Investigating Academic Burnout in Undergraduate Physics Experiences

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The term burnout is being used at increasing rates among physics students, particularly in the wake of the changes to instructional modality prompted by the COVID-19 pandemic. Combined with research linking burnout to negative health and career outcomes, this increase in burnout presents a concern with respect to students’ performance and retention. In this research, we will examine the experiences of undergraduate physics students in order to understand how they experience burnout. At the beginning of Fall 2022, we conducted interviews with 7 undergraduates enrolled in upper-division physics or engineering physics classes at two large research universities. We analyzed the data to determine key symptoms that students who self-identified as having feelings of burnout experienced. Following the interview study, we conducted a survey of 24 students to further investigate the symptoms of students that experienced burnout in physics. This paper presents the symptoms of the students who self-identified as burned out and also discusses strategies used by students with lower levels of burnout.
I. INTRODUCTION

With the pandemic affecting students and creating stressful learning environments, burnout is a growing term used by students to describe their experiences in college. While academic burnout is not yet defined as a mental illness, it is a physiological syndrome in response to stressors. The undergraduate physics degree is challenging and stressful, consisting of demanding core classes and electives. The experiences of physics students can involve significant stress and negative emotions, which could lead to feelings of burnout. The purpose of this study is to characterize the experiences of burnout within the physics classroom by analyzing the results of this mixed-methods study with the eventual goal of understanding the ways in which physics students experience burnout. By defining burnout in the context of physics courses, the results of this study can help professors and students recognize warning signs of burnout and lay the foundation to build tools to combat burnout within the physics curriculum. The value of defining burnout in the context of physics undergraduate studies may help mitigate stress-related conditions, improve attendance, and create a positive classroom environment [1].

Formally, burnout describes a state of excessive or prolonged stress that causes emotional, physical, and/or mental exhaustion [2]. When burnout becomes excessive, it can adversely affect both health and academic performance [1]. Students experiencing burnout may feel exhausted due to coursework demands, have a detached or cynical attitude, and/or constantly fear failure [3]. We aim to better understand the challenges and difficulties encountered by students in physics courses at the university level to determine how burnout affects them. Burnout is not limited to students: anyone who feels prolonged stress causing mental exhaustion can experience burnout. Usually, burnout is due to high levels of demand, overworking, lack of self-care, lack of control, etc. [4], elements that are often present in the physics classroom.

II. SIGNIFICANCE & BACKGROUND

Traditionally, burnout has been studied in professional work fields such as healthcare and business [5]. However, students perform tasks that can be considered as work (e.g., going to class, assignments, exams) often with high stakes [6]. Research specifically on academic burnout is limited and has been mostly conducted in other countries. A German study [7] used The Oldenburg Burnout Inventory (OLBI) to study academic burnout and this instrument served as a useful starting point in designing the work reported here. Additionally, some work has been done in China and Korea; however, these studies are mostly written in languages other than English, making them hard to access without translations available. However, the limited existing research expressed concern for academic burnout in highly demanding majors or fields [1]. Burnout can lead to lower commitment, reduced productivity, low morale, lower attendance, and lower human consideration [6]. Physics students often have heavy course loads and many students also have other degrees they are pursuing (i.e., math, astronomy). In particular, 25 of the 31 students in our study had another major or minor, on top of their physics or engineering physics majors. From a study done in Taiwan, students enrolled in multiple programs showed more burnout, which correlated with reduced academic performance [4]. Anecdotally, there is a sense that the pressure for physics students is more acute and rigorous than in many other majors, and this rigor only increases over the course of the 4-year degree.

Similarly, burnout generally results from long-term stimulus and brings a range of physical and emotional symptoms [3]. Emotional exhaustion and cynicism are two core symptoms of burnout, and this can impact motivation, increase feelings of fear, self-doubt, failure, etc. Studies have found that these negative feelings are potentially harmful to students and can cause poor performance [1].

An important distinction to make is the difference between stress and burnout. Burnout is a result of chronic and prolonged stress. Both often overlap in symptoms and feelings, but burnout can contain feelings of hopelessness and a cycle of negative emotions [2]. There is also a distinction from mental illness to burnout. Many mental and physical illnesses share some of the same symptoms as burnout. When analyzing the experiences of students, we must be mindful that other illnesses exist and can impact (or not) a student’s experience of burnout. Regardless of other circumstances physics students have, being able to support and enhance their learning comes from understanding their experiences within the major.

One distinction helpful in determining the level of burnout students experience are the 5 stages of burnout identified in Ref. [8]. The first stage, the Honeymoon Phase, brings excitement, optimism, periods of productivity, and progress. The second stage, Onset of Stress Phase, is short-term periods of stress that bring a few physical and mental signs. The third stage, the Chronic Stress Phase, is described by persistent stress that can affect performance, negatively impact social relations, and bring feelings of pessimism. The fourth phase, the Burnout Phase, is where stress becomes a negative loop and does not relieve overnight. Usually, people are no longer able to function normally, and problems with work consume their lives. In the fifth stage, the Habitual Burnout phase, burnout becomes a daily part of life and can develop into serious depression or mental illness. Fatigue is dominant and work becomes hard to complete [9]. We will use these 5 stages allow us to understand the degree to which students experience burnout [8].

III. METHODS

In order to gain insight into the experiences of physics students, we developed a research study with two phases. The first phase focused on one-on-one interviews (with a short pre-interview survey) with undergraduate student volunteers. The interview protocol focused on open-ended questions de-
signed to elicit information on the student’s experiences with a high-pressure physics degree. The second phase of the research was informed by an analysis of the interview results from the first phase. Using these results we crafted a survey that could be distributed more broadly. Being one of the first to study burnout in PER, it is important to note that both the interview protocol and survey were informed primarily by results from occupational burnout studies and the Oldenburg Burnout Inventory.

Interviews in the first phase of research consisted of one-hour Zoom sessions. We interviewed seven students from two large research institutions at the start of the 2022 Fall semester. Additionally, the students were considered upperclassmen taking classes that involved multiple prerequisite physics classes to ensure they had been in the program for a minimum of two years since burnout is a long-term condition that builds over time. We recruited these students by email solicitation sent by professors teaching higher level physics core courses to distribute to their students.

The questions within the interview protocol focused on common symptoms of burnout and how students experience them. After a series of background questions about the student’s academic experience, we listed 18 symptoms of burnout and asked students to rank themselves on a 5-point Likert scale with respect to how often they experienced these symptoms, from always to never. To more accurately understand student experiences, we refrained from using the term burnout in either the pre-interview survey or the beginning of the interview protocol to avoid influencing students’ responses. Instead, burnout was not mentioned until the end of the interview study where we asked specific questions about the symptoms of burnout. We also asked students which of the 5 stages of burnout they most resonated with. In order to refrain from implying a diagnosis of students, we emphasized that we are not medical professionals but rather want to understand how physics students are feeling and experiencing their classes and coursework. Campus support resources were also provided to the students at the conclusion of the interview. We were able to categorize each student based on how high they ranked on the burnout scale and the symptoms they felt to search for correlations between the stages of burnout and extent of symptoms experienced.

To analyze the interview responses, we used qualitative coding to characterize students’ responses to common burnout conditions identified in existing literature. We categorized responses into a priori codes that indicate burnout symptoms or feelings. We also identified emergent patterns we refer to as ‘anti-codes’ which were specifically present amongst students who had lower levels of burnout. These anti-codes identified strategies and characteristics that might explain why these students may experience less burnout.

Codes and anti-codes (see Table I) are defined such that there are no overlaps within the codes.

Based on the results of the interview study, we created a second survey to collect information on the experiences of a larger number of students. This survey was distributed, once again, through an email solicitation forwarded by professors teaching upper-division core courses. The survey was fully anonymous; however, to incentivize participation, students were provided an option to enter their email address through a separate interface to enter to win one of 5, $20 gift cards. Overall, 24 students responded to the survey. The survey focused specifically on identifying the symptoms and feelings of physics students. We narrowed the questions asked in the interview to focus on questions giving the largest amount of information on how students experience burnout. All of the closed-response questions asked in the interview study were included in the survey.

IV. RESULTS & DISCUSSION

To gain a sense of how many students were familiar with burnout as a concept, we asked participants to provide a definition of burnout in both the interviews and the survey. Every participant in the study was able to give a relevant and appropriate definition of burnout. The fact that students are (as expected) familiar with burnout lends credence to the concern surrounding students feeling burned out. Moreover, when participants were surveyed, 13 out of 31 students claimed they do not get enough rest always or frequently and 6 others said occasionally, indicating that many students are tired and may lack leisure time for self-care (which can lead to increased experience of burnout).

We focused our efforts largely on identifying how burnout presents and factors that increase or limit burnout. In this section, we will examine which symptoms are more frequent and how those relate to the different stages of burnout. We also investigated the effects of having a community vs. feeling isolated. Within the interview study, we found that students vary in burnout levels, but have similar patterns. Overall, 7 students were interviewed and 24 were surveyed for a total of 31 students. However, since some survey questions were optional or conditional, we have slightly smaller data sets for different parts of the survey. For example, if students did not identify with any of the 5 burnout phases they were not asked to report which symptoms they experienced.

The academic literature around burnout, along with our own experience, suggests that isolation can be both a cause and a symptom of burnout. Between the interviews and surveys, 7 students expressed they felt isolated or alone at college. However, we did not find any conclusive evidence that directly connected isolation (as a symptom or cause) with their experience of burnout, and, overall, these students experienced varying degrees of burnout, from the Honeymoon Phase to the Habitual Burnout Phase. We also asked students if they had friends in the classroom and had a sense of community. The remaining majority of students, 24 out of 31,
felt that they were not isolated and alone. Thus, in our data there was no correlation between isolation and the stages of burnout; however, the small N in our study limits the generalizability of this finding.

Within the interview study, one common trend shows that students generally do not ignore academic responsibilities, whether or not they experience burnout. Out of the seven interview participants, four students directly called academic responsibilities their number one responsibility, while the other three indirectly stated that they prioritize academia. Another commonality between the seven interviewees stated they felt supported by the classroom community regardless of if they had friends within the classroom.

The codes and anti-codes identified in the interview data are given in Table I. Codes indicating burnout are highly consistent with the literature. The only academic-specific code related to stress specifically around exams. Given the high-pressure nature of exams, this pattern is not surprising. The anti-codes, which were extracted from responses from students who were less burned out, show strategies or feelings that correlated with lower levels of burnout. These results suggest that there are certain actions, like careful time management and having support and passion, that students with lower levels of burnout incorporate. While it is not possible to determine, from these data, whether these strategies actively reduce a student’s experience of burnout, they do lay a useful foundation for future studies investigating strategies that might help students mitigate burnout.

Table II shows the frequency of the codes and anti-codes for each of the interview participants. Those with higher levels of burnout have a higher number of codes indicating burnout and very few anti-codes, e.g., Students 1 and 4. Those lower on the burnout scale still experience symptoms of burnout; however, they tend to have more anti-codes, e.g., Students 6 and 7.

In the surveys, our main focus was to identify the symptoms of burnout experienced by the 24 students surveyed. We asked students the same set of symptoms as the interview and the frequency in which they experienced these from always to never. Students were also asked to self-identify which of the five stages of burnout they most aligned with. Out of the 24 students who participated in the survey, 3 students selected none, 1 selected the honeymoon phase, 8 selected the onset of stress phase, 6 selected chronic stress, 1 selected the burnout stress phase and 5 selected the habitual burnout phase. We asked each student to identify how often they experienced the 18 symptoms of burnout seen in Table III and Table IV.

When examining the symptoms, we notice the physical symptoms are less present in students than the general set of mental and emotional symptoms. The most significant concerns are the 11 students who reported feeling ill, 12 students who reported stomach or bowel problems, and 12 students who experienced fatigue or neck pain at high rates of frequently or always. Some of the emotional and psychological symptoms also show high rates in the always or frequently categories, showing that a majority of students are fearful of failing and stressed or anxious. In general, students are physically healthy but have more physiological symptoms. Physics students are in high-stress situations and exams, and the data shows they experience varying symptoms as a result.

Table V reports the average number of symptoms per respondent for students in each of the 5 stages of burnout. In this table, we have categorized always and frequently together, as well as rarely and never to increase statistical power. Table V indicates that students in the Burnout or Habitual Burnout phases had more symptoms at higher frequencies. Students that were low on the burnout scale, showed

<table>
<thead>
<tr>
<th>Burnout Phase</th>
<th>N codes</th>
<th>N anti-code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student 1</td>
<td>chronic stress (4)</td>
<td>18</td>
</tr>
<tr>
<td>Student 2</td>
<td>onset of stress (3)</td>
<td>2</td>
</tr>
<tr>
<td>Student 3</td>
<td>onset of stress (3)</td>
<td>5</td>
</tr>
<tr>
<td>Student 4</td>
<td>burnout (4)</td>
<td>8</td>
</tr>
<tr>
<td>Student 5</td>
<td>habitual burnout (5)</td>
<td>5</td>
</tr>
<tr>
<td>Student 6</td>
<td>honeymoon (1)</td>
<td>2</td>
</tr>
<tr>
<td>Student 7</td>
<td>honeymoon (1)</td>
<td>2</td>
</tr>
</tbody>
</table>

TABLE II. Frequency of Codes and Anti-codes experienced by the 7 interview participants and their corresponding stage of burnout.
TABLE III. Frequency of reported symptoms of Burnout amongst the survey respondents (N = 24).

<table>
<thead>
<tr>
<th>Experience</th>
<th>Feeling</th>
<th>Headaches</th>
<th>Insomnia</th>
<th>Stomach or bowel problems</th>
<th>Muscle Fatigue</th>
<th>Back or neck pain</th>
<th>Perspiration</th>
<th>High Blood Pressure</th>
<th>Depression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>10</td>
<td>9</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Rarely</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Occasionally</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Frequently</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Always</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

TABLE IV. Specific physiology symptoms of burnout reported by the survey participants (N = 24).

fewer symptoms with lower degrees of frequency. Visually there is a clear indication for students falling into the none, honeymoon, and the onset of stress phases will have the majority of symptoms that rarely or never occur. This visual trend is supported using a chi-squared test (p < 0.00001) and a Cramer’s V = 0.3287, indicating a moderate association between the stages of burnout and the number of symptoms.

V. CONCLUSIONS & LIMITATIONS

To address the limited research on academic burnout, this study serves as a basis for future work within the field of physics education. We demonstrated links between the 5 phases of burnout and the frequency of burnout symptoms experienced by students. Our goal was not to identify how to solve or prevent burnout but, rather, to identify how it presents. We studied varying symptoms and have identified how often students experience these. The next step of this research is to determine how these symptoms affect academic performance through additional interviews and surveys. The end goal of this research is to develop resources to help students prevent the symptoms of burnout.

The results presented here have shown physics students have varying levels of burnout and those with higher levels are impacted emotionally, mentally, and physically, lending credence to the concern that many students are experiencing burnout. Regardless of the student’s level of burnout, interview trends showed that they are tired and drained, and most are not getting enough rest. Additionally, almost all students were fearful of failing classes. Notably, selection effects regarding who typically responds to requests for survey suggest our results should be interpreted as a lower bound on the frequency of these symptoms amongst the broader physics student population. Recognizing these patterns serve as a useful step in aiding physics students and gaining better academic results. One important aspect missing from this research consists of the students with no burnout. Only 3 of our students identified as having none of the 5 stages; however, we did not require these students to answer the symptoms questions. In future work, it would be valuable to ask students who don’t self-identify as having burnout what their symptoms are as well for a base comparison. Expanded future work would also address another limitation of the current work - small N and a student population restricted to large, research-intensive institutions. However, despite these limitations, this research gives an insight into the presentation of burnout in physics students and serves as a basis to build from.

ACKNOWLEDGMENTS

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