

Use of Personas in Exploring Scholarship Applicants

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Use of Personas in Rating Scholarship Applications

Introduction

This evidence-based practice paper introduces a method for creating subjective, holistic rubrics based on the human-centered design concept of personas. It can be difficult to align assessment metrics with subjective artifacts, especially when the goal of the artifact itself is subjective. The faculty team who collaborated on an NSF S-STEM project faced this problem when rating student applications that featured essay questions. This program incorporated scholarship funds and structural supports to help students successfully navigate their engineering undergraduate degree program. These supports were chosen with specific target populations in mind, namely low-income, first-generation, mathematically underprepared, and minority students. The project team chose to employ personas in an attempt to create a rubric that allowed for the holistic, subjective, “I know it when I see it” style of selecting students who showed a need for the scholarship program while having a shared vision of what “it” is. This paper presents the method developed to create this rubric using personas and the experience of the team in implementing this method as a case study.

Purpose of this paper

This paper is intended to both present a technique that can be used across a number of contexts and to illustrate a case study of using this technique in a specific instance. Implementation of research-based methods is often slow and difficult [1]. New methods can be presented in a context-less or abstract format, making it difficult to bridge the research-to-practice gap, and publications tend to value an innovative method more than an in-depth implementation example or guide [2]. How does this research-based method look in a real-life context? How can it be adopted? As we see with our students, without concrete examples for reference, it is often difficult to employ a new method, even if we have proof that it is worthwhile. Concrete examples can help to ensure fidelity of implementation of new methods by sharing which aspects are essential and which can be altered through adaptation to new contexts [3, 4]. Essential components of this innovation are shared in this paper via the “Rubric-building process” in the Methodology section. The implementation, how these essential components were used and adapted due to the context, can be seen in the case study presented in the Results and discussion section. Case studies showcasing a specific method in order to support the research-to-practice transition have proven to be useful in a number of areas in engineering education (e.g. [5, 6]) and this paper is intended to support the novel implementation of personas in a similar fashion.

Background

Campbell University is located in a rural area with many first-generation college students in the engineering student population. The institution also accepts many students into the engineering program who may need an additional semester or two of preparatory mathematics before they are able to enroll in pre-calculus. These populations of students are likely to have low social capital or pre-existing networks in areas that would support their college experience [7]. The School of Engineering is able to offer students need-based scholarships through an NSF S-STEM grant. As part of this program, students are expected to take part in a variety of professional development activities including mentoring, industry tours, tutoring, and internship preparation assistance,

chosen to address the expected needs of the student population. To select students to enter the program, an application with four essays and demographic information was developed. In order to select applicants from this pool, the team needed a method for analyzing these applications.

Rubrics are often used to rate the quality of a submission, whether graded work submitted by a student, a report or performance for a competition, a paper presented to a journal or conference, or myriad other situations. Faculty are often trying to improve rubrics, and engineering educators are no exception – there are 3869 results for the term “rubric” in ASEE’s PEER repository [8], ranging from apps to help faculty implement rubrics [9] to the development of rubrics for specific purposes [10, 11, 12, 13] and the analysis of the use of rubrics [14]. Rubrics are a way to translate predetermined performance criteria to a performance rating.

As faculty develop rubrics, we sometimes attempt to create objective, anchored ways of measuring performance criteria (analytic rubrics) or may feel that we are experts enough to recognize the quality level of students’ work without detailed anchors (holistic rubrics) [15]. For objective or formative artifacts, like technical problems or reports with specific components that are required, analytic rubrics more strongly align with the desired outcomes. These rubrics generally incorporate different rating levels for each performance criterion considered, often with anchored details at each level [16]. For subjective or summative artifacts, like reflective essays or design reports that may not have specific required components, a holistic rubric may align better with the desired outcomes. Often, a holistic rubric has performance criteria defined within a single rating system for the entire work and doesn’t provide much performance feedback as part of the rubric itself [16]. For either type of rubric, performance criteria must be developed. For this project, students would not be gaining any feedback and would be scored based on their application, placing it in a summative category rather than formative. Student essays would not have specific required components and instead would allow for strongly subjective ratings by the reviewers. A holistic rubric is appropriate in this case. For the performance criteria, rather than any specific anchored actions, target responses based on personas developed by the team of reviewers would be used.

Personas have been used in engineering education beyond human-centered design. They have been used to illustrate student actions and create empathy for students while discussing evidence-based concepts [17, 18], to provide a way to review student populations holistically [19], and in empathetic course design [20]. This paper provides a look at how personas can be used in a new context: holistic persona-based rubrics.

Methodology

This paper is presented as a case study to introduce the method and to illustrate one example of its use. The use of case study allows for a rich, complex presentation of the situation with multiple forms of data to showcase the situation of interest [21]. The multidimensional presentation of data is particularly useful for exploring the development and implementation of this method as the observations of the method, supporting artifacts, and faculty reflections provide a strong example beyond simply explaining the method. This case study is led by a participant observer, one of the participants involved in the case who also collected observations and led the development of this paper. The other two authors are also participants in this case study, providing reflections and member-checking to ensure veracity of the claims presented.

Data used in this case study includes observations, artifacts, participant reflections, and analysis of the artifacts developed in this study. Observations were noted by the participant observer during the process and therefore may have some bias due to their interest in the project and participation in the development and implementation process. Observations as presented in this paper have been reviewed by the other two participants as part of a member-checking process to ensure veracity and to reduce bias. Artifacts include images of the Google Jamboard used during the development process [22]. Student applications were used to develop personas; student applications are not directly used as part of this case study but the personas developed from these applications and ratings of anonymized student applications are shared. A basic, holistic comparison of the initial rubric personas and the personas developed from student applications is presented. All three participants involved in the rubric development and implementation have shared their reflections on the process in addition to reviewing and contributing to the case study.

This case study relies on two additional techniques, the development and use of personas, and the development and use of target personas as the basis for a rubric.

Personas

Personas are used in many industries, generally by firms focused on human-centered design. They are narratives developed to create a specific, though not real, example of a user, client, or in this case, student. Personas provide designers, marketers, and others a target client to keep in mind and are developed through an understanding of the target audience, often via interviews and interactions with users [23, 24, 25]. Personas include a number of details including a name, marital status, occupation, hobbies, and enough additional information related to your context to be able to really understand the persona as a potential end user in design, or in this case, participant in the application process [23].

Two personas were developed as target personas as the basis for the subjective, holistic rubric. In a prior study, three personas were created from the initial applicant pool [19]. To compare the applicant pool to the target personas created for the rubric and the prior personas, three additional personas were created from the student applications: one to represent students who are likely to apply for this scholarship program, one student who is likely to submit a successful application, and one student who is likely to submit an unsuccessful application. The final personas should not match any one student applicant or be considered either an ideal applicant or composite of all applicants. If added into the pool of student applicants, these personas should not feel out of place or one-dimensional. The five personas developed for this study, when they were developed, and the purpose for each persona can be seen in Table 1.

Table 1. Personas developed as part of this study

Personas	Development Date	Purpose
Target Persona 1	Before application review	Analysis of applications (rubric)
Target Persona 2	Before application review	Analysis of applications (rubric)
General Applicant Persona	After application review	Comparison of results
Successful Applicant Persona	After application review	Comparison of results
Unsuccessful Applicant Persona	After application review	Comparison of results

Application instrument

Once personas were developed via the empathy map, they were used to develop target responses to the application instrument. This instrument included demographic questions such as the applicant's name, employment status, number of hours worked, parental college attainment, community college experience, and whether they entered the program on the track for underprepared engineering students. In addition to these questions, the following four essay questions were asked:

- What have been your most significant challenges to achieving academic success? Comment on how you overcame those challenges.
- Give an example of how you made the most of an academic opportunity.
- What are the biggest challenges to completing your engineering degree at Campbell University?
- How would the CORE-ES scholarship and program help you to overcome those challenges?

Rubric-building process

The process for developing the personas to be used as rubrics is a five-step process as seen in Figure 1. All stakeholders involved in the process should be consulted to ensure that the final personas and rubrics are reasonable for their intended purpose. At a minimum, this should include those who are using the rubric, and can include others involved in the project (e.g. those administering the award, faculty or researchers involved in the project, past participants, etc.) or experts in the area who could provide valuable feedback.

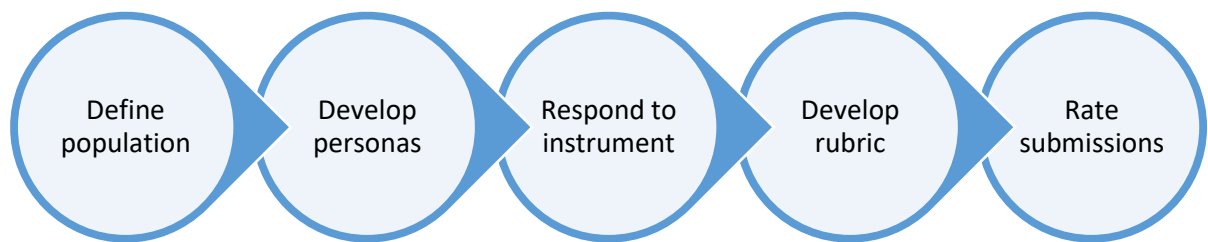


Figure 1. Rubric development and use process

In this section, “data” is the information that is collected, whether that is essays, reports, interview responses, fill-in-the-blank surveys or applications, or other participant responses. “Instrument” refers to the means of collecting that data, which can include an application, survey, essay prompt, interview protocol, or other method. “Participant” or “subject” refers to the person supplying the data such as a student, program applicant, research participant, or any other group.

I. Define target population

The target population needs to be clearly defined. In order to meet the user needs in human-centered design, the target user must be identified [25]. Engineering students or even engineering students at a particular university is unlikely to be well-defined enough. What aspects of the target population define them from their next-closest population? How can you determine who is and is not a part of the target population in a room full of potential participants?

Group consensus and validation from additional stakeholders if available should be achieved before continuing.

II. Develop target persona(s)

Target personas are developed using an empathy map, four questions often used in human-centered design to facilitate persona creation [26]. These questions should be answered from the perspective of the population of interest. This perspective can be gained via a number of methods, from familiarity with the target population to reasonable, evidence-based beliefs or assumptions about the target population or interviews with the target population. The four questions can be seen below, with some guiding questions to help focus the responses:

1. What do they think?
 - a. What is important to the target population? What is on their mind?
2. What do they feel?
 - a. What worries them? What are they excited about?
3. What do they say?
 - a. Verbatim from interviews or what you've heard is best here.
4. What do they do?
 - a. What physical actions do they take?

Rubric developers may answer the four questions individually. In addition to the guiding questions, having one participant or non-participant review the responses for common themes or more importantly, gaps in the responses, is essential to ensure a full picture of the target population.

Responses to the four guiding empathy map questions help to create a general sense of the population. Detailed personas as described in the earlier section can now be created based on the responses to these questions. At least one persona should be created. Multiple personas can provide a richer picture of the targeted population. If appropriate, personas that represent an undesirable participant can also be created to develop a full understanding of what is and what is not desired from participants. Personas should be detailed enough to really understand how the persona would respond to the instrument, similar to interpretive phenomenological analysis [27].

One additional use of the personas is to be sure that the instrument is collecting the information that is desired from participants. If the creation of the persona-based rubrics is early in the data collection process, the instrument can be refined. Any specific information or considerations that have been included in the personas are likely to be important in the analysis process and should be considered for inclusion in the instrument if they are not already present.

Questions may be answered individually but overall empathy map responses and themes should be agreed upon by the group. Personas may also be developed individually or as a group based on the group empathy map and consensus should be reached before continuing.

III. Respond to the instrument as target personas

The responses to the empathy map and the target personas are used to create the target persona responses to the instrument. These can include bullet points, full responses, actions, or other information that will be helpful in determining whether data provided by a participant is similar to what would be expected from the target persona. This provides the target persona data set that all data will be compared to in the final stage.

Target persona responses can be developed individually but must be agreed upon by the group as they are the foundation of the rubric.

IV. Create a rubric

There is not one right rubric. At a minimum, there should be a “Similar to Persona(s)” category as the highest category and “Not Similar to Persona(s)” as the lowest category for participants under consideration. A basic three-bin rubric is “Similar to Persona(s)”, “Less Similar to Persona(s)” and “Not Similar to Persona(s)”. Four bins, splitting the “Less Similar...” bin into a “Somewhat Similar...” and “Somewhat Dissimilar...” bin might be more appropriate. As an example of a holistic five-bin rubric, grants reviewed via NSF panels are rated as “Highly Competitive”, “Competitive”, “Low Competitive”, “Not Competitive” and “Not Discussed by Panel”.

When considering the number of bins, consider how selective the outcome is expected to be. More bins will allow for greater distinction among categories of participants, however more than five bins may cause more confusion for raters. The goal of this rubric is not to rank participants in any sort of order but to evaluate them against the target persona or personas.

This rubric is not intended to ensure consistent ratings between raters as it is a holistic, subjective rubric used in a holistic, subjective manner. If consistency of scoring is intended, a training set of data and additional testing and training of the rating team is needed.

All raters must be using the same rubric to continue.

V. Rate the participants based on the rubric and compare

Initial ratings should be done individually. Each rater should consider what bin of the rubric the data best fits into by comparing against the target persona(s) without considering how each participant compares to the other participants. Reviewers can then compare their ratings in the way that makes sense for the context. The two most likely methods are to come to a consensus on the bin placement for all participants or to provide a numerical value for the bins and average participant scores among raters. This rating system is not intended to provide a linear ranking for all participants; rather, it is for systems that benefit from chunking participants into appropriate groups. It may be helpful at this point for stakeholders who have not been a part of the process to review the final outcome via randomly choosing data and comparing their expected ranking with the committee’s ranking or another appropriate method.

After individual ratings are completed, the group must collaborate and come to a consensus as to the final grouping of participants. Outside validation from stakeholders is recommended, though not required.

Results and discussion

The results of this case study are presented for each step of the process of developing the rubric, followed by the personas and results of the use of the rubric.

Why persona-based rubrics?

In the first year of applications for this S-STEM grant, all three faculty members used a self-created rubric to rank the applications. There were a few applications which had very different scores from the three raters. These applications included essay questions, and the raters felt very differently about what made a good essay. One rater created strong anchors for their rubric, which led to lower scores for potentially deserving individuals if they did not answer questions in an expected way (e.g. discussed their family when the prompt asked how the applicant responded to a situation). This was likely to be more common for the at-risk students who were the target of this grant. The other raters were more likely to rate the situation rather than the students' response to the situation via the mechanics of their essay. After selecting students, we used personas to understand our applicants in the first year of this grant.

In the second year, we considered using persona-based rubrics help to mitigate the rating disparity seen in the first year, and because the research lead was interested in exploring what else personas could be applied to. There were so few applicants in this year compared to available scholarships that there was no need to rank the applications.

In the third year, we had enough applicants and were still interested in finding a way to unify our ratings without creating unnecessary, unfair, or unrealistic rubrics that attempted to create an illusory objective standard for essays. By creating personas, we could create examples of students who should receive this scholarship and holistically and subjectively rate these students' applications. Using persona-based rubrics, we were able to align our assessment of the applications with the content provided by the applicants.

Target population (step I)

The target population was defined as engineering students at a small, rural, liberal arts university who are eligible for and interested in applying for a need-based scholarship. Any US citizen or resident who is not in their final year (quantified by taking (or have taken) Senior Design) and has a GPA above 2.5 is eligible and therefore in the target population.

Persona development (step II)

The four target questions were answered in a group session by the three raters using Google Jamboards to work together remotely. Each question was the topic of a Jamboard and the sticky notes were used to populate responses to the four questions. The raters were all faculty in the department and involved in mentoring and advising students in the target population, so used both their familiarity with the population and the evidence-based knowledge about the student populations the program was designed to support to respond to the empathy map questions.

One of the three raters was also the research lead and led this process. After giving time for all three raters to populate a question with sticky note responses, the research lead quickly summarized common themes and confirmed with all raters to gain consensus, using text rather than sticky notes to differentiate as shown in Figure 2. Two particular moments stood out during this process. During the “What do they think?” discussion, one rater posted “I am a good student” and in the summary, the other two raters added a second clause, “but...I can’t be the best I can.” to connect the other ideas shown on the board. The initial rater pushed back, considering it to be a complete statement, no amendments necessary. The three compromised as shown in Figure 2, “I am a good student. AND/but...I can’t be the best I can.” The rest of the notes were summarized as “I need to pass” and “\$” (money).



Figure 2. What do they think? Jamboard image. Initial thoughts are on sticky notes, summarized themes in orange text.

The second moment that stood out in the process was when answering “What do they say?” There was not a single positive response in the initial consideration of this question. The research lead noted this and asked the raters to reconsider whether there were any positive things that they could add. Positive responses were included once raters were prompted to add them. Responses to the remaining targeted questions can be seen in Appendix A.

In preparation for developing the full personas, we used the general demographics questions from our application. This helped us to focus our personas on what would align with the application. If we were using this method for a new project, we would not yet consider the application so that we could compare what we thought was important to include in the personas we have developed to what we would be asking for in the application. This was a new rubric method used for our third round of applications so we would not be using this method to update the application questions or process.

At this point, the time set aside to develop these personas was running short, so instead of using the questions and basic demographic details to develop full, rich personas, we moved directly to the persona responses to our application. In the future, we should have separate times for developing the personas and responding to the rubric. We spent one hour on the development of the rubric, including the empathy map, and should have given ourselves two separate one-hour sessions at a minimum.

Persona responses (step III)

The brainstorming responses to the application questions can be seen in Appendix B. Personas presented here are ad hoc personas using the information shown in Appendix B and were not developed during the rubric development process. We felt that we were able to use the empathy map and demographic questions to develop the target persona responses to the application essay questions and did not need to create full personas before moving on given our timeframe. This is not the recommended method, however we are presenting our full experience as it occurred.

Target Persona 1: Eduardo Garcia

Eduardo is from North Carolina. He came to the university directly from high school with no transfer credits. His mother has a college degree. He works on campus as a lab attendant and with student life for approximately eight hours per week. He was the best in his year at his rural high school but has found college to be much more challenging. He was surprised to learn when he came to the university that he would be starting behind the majority of the engineering students in mathematics and taking an additional engineering class as well. He has been working hard with a teacher to get by and makes time to be involved with the engineering organizations on campus. Eduardo is concerned both about finding time to do well and work with study groups. He hopes to build a better support system of students and reduce the number of hours he works through the scholarship program.

Target Persona 2: Hannah Moore

Hannah is from North Carolina. She has an Associate's degree in engineering from a local community college which she earned before transferring to the university. Neither of her parents attended a college, though her father did attend a trade school for his work as an electrician. She is employed off campus at Pizza Hut and works approximately ten hours per week. She helps out at home as often as she can, babysitting younger family members and contributing money when possible. She is concerned about not having enough time to go office hours or extra review sessions due to her family's needs. Hannah has been working hard to get by and started at a community college to save money in the long run. She is concerned about keeping her GPA up due to the online classes and hopes that this scholarship will improve her engineering network as she hasn't been able to make many connections due to COVID.

Rubric and rankings (steps IV& V)

Our rubric was a three-bin rubric that included "Similar to persona(s) generated", "Not like the persona(s) generated, but not too far off" and "Very dissimilar" as seen in Figure 3. All three raters used the same rubric to score. The rater scores in Figure 3 use the overall rubric but have split the center category into "more similar" and "more dissimilar" bins, a change we would implement in future uses of this method.

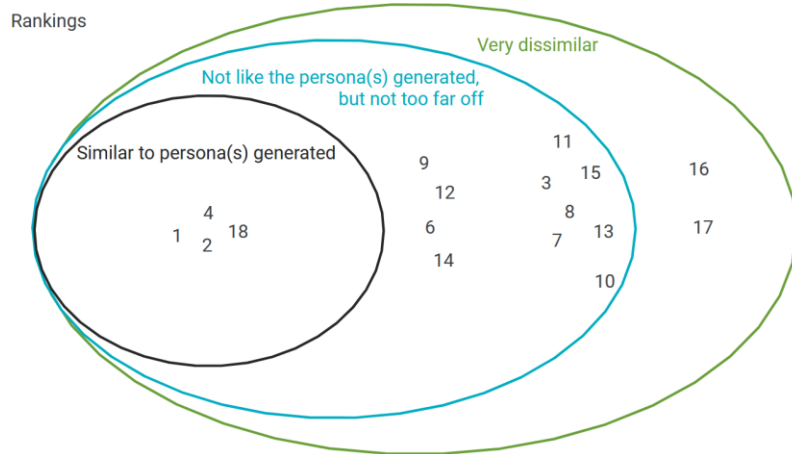


Figure 3. Example of rubric with evaluations.

Once all three raters had rated the applications, we compared them by putting them into Excel and giving a score of 3 to those in the “Similar...” category, 2 to those in the “...not too far off” category, and 1 for those in the “Very dissimilar” category as seen in Table 2. In our case, we were able to adjust the number of scholarships awarded and the amounts based on the average scores. If we needed to reconsider any scholarships, we would have had to review the individual grants more explicitly. A four-bin rubric may be used in the future to promote greater discrimination between groups.

Table 2. Rubric analysis, scholarships awarded to applicants above the line in the table.

Application	R1	R2	R3	Average
1	3	3	3	3
2	3	3	3	3
4	3	3	3	3
18	3	3	3	3
7	3	2	3	2.67
10	3	2	3	2.67
11	3	2	3	2.67
12	3	2	3	2.67
6	3	2	2	2.33
14	3	2	2	2.33
3	2	2	2	2
8	2	2	2	2
9	2	2	2	2
13	recuse	2	2	2
17	2	1	2	1.67
15	1	2	1	1.33
16	1	1	1	1

In Table 2 it can be seen that there was strong agreement in the ranking of half of the applications. For our context, we used this rubric to help us ensure we are accepting the students

who are most likely to benefit from the program's scholarship and structure, so some differentiation was reasonable and allowed us to offer three different scholarship levels for the three different scores that were within our scholarship cutoff (3, 2.67, 2.33). We did not require a rubric that was likely to give the same score independent of the rubric user, we instead were pleased to have a rubric that was intentionally subjective for a subjective purpose.

Personas from applications

The following three personas have been developed using the 2020 application pool. While the target personas used for the rubrics were developed using the process noted above, these personas were developed using the student responses to the applications. For a more in-depth discussion of the method used, see our prior work [19].

General Applicant Persona: Mark Johnson

Mark is from North Carolina. He didn't attend a community college before coming to this university. Both of his parents are college graduates. Mark is a second-year student in the mechanical engineering concentration. Making the leap from an easy high school career to a much more difficult undergraduate engineering career and learning how to effectively study is the biggest academic challenge Mark has faced. He believes that finances are the biggest challenge remaining for him, or at least, will be once the pandemic is no longer throwing a wrench into his college career. He believes that the program's mentoring will help him to fully achieve his engineering and academic potential and is looking forward to building the network that he feels is lacking due to the pandemic's social restrictions.

Successful Applicant Persona: Susan Smith

Susan was born and raised in North Carolina. One of her parents graduated from college, the other never attended. Susan is in her first year at the University and is in the chemical engineering concentration. She is a Tier I student, meaning that she came to the university underprepared in mathematics and is in the process of taking a year of preparatory courses before being able to start the Fundamentals of Engineering sequence. She plays an instrument in the band, works on campus approximately ten hours per week, and goes home to see her family at least once a month. She isn't yet involved in any engineering student organizations but hopes to become more involved as time goes on. Susan's biggest academic challenge has been the health of her mother who had cancer on top of her own learning disability. Susan hopes that the scholarship will help her to work on her time management and help her to adjust to college a second time, once the pandemic is no longer a major factor in how the university runs.

Unsuccessful Applicant Persona: Randall Jones

Randall is from North Carolina. Both of his parents graduated college. He is a second-year student with a focus on mechanical engineering. Randall has taken a couple of classes at a community college over the summer to help make the rest of his engineering semesters more manageable. Randall is very involved in a number of extracurricular activities including taking on a leadership role on the Human Exploration Rover Team. He doesn't work during the school year. His biggest challenge at the university has been trying to find a work-life balance between extracurricular activities and schoolwork. He believes that the community and GPA requirements will help him to find the motivation that he needs to succeed, while relieving some financial anxiety via the scholarship.

Persona comparison

The personas developed from the pool of successful applicants share a number of characteristics with the persona developed as an ideal scholarship awardee. Both are local to the university. None have two parents with college degrees and one spent time at a community college and Susan, the successful applicant persona, did not. Two are not Tier III students, which means that they have entered engineering as a mathematically underprepared student and have needed to take some additional classes before starting the fundamentals of engineering course sequence. This causes students to spend additional time at the university and also can have an impact on their social interactions with students, as they are not taking the fundamentals of engineering sequence and associated mathematics and science courses at the same time as other first-year students.

All five developed personas would be reasonable to find in the general pool of applicants. Looking at the two target personas (Eduardo & Hannah), the successful applicant persona (Susan), and the unsuccessful applicant persona (Randall), the successful applicant persona and two target personas are more similar to each other than to Randall. While not an objective measure of success, this method seems to suggest that the successful applicants were similar to the targeted personas as intended. Given the subjective nature of this system and of any system chosen to rank the student applications, a holistic comparison between personas provides a reasonable mechanism to verify the reliability of the results.

Faculty reflection

Rater #1

I found this to be a great exercise. As the lead researcher and the rater who had particularly different ratings in the first year, I appreciated the use of personas to create a more subjective, holistic rubric aligned with the content in the applications. I really like rubrics. I like strongly anchored rubrics that take out a lot of the wiggle room when grading student work. I use them for lab and design reports as well as for longer questions on homework assignments or exams. I like to know where I am assigning points so I am much less likely to consider what the student may have meant or whether I know the student has tried hard (or has given me a hard time). The rubric tells me in an objective way what I am looking for from students' work. For these scholarship applications, we are trying to help students, particularly at-risk students. Creating an objective rubric that links what kinds of responses I'm expecting to the student essays isn't a *bad* way to rate these, but is likely to give lower scores to students who may not be able to decode what the question is asking and get in the mind of the rater to anticipate what they want. Students who can play the school game well, and are therefore probably less in need of the supports that come with the scholarship, are the ones that were more likely to get high scores in my initial rubric, even if they were not the ones that I was hoping to target. With this rubric, creating expected responses based on the kinds of students we are hoping to reach with this scholarship, my scores are much more in line with the other raters and I feel more confident that we are reaching the targeted students, or at least, not passing them over due to a rubric that doesn't really match the goals of the program.

As for the process itself, I appreciated hearing from the other raters and building a consistent idea of what students we are expecting to reach. It took a bit more time to develop this rubric via the persona generation but took me less time to rate the applications. I wasn't trying to fill out

every column in a multi-component rubric, I was rating whether the applicant presented themselves as someone who was similar to the personas we generated or not, the kind of student this scholarship program was meant for versus a student who may not have needed these supports as much. This is a method I will certainly use and recommend for others in similar contexts where a more holistic, less objective rating method is appropriate.

Rater #2

I was skeptical at first, but this turned out to be a worthwhile exercise. In previous application cycles, I was more of a "know it when I see it" type of evaluator. This was our third year for reviewing applications. The same three people have been involved all three years. In the first two years, we brought different values and approaches to doing the ratings. While we tended to agree about most applications, we did reach different conclusions for a few applications. Discussions about these applicants helped us clarify our shared and individual priorities. By doing the personas exercise this year, we had those discussions up front. The approach helped us identify student qualities that we might have had in our heads but didn't put a name to. By naming them, we were better able to communicate amongst each other what we valued.

Rater #3

I was unsure about the contribution this exercise would make to our overall evaluations. In previous years, the system whereby we had our own criteria allowed differing views to be weighted separately, giving each rater a voice. My concern with this was we would be profiling the type of student we wanted to get, potentially limiting the successful applicants to this pool of predefined characteristics. It was possible we would leave qualified candidates out, because we simply did not think of the struggles that certain students were facing.

In going through the exercise, it turned out to capture a much broader range of student experiences than I had thought. The development was continuous rather than discrete, which mitigated some of my apprehension about leaving certain students behind. Additionally, because of the questions the lead rater asked while developing the Jamboards, it allowed me to identify student characteristics I thought were deserving of scholarships and consider other characteristics and student experiences posted by other raters that I had not considered.

During the process, I drew on my expectations of who I thought should be in the program and past experience with the S-STEM students to develop the Jamboards. However, because of the synchronous creation of the boards among the raters, each rater was given the opportunity to develop the profiles based on their experience and expectations, which created a more holistic student profile. In the process, I learned both what my colleagues value in student applicants and was able to broaden my own ideas about the profile of a successful applicant.

Other uses of personas

As part of this overall project, personas have been used to understand the population of students who are applying to the program and to develop a rubric for holistically scoring applications. Outside of rubric-based uses of personas, personas can be used in the classroom to illustrate concepts to students. For student collaborations, creating a persona of a strong collaborator or a narrative based on strong or weak collaborators, similar to "Coping with Hitchhikers and Couch Potatoes on Teams" can illustrate what is expected for your students or help you to grade team collaborations [28]. For excellent examples of in-depth personas based on specific attributes or

criteria, see the first two installments in the Meet Your Students series by Richard Felder [17, 18]. Co-creating these personas with students as part of the course may also help them to understand what attributes will help them to be successful in your course. For example, creating a successful student persona on the first day of class (and then possibly adding them to the roster and referring to them throughout the semester) can help engage and focus students. Creating personas of successful and unsuccessful collaborators in an introduction to a teaming project, wrap-up of a teaming exercise, or check-in as part of a larger, ongoing collaborative project can again show students what they should and should not be doing. Personas have a wide variety of uses in and out of the classroom when a holistic, subjective perspective on a situation is appropriate.

Conclusions

This is a novel use of personas, a technique used in human-centered design, to develop a holistic rubric. In this case, this method was used to categorize essay-based applications for a scholarship program for engineering students. Instead of creating a false sense of objectivity when scoring students' subjective essays, this method allowed for a subjective method of categorizing the essays. This method allows for a clearer target (a specific persona or personas), incorporating the more amorphous, affective aspects of the student rather than attempting to focus on concrete aspects or provide ad hoc rationales for rating student applications.

The rating team spent more time upfront to develop the personas than in past years when each member developed their own ranking method or rubric for analysis. The meeting to review and finalize decisions, however, was much faster than prior years, with fewer strongly split ratings and discussions of whether one student or another should be prioritized or which factors we should be considering. The team had a strong collective idea of what types of students we intended to admit to the program and were able to more easily agree on the final categorization of applicants. There were no applications that were rated in the highest category by one rater but the lowest category by another, another difference from prior years' ratings. We recognize that in our case, the final splits naturally occurred such that we did not have to have any additional rounds of analysis or discussion, which may not always be the case in other situations.

The presented rubrics based on personas are holistic and subjective and therefore allow for holistic and subjective rating. They are not instruments that require intensive training to use or that require high inter-rater reliability. They can be adapted for use when consensus of specific bins for all data is required but are better used when the subjective nature of the data inputs and the rating outputs are prioritized.

Persona-based rubrics allow for a clearer picture of what "it" is in situations where "I know it when I see it." Any situation that would benefit from a holistic and subjective rubric, rather than a strictly objective rubric, could employ this method. This includes semi-competitive competitions, where there is no need for linear ranking but a need for chunking candidates of similar quality, student writing assignments, analyses of student collaborations, and example descriptions of successful (or unsuccessful) students. This paper presents a rubric-building method incorporating a novel use of personas, adding to the literature in both domains and providing an example case study to help bridge the theory-to-practice gap.

References

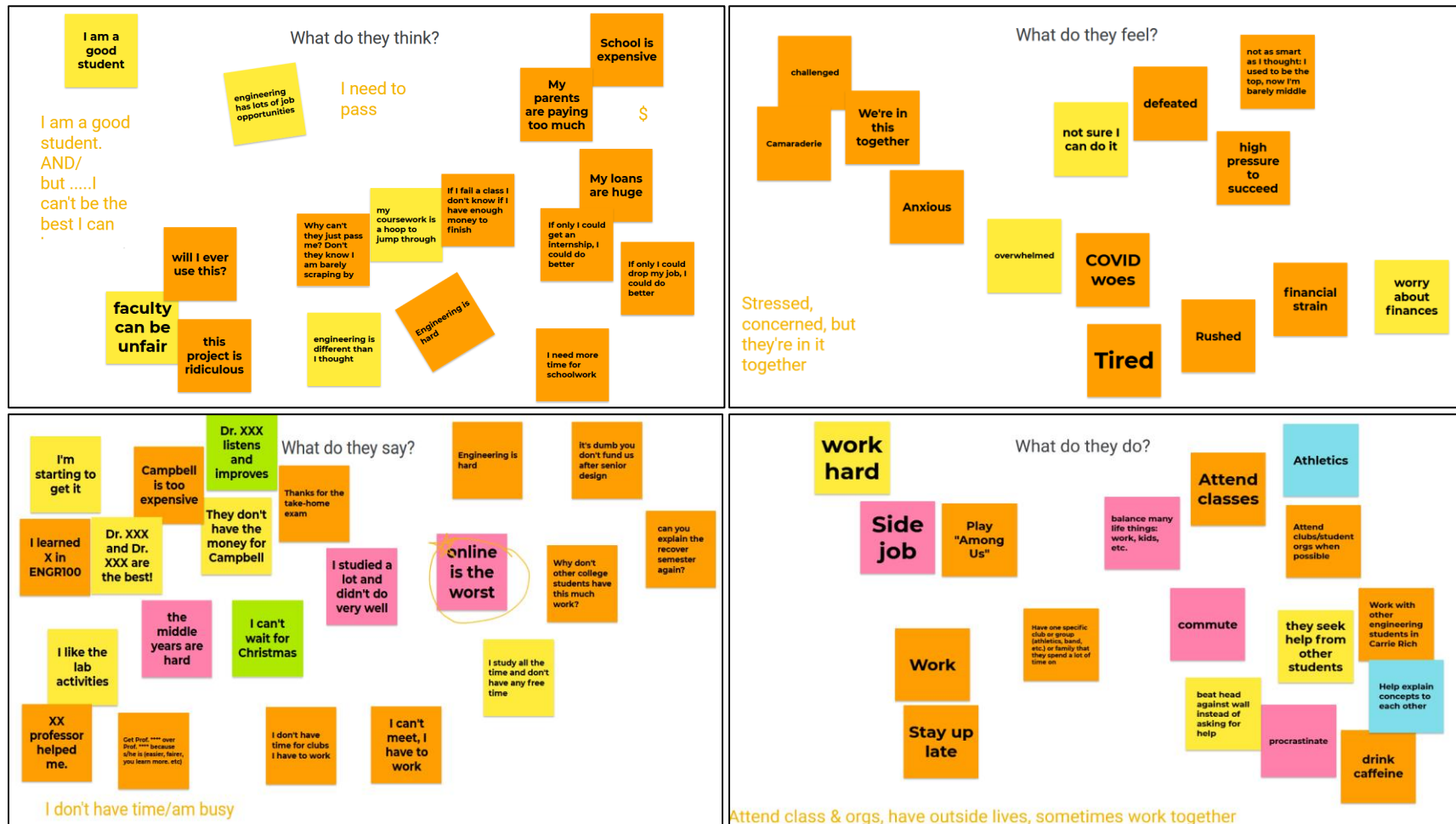
- [1] C. J. Finelli, S. R. Daly and K. M. Richardson, "Bridging the Research-to-Practice Gap: Designing an Institutional Change Plan Using Local Evidence," *Journal of Engineering Education*, vol. 103, no. 2, pp. 331-361, 2014.
- [2] R. M. Felder and R. G. Hadgraft, "Educational Practice and Educational Research in Engineering: Partners, Antagonists, or Ships Passing in the Night?," *Journal of Engineering Education*, vol. 102, no. 3, pp. 339-345, 2013.
- [3] M. Borrego, S. Cutler, M. Prince, C. Henderson and J. E. Froyd, "Fidelity of Implementation of Research-Based Instructional Strategies (RBIS) in Engineering Science Courses," *Journal of Engineering Education*, vol. 102, no. 3, pp. 394-425, 2013.
- [4] G. F. Hall and S. F. Loucks, "Innovation Configurations: Analyzing the Adaptations of Innovations," Texas University, Austin: Research and Development Center for Teacher Education, Austin, 1978.
- [5] R. A. Streveler, K. A. Smith and M. Pilotte, "Aligning Course Content, Assessment, and Delivery: Creating a Context for Outcome-Based Education," in *Outcome-Based Science, Technology, Engineering, and Mathematics Education: Innovative Practices*, Hershey, PA, ICI Global, 2012, pp. 1 - 26.
- [6] T. M. Fernandez, K. M. Martin, R. T. Magnum and C. L. Bell-Huff, "Who's grade is it anyway?: Transitioning engineering courses to an evidence-based specifications grading system," in *American Society for Engineering Education*, Virtual, 2020.
- [7] N. Lin, *Social Capital: A Theory of Social Structure and Action*, Cambridge, UK: Cambridge, 2004.
- [8] American Society for Engineering Education, "Papers on Engineering Education Repository," ASEE, [Online]. Available: <https://peer.asee.org/>.
- [9] S. Bakrania and S. Banger, "A rubric-based grading app for iPads," in *2013 ASEE Annual Conference & Exposition*, Atlanta, Georgia, 2013.
- [10] K. Reid and E. Cooney, "Assessment Rubrics For TAC-ABET Interpersonal Skills," in *2004 Annual Conference*, Salt Lake City, Utah, 2004.
- [11] P. Ralston and C. Bays, "Refining A Critical Thinking Rubric For Engineering," in *2010 Annual Conference & Exposition*, Louisville, Kentucky, 2010.
- [12] J. Newell and K. Dahm, "Rubric Development For Assessment Of Multidisciplinary Team Projects," in *2003 Annual Conference*, Nashville, Tennessee, 2003.

- [13] J. A. Enszer, "Developing Reliable Lab Rubrics Using Only Two Columns," in *2019 ASEE Annual Conference & Exposition*, Tampa, Florida, 2019.
- [14] N. M. Hicks and H. A. Diefes-Dux, "Grader Consistency in using Standards-based Rubrics," in *2017 ASEE Annual Conference & Exposition*, Columbus, Ohio, 2017.
- [15] C. Chan, "Rubrics for Engineering Education," in *Engineering Education Enhancement and Research Asia (E3R Asia)*, 2015.
- [16] A. M. Quinlan, *A Complete Guide to Rubrics: Assessment Made Easy for Teachers of K-College*, Lanham, MD: Rowman & Littlefield Education, 2012.
- [17] R. M. Felder, "MEET YOUR STUDENTS. 1. STAN AND NATHAN," *Chemical Engineering Education*, vol. 23, no. 2, pp. 68-69, 1989.
- [18] R. M. Felder, "MEET YOUR STUDENTS. 2. SUSAN AND GLENDA," *Chemical Engineering Education*, vol. 24, no. 1, pp. 7-8, 1990.
- [19] A. M. Rynearson, M. Miller and J. B. Gartner, "Need-based Scholarship Program: Who is Applying, Who is Successful, and Who is Not Applying?," in *American Society for Engineering Education*, Tampa, 2019.
- [20] R. E. H. Wertz, N. D. Fila, K. A. Smith and R. A. Streveler, "How Do I Understand Them? Integrating Empathy into Course Design through Personas," in *IEEE Frontiers in Education*, Virtual, 2020.
- [21] R. K. Yin, *Case Study Research and Applications: Design and Methods*, Thousand Oaks, CA: Sage, 2017.
- [22] Google, "Google Jamboard," Google, 2017. [Online]. Available: jamboard.google.com.
- [23] A. Cooper, *The Inmates are Running the Asylum: Why High-Tech Products Drive Us Crazy and How to Restore the Sanity*, Indianapolis IN: SAMS, 1999.
- [24] "Personas," Open Design Kit, 2017. [Online]. Available: <http://opendesignkit.org/methods/personas/>.
- [25] T. Adlin, H. Jamesen and T. Krebs, "Fake People and Sticky Notes: Fostering Communication for Human-Centered Software Design," Akamai Technologies, Inc., Seattle WA.
- [26] B. Ferreira, W. Silva, E. Oliveira and T. Conte, "Designing Personas with Empathy Map," in *SEKE*, Pittsburgh, PA, 2015.

- [27] V. Eatough and J. A. Smith, "Interpretive Phenomenological Analysis," in *The SAGE Handbook of Qualitative Research in Psychology*, Thousand Oaks, CA, Sage, 2008, pp. 193-211.
- [28] B. Oakley, R. Brent, R. Felder and I. Elhajj, "Turning student groups into effective teams," *Journal of Student Centered Learning*, vol. 2, no. 1, pp. 9-34, 2004.
- [29] S. B. Merriam and R. S. Grenier, *Qualitative Reserach in Practice: Examples for Discussion and Analysis*, San Francisco: Jossey-Bass, 2019.

Appendix A

Empathy map



Appendix B

Persona responses to application

General Demographics			
Last Name: Garcia, Ramariz, Smith, Johnson, Moore			
First Name: Hannah, Matt, Eduardo, Jesus, Josh			
High School City/State:	Clayton HS	NC	
Did you attend community college?	No	Yes, I have an associates in engineering	
How many courses did you take?	5		
Did your parents attend college?	1 did	trade school	
Have you taken ENGR110?	No	Yes	
Are you currently employed?	yes		
Doing what?	lab attendant	working at Pizza Hut	student life
On/Off campus?	On	off campus	
How many hours?	8 hours/week	10 hours per week	

What have been your most significant challenges to achieving academic success?
Comment on how you overcame those challenges.

Babysitting
younger
family
members

I was the best
in my year at
my rural high
school, now I
am barely
passing

Some
courses
go too
fast.

I had a
teacher who
helped me.

Not having
the time to go
to office hours
or extra
review
sessions

My family depends
on me and my job to
pay bills, drive, help
care for my
grandparents

I worked
really
hard.

Problem: School is hard

Problem: External to school

Solution: I worked hard/
sought help

Give an example of how you made the most of an academic opportunity.

I was really
interested in
engineering and
made it work that I
could work at night
and go to
engineering / math
club after school

My family doesn't
have a lot of money,
so I knew the only
way I could afford a
college degree was
to start with and do
well at community
college

I got a
scholarship
and kept my
grades up

Got a scholarship
and quit my
summer job to go to
community college

Met with the
professor
outside of
class to really
understand
the material

Made good
choices
after
getting \$

Working within limits
(making time/CC)

What are the biggest challenges to completing your engineering degree at

Having enough money to graduate if I have to take an extra semester

My grandparent / parent / relative is sick, out of work, etc. and my family is depending on me to be home on weekends and help

Finding the time to do well in all my classes

Finding study groups I can meet with with my super busy schedule

I learn really terribly online and I'm afraid with this format I won't be able to keep my scholarships because of my GPA

Paying tuition every semester

Time, money, passing hard classes, outside influences

How would the scholarship and program help you to overcome those challenges?

I could reduce the hours that I work

I could build a support system with other students

The accountability will help me stay motivated

Give me a stronger network of students to talk to

Allow me to quit my job and take more time for classes/schoolwork

The GPA threshold is lower than my other scholarships so I can focus more on learning and less on grades

I will be able to meet more students in other years and learn from them and my mentor about how to expect. I don't have a strong network at home.

Not just \$, also support system/other students, etc.