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Engaging students emotionally with Physics using stories

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Engaging students emotionally with Physics using stories

Abstract. Incorporating stories though recommended to attract students, yet it is not implemented enough in undergraduate physics. We crafted novel colorful stories containing historical anecdotes to engage students emotionally. Stories on electricity practicals were created for two first-year physics courses, Environmental and Technological. Data were collected from 164 students, in the form of a survey, observations, and tutor interviews. Students from both courses scored their emotions on the survey. No significant difference was found between the emotions of the courses but correlations between emotions differed. Qualitative data points towards the differences in students' goals for the courses. Stories stimulated students' interests.

Introduction

Not all the students are interested to continue in physics. Stories can work as a vehicle for students' conceptual change, motivate them, develop various skills, and stimulate their imagination [1]. It seems likely that there will be inherent differences between how students Technological (TEC) and Environmental (ENV) feel about their physics courses. We incorporated stories in students' laboratory notes, measured using AEQ-PhysicsPrac [2] and compared students' emotions with two such courses and found interesting dynamics at work.

Method

Using AEQ-PhysicsPrac, we collected data from a total of 46 students from 62 present in ENV, and 118 from 187 present in TEC. Confirmatory factor analysis, descriptive statistics and inferential statistics were conducted on the quantitative data gathered. Thematic analysis was conducted on the qualitative data gathered through open ended questions on the survey.

Results

Being asked if they would like short colorful historical stories added to their laboratory instructions, 60% answered 'yes' and 20% answered 'no'. Overall, it was found that students appreciated such a context given to their regular laboratory saying, 'They added context to the practical, they alloyed my resignation and left me in a better mood'. Students' responses could be reliably placed into seven descriptive categories as shown in table 1.

Catagories (Short form)

Example of students' comments

Interesting (I)

'refreshing', 'Yeah it is cool', 'sometimes motivated by the story'

Interesting and helps feelings (IF)

'It's good for my feelings about physics', 'It is always nice to hear about the greatness of Einstein-I idolise him'

Interesting and helps learning (IL) 'it provides another way of study', 'we can learn more things about the practical'

Interesting and helps feelings and learning (IFL) 'It was good to learn the history, somewhat helps create a direction of work and helps you get into the 'scientist' mindset'

Interesting but not helpful (IN) 'Interesting historical context, they didn't have any impact ... unless crucial knowledge for exams'

Uninteresting (U) 'Stories didn't motivate me. University is difficult. So is life'

Miscellaneous (M)

'Want this lab weighted more in the whole course', 'Perhaps the instructions in the manual to be clearer'

TABLE 1. Categories developed from students' open-ended responses

Table 2 below shows the Pearson's correlations; enjoyment and pride are correlated with each other for both courses, three of the four negative-valence emotions, anger, hopelessness, and boredom are correlated with

each other. Anxiety is anomalous. In ENV, anxiety is correlated with enjoyment, but not with anger, while in TEC, anxiety is correlated with pride, enjoyment, and anger. Table 3 shows the descriptive statistics. The t-statistics with $p > 0.05$ for all the emotions, informed no significant differences between the two course.

Pr - .740En .742 - .400An - .702 .497Anx .285 .250.625 - .398.325*

Ho .728 .652- .683

Bo .578.292 .468-. Significant at the 0.01 level (2 tailed).

*. Significant at the 0.05 level (2-tailed).

TABLE 2. Correlations between the emotions for the ENV (above the diag- onal) and TEC (below the diagonal) Emotion Mean (SD;SEM) Range

ENV (n=46) TEC (n=117)

Pr 14.20 (2.90; 0.43) 14.47 (2.49; 0.23) 4-20

En 16.78 (3.41; 0.50) 17.35 (3.80; 0.35) 5-25

An 8.15 (2.20; 0.32) 8.21 (2.43; 0.23) 3-15

Anx 7.87 (2.68; 0.40) 7.93 (2.89; 0.27) 3-15

Ho 5.30 (1.95; 0.29) 5.42 (1.94; 0.18) 2-10

Bo 5.48 (2.19; 0.32) 5.50 (2.06; 0.19) 2-10

TABLE 3. Comparative ratings for ENV and TEC for each emotion: descriptive statistics and t-statistics

Conclusion

The 'colorful historical stories' were well received for a series of experiments on electricity by students in the two courses, Environmental and Technological. Students responses pointed to the role of interest that links to attention, impacting engagement and learning. The quantitative measure of emotions are not significantly different for students in both the courses. I also looked into qualitative responses and it was visible that both the cohorts found the 'colorful historical stories' interesting. Though correlations between emotions are different for both the cohorts, TEC students having more correlations between the emotions and showcasing their anger/anxiety. This might be due to the fact that cohorts are different in their predilection for physics.

References

- [1] Stinner, A. (1995). "Contextual settings, science stories, and large context problems: Towarda more humanistic science education". In:Science Education79.5, pp. 555–581.
- [2] Bhansali, A. and M.D. Sharma (2019). "The Achievement Emotions Questionnaire:Validation and implementation for undergraduate physics practicals". In:InternationalJournal of Innovation in Science and Mathematics Education27 (9), pp. 34–46

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