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BACKGROUND

Students seeking enrichment through independent study (IS) courses often have limited opportunities of guided instruction that provide structure, motivation, and assessment. In typical IS courses, students frequently become distracted when the work gets challenging or they get so far off track from their original plan that they end up completing very little, and therefore, learning very little. This case study involves five students, all seniors in high school, who elected to enroll in a Massive Open Online Course (MOOC) as part of their IS courses during the final trimester of the 2016 school year. The students chose their fields of study and the primary topics they intended to investigate. The topics extended beyond the school's curriculum, thus, the students were pursuing these courses for enrichment purposes.

QUESTIONS OF INQUIRY

Primary Question of Inquiry:

- What impact can MOOCs have in high school independent-study enrichment courses?

Sub-questions of Inquiry:

- How can MOOCs provide guidance and structure to the independent-study course?
- How do MOOCs affect students' attitudes and motivations in an independent-study course?
- What value do the tools and resources in MOOCs add to the independent-study course?

METHODS AND DATA COLLECTION

The students enrolled in one of three MOOCs via the edX platform. One student learned about some advanced mathematics using a MOOC specifically designed for differential equations. One student was learning advanced physics topics on the level of Advanced Placement (AP) Physics 1, with an emphasis on electricity and magnetism. Three other students were learning calculus-based electricity and magnetism on the level of AP Physics C. Five instruments were used to measure how much students were interacting with the MOOC and the value of the MOOC in terms of learning: pre-course interviews, post-course interviews, mid-course surveys, post-course surveys, and the Brief Electricity & Magnetism Assessment (BEMA) concept inventory.



INTERVIEW DATA AND ANALYSIS

Figure 1 shows the raw count of evaluative comments made by students in the post-interview grouped according to four categories. A typical positive comment is represented by the quote: "I liked that it pushed me to get things done in a particular order with deadlines." Positive comments outnumbered negative comments.

Figure 1
Counts of Positive, Neutral, and Negative Comments

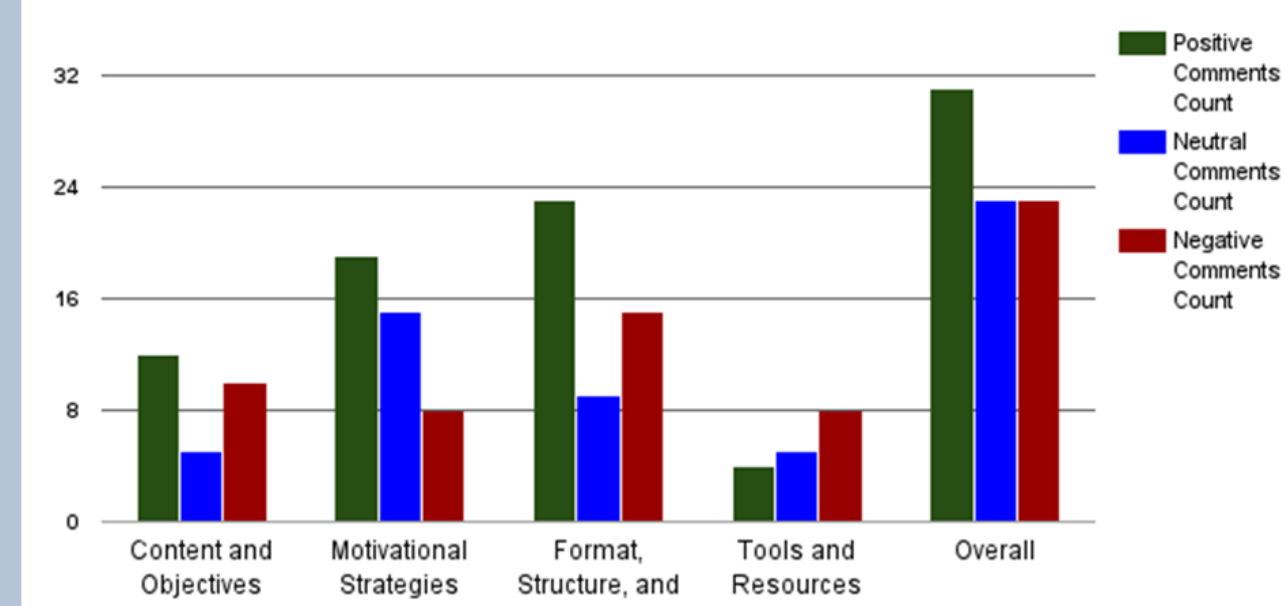
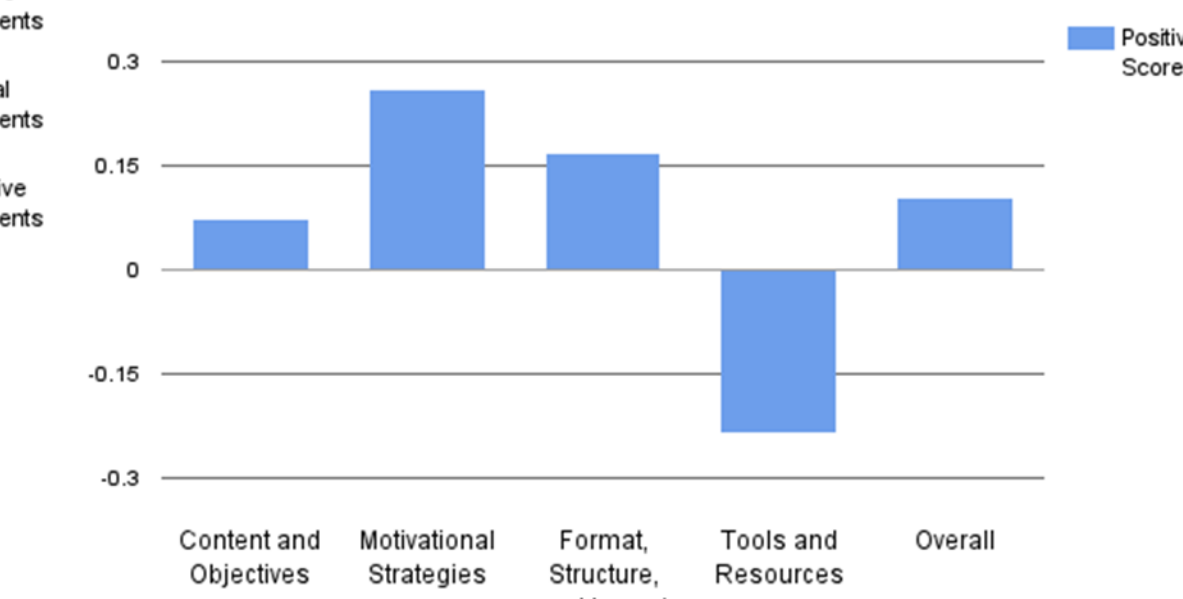


Figure 2 shows the relative positivity of the students' interview statements. The mean scores were calculated by assigning a +1 value to positive comments, a 0 value to neutral comments, and a -1 value to negative comments. All but the Tools and Resources category had a positive mean value. Overall, the students revealed net positive statements with a score of 0.104.

Figure 2
Positivity of Comments Per Category and Overall

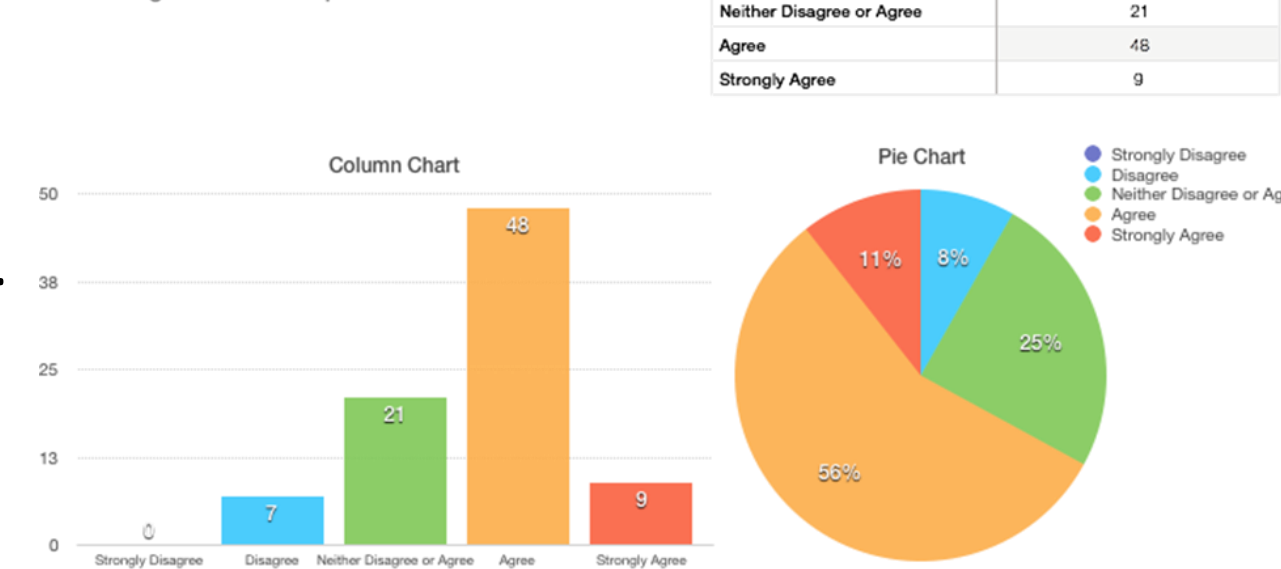


SURVEY DATA AND ANALYSIS

The mid-course survey shows that students felt mostly agreeable about using the MOOC as a tool in independent studies. Figure 3 shows that only 7% of responses were disagreeing with items about the value and utility of the MOOCs. Likewise, 67% of the responses agreed with such items.

Figure 3

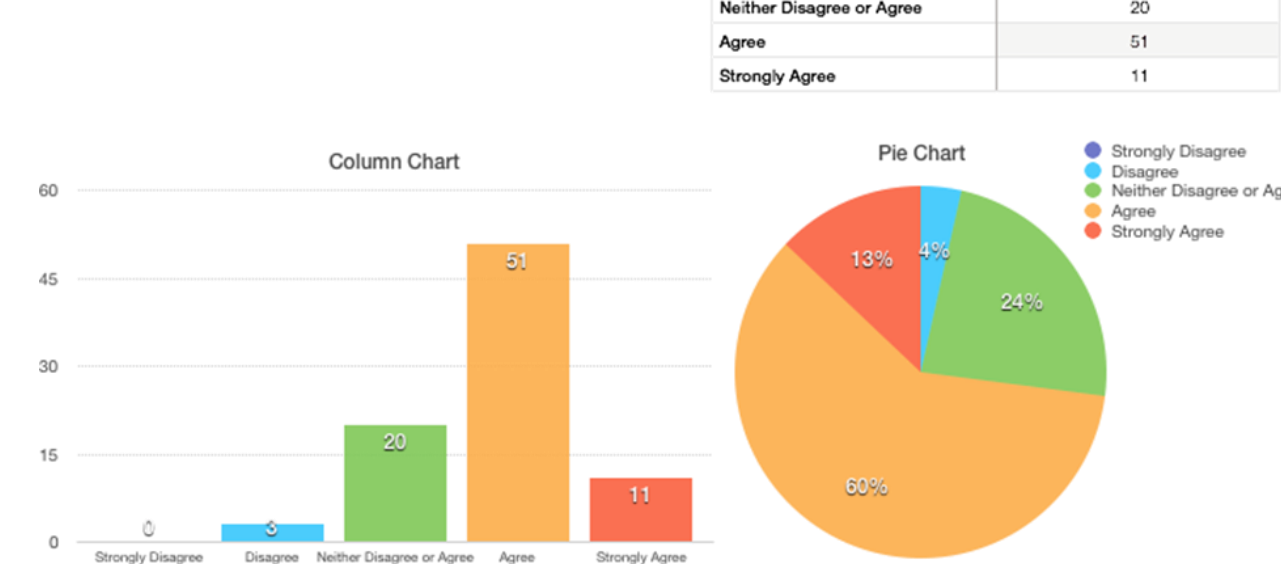
These charts show the total number of responses for each of the items on the survey. All items are worded in such a way that Strongly Agree can be interpreted as having a favorable experience in the MOOC.



The post-course survey provides even stronger evidence that students felt mostly agreeable about the using the MOOC as a tool in independent studies. Figure 4 shows that only 4% of responses were disagreeing with items about the value and utility of the MOOCs. Likewise, 73% of the responses agreed with such items.

Figure 4

These charts show the total number of responses for each of the items on the survey. All items are worded in such a way that Strongly Agree can be interpreted as having a favorable experience in the MOOC.



CONCEPT INVENTORY DATA AND ANALYSIS

Four of the five students took the Brief Electricity & Magnetism Assessment (BEMA) concept inventory to measure their gains in conceptual knowledge about the emphasized topics in their respective courses. The fifth student did not take the BEMA, because the MOOC involved was a mathematics course in differential equations and was not aligned to the assessment targets of the BEMA.

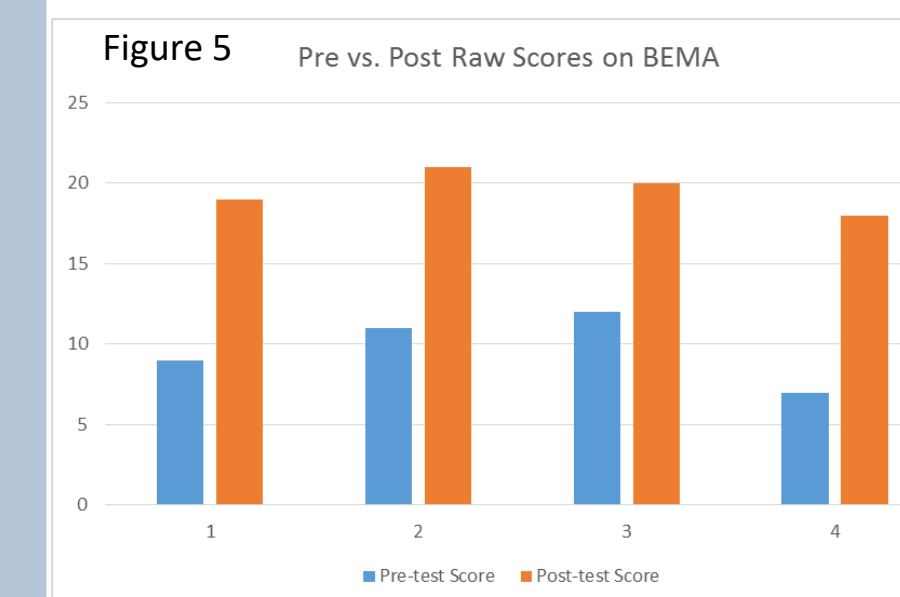
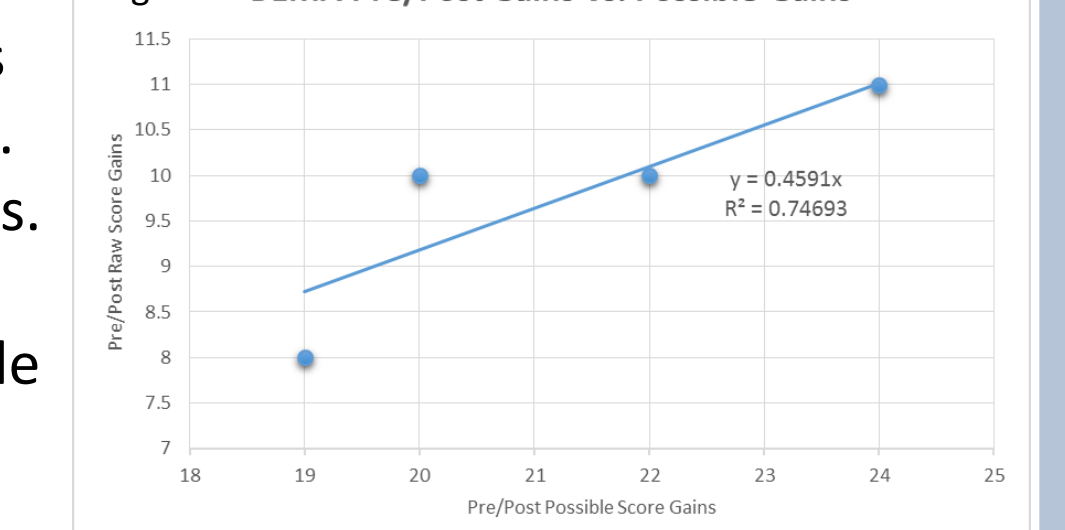


Figure 5 shows the comparison between the pre-test and post-test raw scores on the BEMA. The maximum possible score was 31. The average pre-test score was 9.75. The average post-test score was 19.5. The average gain was 9.75 points.

Figure 6 shows the comparison between the pre/post-test gains and possible gains on the BEMA. The average gain was 9.75 points. The average possible gain was 21.25. The ratio of gain : possible gain is represented by the slope of the trend line. The average gain to possible gain ratio was 0.46.

Figure 6 BEMA Pre/Post Gains vs. Possible Gains



CONCLUSIONS

Revisiting the research questions, there is evidence to support decisions to continue using MOOCs, at least as part of an independent study. The students agree that MOOC provided rigorous content and appropriate objectives. Scores on the BEMA corroborate this perception. The students also agree that the MOOC motivated them to stay on track while progressing through the content. Interviews and surveys show that the students were satisfied with the tools and resources provided by the MOOC despite their dislike of the discussion boards. When considering the primary research question, "What impact can MOOCs have in high school independent-study enrichment courses?", there is evidence in this case study to suggest that MOOCs can have a positive impact and, therefore, can be used to guide and support students seeking such enrichment opportunities.