Student Affect during Learning with a MOOC

John Dillon  
Univ. of Notre Dame  
jdillon5@nd.edu

G. Alex Ambrose  
Univ. of Notre Dame  
gambrose@nd.edu

Nirandika Wanigasekara  
IBM Research, India  
nwaniga4@in.ibm.com

Malolan Chetlur  
IBM Research, India  
mchetlur@in.ibm.com

Prasenjit Dey  
IBM Research, India  
prasenjit.dey@in.ibm.com

Bikram Sengupta  
IBM Research, India  
bsengupt@in.ibm.com

Sidney K. D’Mello  
Univ. of Notre Dame  
sdmello@nd.edu

ABSTRACT
This paper presents affect data collected from periodic emotion detection surveys throughout an introductory Statistics MOOC called “I Heart Stats.” This is the first MOOC, to our knowledge, to capture valuable student affect data through self-reported surveys. To collect student affect, we used two self-reporting methods: (1) The Self-Assessment Manikin and (2) A discrete emotion list. We found that the most common reported MOOC emotion was Hope followed by Enjoyment and Contentment. There were substantial shifts in affective states over the course, notably with Anxiety and Pride. The most valuable result of our study is a preliminary description of the methods for collecting self-reported student affect at scale in a MOOC setting.

Categories and Subject Descriptors
K.3.1 [Computer Uses in Education]: Distance learning

Keywords: Affect; Data Collection; Technology and Learning.

1. INTRODUCTION
Despite the burst of research focused on educational data generated by MOOCs, little work has been done on student affect in MOOCs. This is surprising given that previous research has demonstrated that student affect is a critical part of the learning process [1,7]. Although a few previous papers have considered emotions in a MOOC context [5,8], this paper reports the first broad study of self-reported student affect in a MOOC context. This study is based on the University of Notre Dame’s introductory statistics MOOC called “I Heart Stats.” Previous and extensive research has focused on anxiety during learning Statistics [6]. One of the learning objectives of this course was to alleviate student anxiety towards Statistics, and in this regard, it was an ideal opportunity to investigate affect.

2. RESEARCH QUESTIONS
Unlike previous research, which has inferred student affect based on discussion fora [8] or click behavior [5], in this study, we directly and periodically ask students to self-report affect. Furthermore, we track a substantially greater number of affective states than previous studies. We investigate three research questions: Q1. What affective states do students experience in a MOOC setting? Q2. How do the reported affective states co-occur? Q3. How do these affective states change over the duration/modules of the course?

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author. Copyright is held by the owner/author(s).

LAK ’16, April 25-29, 2016, Edinburgh, United Kingdom
ACM 978-1-4503-4190-5/16/04.
http://dx.doi.org/10.1145/2883851.2883960

3. SETUP AND DATA COLLECTION
There were 8 modules (or weeks) of content for “I Heart Stats” and all of the content was released simultaneously. Total enrollment was 24,279 from 183 different countries. The content included short videos as well as multiple-choice assessments, similar to many MOOCs. To measure student emotion in the course we used two self-report assessments. The first (see Figure 1) was the Self-Assessment Manikin’s (SAM)

4. PRELIMINARY RESULTS
Q1. What affective states do students experience in a MOOC setting?
Approximately 3,968 students completed the discrete emotion response survey at least once. The most frequently reported
affective states (see Figure 3) were Hope, Enjoyment, and Contentment.

**Q2. How do the reported affective states co-occur?**
Table 1 lists the number of distinct emotion combinations for each survey. Asking students to report two emotions affords an analysis of co-occurring states [2]. For instance, the top five emotion pairs from Week 0 (see Table 2) show that frequently reported affective states such as Hope are often paired with several different affective states. Further study, however, is needed to determine the Lift scores of these co-occurring emotions [2].

<table>
<thead>
<tr>
<th>Emotion Survey</th>
<th>Emotion Combination</th>
<th>No. of Learners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 0</td>
<td>135</td>
<td>2962</td>
</tr>
<tr>
<td>Week 2</td>
<td>119</td>
<td>2128</td>
</tr>
<tr>
<td>Week 4</td>
<td>105</td>
<td>991</td>
</tr>
<tr>
<td>Week 6</td>
<td>93</td>
<td>631</td>
</tr>
<tr>
<td>Week 8</td>
<td>35</td>
<td>129</td>
</tr>
</tbody>
</table>

Table 2. Top 5 Co-Occurring Emotion Pairs in Week 0

<table>
<thead>
<tr>
<th>Emotion Combination</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoyment, Hope</td>
<td>31.16</td>
</tr>
<tr>
<td>Anxiety, Hope</td>
<td>14.75</td>
</tr>
<tr>
<td>Contentment, Hope</td>
<td>8.91</td>
</tr>
<tr>
<td>Contentment, Enjoyment</td>
<td>5.17</td>
</tr>
<tr>
<td>Hope, Pride</td>
<td>3.85</td>
</tr>
</tbody>
</table>

**Q3. How do these affective states change over the duration/modules of the course?**
Figure 4 presents the distribution of individual affective states over the duration of the course. Note that Hope, Enjoyment, and Contentment remained dominant positive affective states. Pride increased as the course progressed, while Hope and Anxiety decreased.

![Figure 4. Distribution of Emotions Over Course](image)

**5. CONCLUSION/FUTURE WORK**
We collected affect data in a MOOC setting. We found that Hope, Contentment, and Enjoyment are frequent and persistent MOOC emotions. Previous research on affect and learning with technology has largely overlooked some of these emotions, especially Hope [4]. We have also found that the frequency of certain emotions such as Anxiety, Relief, and Pride can change substantially over a course. We acknowledge that our results may be biased by the high rate of MOOC attrition. Once a student drops out, we can no longer collect his or her self-reported emotion. Further research to control for dropout bias in self-reporting affect surveys is needed.

We also plan to study the co-occurring affective states and discrete states in conjunction with course log data. One practical application of sensor-free affect detection in a MOOC context is affect prediction and affect-based intervention. Detecting if a student is confused or frustrated would allow designers, instructors, and learning scientists to orchestrate personalized and timely interventions at scale. An additional practical application of this research is a better understanding of how students feel about different types and samples of learning content. These items will be pursued in future work in the context of “I Heart Stats” and in other MOOCs as well.

**6. ACKNOWLEDGEMENTS**
We would like to thank Crystal DeJaeger and Xiaojing Duan for their contributions in the design and data collection of this project.

**7. REFERENCES**