- Anderson's second hypothesis about satisfaction (attitude) appears to be supported, but only to an extent (i.e., only 5 studies in High Category)

Do interaction types differ in strength?

Achievement and Attitude Outcomes

| Interaction Strength | Achievement (Student-Content) | | | Attitudes (Student-Content) | | |
|----------------------|-------------------------------|-------------|-------|-----------------------------|-------------|-------|
| | k | $g_{+adj.}$ | SE | k | $g_{+adj.}$ | SE |
| Low Strength | 35 | 0.247 | 0.043 | 27 | 0.018 | 0.036 |
| Moderate Strength | 27 | 0.212 | 0.044 | 14 | 0.226 | 0.058 |
| High Strength | 12 | 0.515 | 0.059 | 3 | 0.183 | 0.079 |
| Total | 74 | 0.291 | 0.027 | 44 | 0.090 | 0.029 |
| (Q) Between-class* | | 18.523** | | | 10.872** | |

- Significant linear relationship (regression) for achievement and attitudes

- **Achievement:** High strength > Low and Moderate
- **Attitudes:** High and Moderate strength > Low strength

Do interaction combinations differ?

Achievement Outcomes

| Levels of Treatment Strength | SS + SC | | | ST + SC | | |
|------------------------------|---------|----------|-------|---------|----------|-------|
| | k | g+adj. | SE | k | g+adj. | SE |
| Equal (0) | 11 | 0.147 | 0.097 | 4 | 0.099 | 0.148 |
| Low (1) | 34 | 0.220 | 0.040 | 32 | 0.211 | 0.040 |
| Moderate (2) | 29 | 0.388 | 0.041 | 38 | 0.381 | 0.039 |
| Total | 74 | 0.291 | | 74 | 0.291 | |
| *(Q) Between-class | | 11.041** | | | 10.992** | |

- Significant linear relationship (regression) for achievement (both combinations)

- **SS + SC:** High strength > Moderate > Low
- **ST + SC:** High strength > Moderate > Low

What have we learned about the effects of interaction on achievement?

- The presence of any class of interaction treatment enhances achievement outcomes
- Strengthening treatments (i.e., providing the conditions for interaction to occur) improves achievement
- This is especially true for student-content interaction treatments
- Combining student-content with S+S and S+T lead to improvements in learning

What have we learned about the effects of interaction on attitudes (satisfaction)?

- The relationship between attitudes and interaction is more complex than for achievement
- Student-student interaction seems important
- Strengthening interactions (in general) has a modest impact
- Increasing student-content interaction treatments is related to increasing achievement

References

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